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THESIS

RESEARCH ARTICLE ABSTRACTS IN NATURAL SCIENCE: A STUDY OF LINGUISTIC REALIZATIONS OF RHETORICAL STRUCTURE

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A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
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The abstract found at the beginning of most journal articles has increasing become an essential part of the article. It tends to be the first part of the article to be read. The purposes of this study were to 1) investigate 2) compare and 3) analyze the organization of abstracts, linguistic realization, and authorial stance in the scientific field. Thirty abstracts investigated in scientific abstracts of Kasetsart Journal, the year of 2008, were objectively selected for analysis.

In order to analyze the organization of scientific abstracts, Santos' abstract move patterns theory (1996) was used as the paradigm for this study. The results of this study were compared with Santos' study in order to find the differences in the nature of abstract writing. Three specialists from the English and linguistic fields analyzed the corpus for this study, and the rhetorical moves were reliably identified.

The results of this study showed that there are four obligatory moves in abstracts – the Presenting the research move (83.33%), the Describing the methodology move (93.33%), the Summarizing the finding move (100%), and the Discussing the research move (83.33%). The least frequency of occurrence of move was the Situating the research move (23.33%). The results also indicate that a combination of certain linguistic features such as grammatical subjects, verb tense and voice help distinguishing moves in the abstract. Also, the use of authorial stance did exist in almost every abstract move except for the Describing the methodology move.

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Wasan Aryubken

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CHAPTER I

INTRODUCTION

Rationale of the Study

The point that has gained attention among linguists, educators and professional researchers for a long time are the analysis of professional and academic genres for applied linguistic purposes. 'Genre analysis' is generally considered as part of the larger field of study 'discourse analysis'. A study of language used beyond the sentence boundaries is discourse analysis. In other words, the focus of the differences between text types, or genres, is genre analysis (Dudley-Evan and John, 1998). Particularly, genre analysis focuses on looking at both written and spoken texts, also the distinguishing features of different texts in all areas of English for Specific Purposes (ESP). However, with the investigation of regularities of communicative purpose and language form in genres that can inform ESP materials for writing and teaching. Genre analysis is not principally concerned with the classification genres. The main factor which influences on the current practices in the teaching and learning of languages are genre analysis, in general, and in the teaching and learning of ESP and English for Professional Communication (EPC). Especially, in the teaching and learning of languages, mass communication, writing research, language reform and a number of other areas related to professional and academic communication. Discourse and genre analyses have established themselves as important field of study within linguistics having implications for applied linguistics

Genre is described as a language used in conventionalized communication settings (Bahatia, 1997; Nwogu, 1991; Swales, 1990). Furthermore, Crossley (2007) claims, genre and genre analysis are certain categories of texts as social genres whose operation within a context is investigated in terms of 'sets of shared communicative purposes' (Askehave and Swales, 2001: 210). Most recently, genre analysis has been used to refer to the overall cognitive orientation and internal organization of a

segment of writing that realizes a single, more general rhetorical purpose of representing one type of information within a discourse (Bruce, 2008). It can be seen that genre analysis provides benefits for learners, particularly in improving writing skills.

Among the four skills of learning English, writing is one of the most essential academic skills needed by international students, especially for graduate students (Casanave and Hubbard, 1992). This is because scientific journals are published in English and theses and dissertations must be written in English. In the case of articles which are first published in other languages, English abstracts are usually required (Lores, 2004). Moreover, Casanave and Hubbard indicated, when international students have to write at advanced proficiency level, the difficulty increases. To solve this problem, those international students should master some formal genres in order to pursue their degrees in their disciplines (Samraj, 2005). These would include research articles, abstracts, and dissertations.

An abstract is a concise summary of a research article (Lores, 2004). It is often used to help the readers quickly ascertain the paper's purpose (Salager-Meyer, 1992). Basically, an abstract always appears at the beginning of a manuscript, acting as the point-of-entry for any given scientific paper or patent application (Day, 1988). As many researchers have mentioned, the abstract should be the first part that comes into the readers' consideration and the only part that is read more receptively because it portrays the general information of a piece of work (Cross and Oppenheim, 2006; Day, 1988; Hartley, 2000; Harvey and Horsella, 1988; Lock, 1988; Squires, 1991; Swales, 1990) as well as 'gives readers an adequate view of whether particular papers are worth requesting for further attention" (Salager-Meyer, 1992: 4). Thus, in many cases, it also provides the basis for acceptance or rejection of given research at international discussion level such as at conferences (Lores, 2004), the implications of which can scarcely be ignored, in terms of the value and impact (or otherwise) of particular research. Therefore, abstracts need to be written in the clearest and most accurate language. As Hartley, Sydes and Burton (1996), claim, abstracts become a

standard gateway into the research literature for the scientific community. So, abstracts must be coherent syntactically and semantically (Pinto and Lancaster, 1994).

To write an effective abstract seems to be a difficult task for non-native students because abstract may be quite complex (Bazerman, 1988), and students have to master the textual organization and other key linguistic features that constitute a successful abstract (Martin, 2003). This is further supported by Buell's study (1991), in which he also interviewed a group of science students in graduate programs and found that thesis writing becomes a tough task for the non-native speaker students, partly because insufficient practice and little preparation for postgraduate writing were provided. Casanave and Hubbard (1992) also investigated the writing problems also investigated the writing problems of doctoral students at Standford University. They found that written proficiency in English tends to become increasingly important for students as the end of their program approaches.

However, this difficulty may be solved for non-native students if they have the opportunity to understand the organization of abstracts (Lores, 2004; Martin, 2003; Wu *et al*., 2006: 120). More importantly, to facilitate effective writing in the abstract section, more research of the organization of non-native English speakers' abstract writing should be conducted. As Hopkins and Dudley-Evans (1988) claim, there is a need 'for move to build up a solid stock of information about the structure of various genres and sub-genres as well as to develop our knowledge of regularities and varieties of textualization associated with particular moves and move cycles within identifiable groups of texts". For this reason, the present intended to fill the gap by studying the organizational aspect found in abstracts.

Authorial voice can be regarded as the ways in which writers reveal personal thoughts and feelings within their texts (Hyland, 2002: 1091). It is counted to be the problem that novice writers confront (Flowerdew, 2001). The issue of authorial voice (i.e. expression of the writer's judgments or attitudes towards a proposition or an object) has not been focused of most previous studies of abstracts. There are a few studies on this interpersonal aspect of the abstract in the literature. Yet, they focus on

only one or two expressions of authorial stance. For example, Hyland (2003 cited in Pho 2008) investigates the use of self-reference and self-citation and Hyland and Tse's studies (2005a, 2005b cited in Pho 2008) examine authorial stance through the evaluative that-construction in abstracts from various discipline. Stotesbury (2003, cited in Pho 2008) studies authorial stance through the use of evaluative words and in another study (Stotesbury, 2003b, cited in Pho 2008) the use of personal pronouns in abstract from several broad areas. However, the possibility that authorial stance might differ across moves has not been fully considered.

The study reported here examined not only the rhetorical moves of abstracts in the field of Natural science, but also the linguistic realizations of moves and authorial stance in different abstract moves from *the Kasetsart journal* produced by Kasetsart University.

Objectives of the Study

This research conducted the genre of research article abstracts in order to analyze the rhetorical structure/move structure, linguistic realizations of moves and authorial stance in the genre of research article abstracts of *the Kasetsart University journal* produced by Kasetsart University. The objectives of the study are to analyze the following areas:

1. To analyze the rhetorical structure/move structure in research article abstracts in the field of Natural Science of *the Kasetsart University journal*

2. To analyze the linguistic realizations of moves in research article abstracts in the field of Natural Science of *the Kasetsart University journal*

3. To analyze the authorial stance in research article abstracts in the field of Natural Science of *the Kasetsart University journal*

Research Questions

Since this present research aimed to analyze the rhetorical structure/move structures, linguistic realizations of moves and authorial stance in the genre of research article abstracts of *the Kasetsart university journal* produced by Kasetsart University, the research then focused on the following questions:

1. What are the rhetorical structure/move structures of research article abstracts in the field of Natural Science of *the Kasetsart University journal*?

2. What are the linguistic realizations of moves in the research article abstracts in the field of Natural Science of *the Kasetsart University journal*?

3. To what extent does the authorial stance appear in the research article abstracts in the field of Natural Science of *the Kasetsart University journal*?

Scope of the Study

This research will be restricted in the following ways:

1. A total of 30 research article abstracts, ten from each volume, were selected from *the Kasetsart journal of Kasetsart University* starting from volume 42 number 1 of January-March 2008, volume 42 number 2 of April-June 2008, and volume 42 number 3 of July-September 2008.

2. All of the research journal article abstracts were collected only from the field of Natural Science. All of the major fields from Natural Science were be included.

3. All of the research article abstracts of *the Kasetsart journal* produced by Kasetsart University were down loaded directly from the University's website.

4. The analysis of the analytical framework for the rhetorical structure of the research article abstracts was based on the study of genre of Santos's (1996) model.

5. An initial analysis of the linguistic features of the research article abstracts was carried out to identify the features that have the potential of distinguishing moves and indicating authorial stance. Linguistic features identified in previous studies of research article abstracts as well as the research article proper (e.g. Hyland, 1996, 2005; Vassileva, 2000, 2001) were also taken into consideration.

Benefits of the Study

The findings mainly concern the descriptive study of three main follows: rhetorical moves, linguistic realizations of moves and authorial stance. These findings could serve as a model for writings the abstract, particularly for non-native speakers of English. In addition, as Thompson (1994) suggests, the implication of the research is pedagogic, the model obtained from the study can also be used as guidelines for teaching how to write this type of genre. Also, student would also gain ideas of how to write the scientific abstract.

Definition of Key Terms

Abstract: likes all summaries, cover the main points of a piece of writing which can be adapted in many ways to meet various readers' and writers' needs. Also, abstracts are typically 150-250 words and follow set patterns.

Authorial stance: This indicates how certain the speaker or writer is or feelings or judgments about what said or written.

Genre: refers to a particular type of a written discourse made distinctive by its purpose, and the discourse community for which it is intended. Examples of genres are; abstracts, grant proposal, laboratory reports, poems, letter, editorials and novels.

Linguistic realizations: Linguistic feature used in this study mainly for distinguishing moves and indicating authorial stance e.g. grammatical subjects, verb tense and aspect, voice, modal auxiliaries, epistemic (adjectives, adverbs and nouns), attitudinal (adjectives, adverbs, nouns), self-reference words, reporting verbs, and that-complement.

CHAPTER II

LITERATURE REVIEW

This chapter is set out of seven sections in order to review the literature related to the study. First, this chapter presents some background information on genre analysis. Second, background information on move analysis is presented. Third, overview of an abstract is also presented. Fourth, theoretical frameworks of move analysis are discussed. Fifth, linguistic realization is shown. Sixth, authorial stance is also shown. Lastly, a review of related studies in genre analysis is presented showing their relevance to this study.

Background Information on Genre Analysis

The term 'genre' is thought of sociolinguistic activity through members of a discourse community achieve their communicative goals. In the 1990's, genre became the main focus in applied linguistics. In his book *genre analysis: English in Academic and Research Settings*, Swales (1990: 58) provides a detailed definition of genre within the field of English for Specific Purposes. To a greater extent, a genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of discourse and influences and constrains choice of content and style. Communicative purpose is both a privileged criterion and one that operates to keep the scope of a genre as narrowly focused on comparable rhetorical action. In addition to purpose, exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience. If all high probability expectations are realized, the exemplar will be viewed as a prototypical by the parent discourse community. The genre names inherited and produced by discourse communities and are imported by others constitute valuable ethnographic communication, but typically need further validation.

Genres vary in terms of their complexity and rhetorical purpose which they are expressed. A genre approach to language teaching attempts to teach the main parts, 'moves', of a genre and the most common linguistic features associated with the moves. According to Ding (2007), the notion of move (Swales, 1990) defined as a functional unit in a text used for some outstanding purpose, is often used to identify the textual regularities. Move analysis has been used as on approach to genre analysis, especially in the field of English for Specific Purposes (ESP). Ding (2007) states that move analysis is a helpful tool in genre studies since moves are semantic and functional units of texts, which can be identified because of their communicative purposes and linguistic boundaries. The field of genre analysis began with Swales' pioneering work (Swales 1981 and 1990) in the introduction to an academic article.

Background Information on Move Analysis

Move is defined as a segment of text that is shaped and constrained by a specific communicative functions or can be divided by its particular linguistic clues. The move allows for a specific function within a text to be met. A definition can be found in Nwogu (1991: 114)

> …By the term "Move" I meant a text segment made up of bundle of linguistic feature (lexical meanings, propositional meanings, illocutionary forces, etc.) which give the segment a uniform orientation and signal the content of discourse in it. Each "move" is taken to embody a number of "Constituent Elements" or sub moves which combine to constitute information in the move…

Move is the main part of a genre approach to language teaching which is attempted to teach learners the most common linguistic features associated with the move (Henry and Roseberry, 2001). However, move in some genres can be accomplished by a variety of strategies, in other words the writers have a choice of how they realize the moves (Henry and Roseberry, 2001). That is to say, a move can be thought of as a segment of a text, written or spoken, which achieves a particular

purpose within a text. The move contributes in some way to fulfilling the overall purpose of the genre. For example, the move analysis describes language used in professional settings (Bhatia, 1993) on the basis of how language is used to participate in the actions of community. Therefore, it should be noted that move analysis is a useful methodology to investigate patterns in language features patterns in language features across different types of texts in any discipline.

Recurring Patterns or Move Cycles

Previous studies on research article introduction (Crookes, 1986; Peng, 1987; Swales, 1990) found that Introductions tend to be linear. The methods sections are also linear; the procedure is described chronologically (Weissberg and Buker, 1990). The repeated use of move cycles or recursion differentiates the discussion from the other sections of empirical research articles.

It seems, then, that writing a discussion section requires not only a greater skills such as reporting, commenting, reasoning, and persuading as evidenced by the section's many functions but also an understanding of its recursive dimension through the use of move cycles. The understanding of move cycles can aid in the organization of this section. The use of the move cycle can help writers to include necessary communicative purposes in their discussion of results and organize in an orderly or logical order, thus adding plausibility to authors' claims or arguments as well as a study's results (Dudley-Evans, 1994).

In order to persuasively and convincingly answer the research questions that study has initially set out to answer, authors need to select and sequence both objective results and interpretations of or comments on results. Shorter cycles or low level move cycles, comprising two to four moves, such as 'statement of results' – 'Comparison', are used to validate the results of a study. A move cycle such as 'Statement of results' – 'Comparison' – 'Deduction', can be used to first report the results of the study, then to compare and contrast the results with previous studies in order to support them. Next, the authors can make a claim or deduction based on the

results. Whereas, a high-level move cycle is a recurring pattern or move cycle which answers a study's research questions. For example, the communicative purpose of the function of 'Reference to previous research move (Comparison)' in Hopkins and Dudley-Evans' (1988) eleven-move model may be used to support the validity of results and convince readers that the results of a study were consistent or agreed with previous research. Then, authors may use the 'Deduction' move in order to suggest a low level claim based on a particular result. Next, they may use 'Reference to previous research (Support) move so that they can cite or quote previous studies to substantiate their claim or deduction. Then, they may make a higher level claim based on the results of the study or use the 'Hypothesis' move to answer the study's research question. Next, they may point out a new area of research or use the 'Recommendation' move (Hopkins and Dudley-Evans, 1988).

In a structural move analysis study by Peng (1987) of ten research article introduction sections and discussion sections in chemical engineering, she found that, unlike move in introduction sections which generally occur linearly starting with move 1, move 2, and move 3, contain moves in discussion sections tend to co-occur and re-occur, and that these recurring patterns or cycles can be found throughout the discussion sections. The lowest number of moves in a cycle is two moves and in rare cases can be as many as eight moves (Peng, 1987; Hopkins and Dudley Evans, 1988). Peng (1987) classified move cycles into two levels: a high level cycle which answers research questions and a low level cycle which forward authors' claims or hypotheses or provides interpretations of results. Using the terms in her eleven-move model, four of the most common low level cycles are:

1. 'Statement of results' + 'Comparison'
2. 'Statement of results' + 'Comparison' + 'Deduction'
3. 'Statement of results' + 'Comparison' + 'Explanation'
4. 'Statement of results' + 'Comparison' + 'Expected outcome'

Apart from a large number of move cycles that begin with ‘statement of results’, Peng (1987) also reported that there were stances of move cycles beginning with ‘Hypothesis’ – ‘Comparison’ – ‘Deduction’. She states that authors who select this cycle do so because of unexpected or surprising results.

More recent related studies on move cycles (Hopkins and Dudley-Evan, 1988; Dudley-Evan, 1994; Holmes, 1997; Peacock, 2002; Yang and Allison, 2003; Kanoksilapatham, 2005) also support the findings of Peng’s (1987) study. In sum, a move cycle may begin with, using Peng’s terms, an ‘Information move’, and/or ‘Statement of results’ or ‘Hypothesis’ and then end with ‘Comaprison’ and/or ‘Deduction’ and/or ‘Explanation’. Longer cycles are a result of a combination of shorter move cycles which usually end with ‘Deduction’ or ‘Recommendation’ and/or ‘Deduction’ or ‘Justification’ and ‘Deduction’.

Overview of an Abstract

In this section, some basic concepts of information about abstracts were talked about. The definition of abstracts, types of abstracts, and characteristics of scientific abstracts are presented in the following section.

Definition of Abstract

Abstracts differ from introductions in providing an overall view of each main section of a paper. They aim to assist readers to get through the whole paper quickly (Brown, 1983; Day, 1988). Therefore, abstracts should include all of the necessary and primary information of the research. This distinction between an abstract and summary is discussed by Day. He stated that an abstract should be based on the digestion of the whole paper. Thus, it can be put either at the beginning or at the end of a paper. Usually, it includes purpose, method, results, and conclusion. In contrast, a summary often focuses on a summary of conclusions, and it is usually put at the end of a paper. An abstract, therefore, is important as a brief but informative synopsis of the article.

Type of Abstracts

Basically, abstract can be divided into two types; namely, informative and indicative or descriptive (Day, 1988, Huckin and Olsen, 1991; Swales and Feak, 1994). In most cases, an informative abstract outlines problems of the study, the methods used in study, the results, and the conclusions. This kind of abstract enable readers to form an idea of what a paper is about. It also presents a precise version of the whole text for readers to decide whether the subject matter relates to their interest or not. Moreover, it provides certain background information for readers before they start reading. Likewise, Brown (2004: 1) concluded an informative abstract as follows:

An informative abstract is a concise summary of the longer work it abstracts. The informative abstract can stand in for the longer working of telling the reader what points the longer work. For example an informative abstract for a research paper would include in 100-150 words: the problem under investigation, in one sentence if possible; the subjects, specifying pertinent characteristics, such as number, type, age sex; the experimental method, including the data-gathering procedure; the findings, including statistical significance levels; conclusions and implications or applications. Another type of abstract is shown as an indicative or descriptive abstract. It indicates the content of the article but exclude statements about the outcome of any discussions or conclusions. In other words, it seems to indicate what kind of research has been done (Swales and Feak, 1994). It usually appears in review papers, reference reports, government papers, reference reports, government reports, or in literature. In conclusion, an indicative abstract indicates what kind of information is contained in the longer work, but it does not tell the readers the essence of that information

Alternatively, Swales and Feak (1994) also offered two approaches to writing abstracts which are ‘results-driven’ abstract and ‘a research paper summary’ abstract. The first approach is concentrated on the research findings, and what might be concluded from them. The second approach summarizes the sections of the research such as purposes, method, findings, conclusion, and discussion. In both cases,

abstracts can be informative or indicative. However, most abstracts should aim to be informative; for example, they should contain the main findings.

Therefore, research paper abstracts and conference abstracts seem to be informative abstracts. However, Swales and Feak (1994: 214) indicated that conference abstracts can be indicative or informative, depending on whether the work has been finished. If the work has been finished, it is informative. If not, it is indicative. For example, "you might have three experiments planned, but as the deadline descends on you, you have results from only two of them. In effect, your abstract may not be entirely informative". Moreover, it depends on the field of the study. For example, a scientist has to put much more information in the abstract; therefore, it is to be informative. Consequently, in the field of art or social science, when an abstract is written, indicative abstracts seem to be used more often than informative.

However, Huth (1987) and Lock (1988) have pointed out that abstracts often lack the detailed information that many readers need, such as more in depth statements summarizing what actually reported. Therefore, Ad Hoc Working Group for Critical Appraisal of the Medical Literature (1987) and Squires (1990) presented a structured abstract which is more informative for research article in medical disciplines. A structured abstract usually consists of eight sections together with its heading comprising objective of the study, design, setting, participants, interventions, measurements, main results, and conclusions. Since it provides more details on data identification and study settings, a structured format can represent the whole study in a better way. Structured abstracts are recommended for use in medical journals (Huth 1987; Mulrow, 1987; Taddio *et al*. 1994).

Characteristic of Scientific Abstracts

An abstract or summary of the work accompanies the talk or paper so that others can quickly decide whether to attend the talk or read the full paper (Lores, 2004). It is normally a concise summary of a much longer report. Thus, scientific

abstract must be well organized and written and concisely in both form and style (Sereebenjapol, 2003). Also, Hartley (1997), who stated that the abstracts should contain more information, higher quality, facilitate peer review, and be welcomed by readers and by authors. Studies in writing abstracts have shown that in general, authors have much the same goals in writing abstracts in different disciplines. As reported by Taddio *et al.* (1994), abstracts should provide all the necessary and important information on the research performed such as purpose, design, results, and conclusion. They should enable readers to search more relevant features of the research without reading through the whole paper.

However, in this study, it can be drawn from Cross and Oppenheim (2006) in order to picture the characteristics of scientific abstracts as follows: the abstracts should save reading time, readers should be able to gauge whether the full paper is likely to be sufficient interest to warrant reading in its entirely. Abstracts should help overcome the language barrier. They allow the readers access to the central themes of an article written in a foreign language. Abstracts should provide some language preparation for the paper by using the key words and ideas that are used in the full paper. Well written abstracts can serve as a key to understanding fully the argument of the original paper. Moreover, abstracts should search the function of a current awareness tool and can act a reminder of the contents of the paper and can help to consolidate ideas and opinions regarding the research.

Theoretical Frameworks of Move Analysis

Textual analysis was gradually extended in the 1980's to an analysis of genre by many writing scholars (Bhatia, 1993: 17). Genre analysis was more realized than the notion of the underlying concept as to a communicative purpose that influences the conventions of the genre within particular setting (Dudley-Evans, 1994: 219). Move analysis has been used as one approach to genre analysis, especially in the field of English for Specific Purposes (ESP). The clear example is Swale's (1990) pioneering work on the introductions to academic articles. According to Dudley-Evans and St. John (1998: 89), notes that "there is a regular pattern of 'moves' and

'steps' that appear in a certain order in the majority of the introductions investigated". Move is defined as 'a unit that incorporates both purposes and content within a unit that the writer intentionally communicates to the readers'. And step is defined as 'a lower level text unit than the move that provides a detailed perspective on the options open to the writer in setting out the moves in the introduction. In Swales' move analysis; he first developed a four-move structure of the introductions in research article, from this examination of forty-eight introductions in different journals.

Swales' (1990) CARS Model

Swales' revised move structure had been revealed in the Create a Research Space (CARS) model, which the typical four-move structure had been reformed to a three-move structure. According to Swales (1990), the pattern of moves and steps in article introductions is as follows:

Table 1 Swales' move pattern (1990)

Move 1	**Establishing a territory**
Step 1	Claiming Centrality and/or
Step 2	Making topic generalization (s) and/or
Step 3	Reviewing items of previous research
Move 2	**Establishing a niche**
Step 1 A	Counter-claiming or
Step 1 B	Indicating a gap or
Step 1 C	Question-raising or
Step 1 D	Continuing a tradition
Move 3	**Occupying the niche**
Step 1 A	Outlining purposes or
Step 1 B	Announcing present research
Step 2	Announcing principal findings
Step 3	Indicating RA structure

According to Swales (1990), research article introduction often include these moves

The following review will briefly explain each move and step.

Move 1: Establishing a territory

This move consists of three steps: (1) Claiming centrality: Swales (1990: 144) says, “centrality claims are appeals to the discourse community whereby members are asked to accept that the research about to be reported is part of a lively, significant or well-established research area.”; (2) Making topic generalizations, this step provides more details of the topic, whereby presented the phenomena or knowledge. And (3) Reviewing item of previous research, this step aims to refer to previous work in which relevant information is included.

Move 2: Establishing a niche

Four options can be utilized in this move can be utilized in this move: (1) Counter-claiming, to indicate disagreement by claiming other studies; (2) Indicating a gap, to explain and fulfill a gap in previous work, the author does not counter-claim that the previous work is hopelessly misguided, but rather suffers from some limitations. Swales (1990: 154) explains; (3) Question-raising, to pose questions and offer the answers in present study and (4) Continuing a tradition, to state the stand point or framework of the study.

Move 3: Occupying the niche

This move outlines the framework by stating the objectives of the study and/or the major result. “The role of move three is to turn the niche established in move two, into the research space that justifies the present article” (Swales, 1990: 159). Move 3 can be divided into three steps as follows

Step 1 a: Outlining purposes, to indicate the main purposes of the author.

Step 1 b: Announcing present research, to describe the main features of the research article

Step 2: Announcing present research, to select some key findings and their summarize.

Step 3: Indicating research article structure, according to Swales (1990), this step is to indicate, to some extent, of the structure and content in the remainder of the research article.

Swales pioneered the notion of *genre analysis* for the English for Specific Purposes area. He is best known for the work on the analysis of moves in academic research article, which is a way of approaching the same problem from a different direction (Bloor, 1998). Further studies indicated that not all papers' introductions follow Swales move pattern exactly (Bhatia 1993; Copper, 1985; Crookes, 1986; Dudley-Evan, 1986; Hopkin and Dudley-Evan, 1988). Nevertheless, the *moves*, he reflects the writer's purpose much more precisely than general categories such as *definition* or *classification*. Therefore, as a general model for structure analysis, it remains valid. It has also been revised and has been modified (most recently in 2004) to compensate for many exception to the rule. As Ozturk (2007) stated, the model can be considered one of the strongest descriptions of text structure to date. He also implied that the fact that it was recently remodified in 2004 would further to attest this, in having addressed many limitations especially those argued by Samraj (2002). However, there were some moves which resist classification altogether and are characteristic only of certain disciplines.

Therefore, Swales' move pattern in 2004 seems to be the prevalent in move pattern occurring in the various disciplines. According to Swales (2004), he included move 1 to be one step of topic generalization of increasing specificity. Move 2 is concerned; the four options in the 1990 model reduced two, now there is a new option

step (step 2), presenting positive justification. Move 3 re-labeled presenting the present work, the number of steps raised to seven with one obligatory, three optional and three PISFC probable in some field.

Table 2 Swales' move Pattern (2004)

Move 1 Establishing a territory (Citation required) *** via
Step 1 Topic generalizations of increasing specificity
Move 2 Establishing a niche (Citation possible) * ** via
Step 1 A Indicating a gap or
Step 1 B Adding to what is known
Step 2 Presenting positive justification (Optional)
Move 3 Presenting the present work
Step 1 Announcing present research descriptively and/or Purposively (Obligatory)
Step 2 Presenting research questions or hypotheses (Optional)*
Step 3 Definitional clarifications (Optional)*
Step 4 Summarizing methods (Optional)*
Step 5 Announcing principal outcomes (PESF**)
Step 6 Stating the value of the present research (PISF **)
Step 7 Outlining the structure of the paper (PISF **)

Note: *step 2-4 are not only optional but less fixed in their order of occurrence than the others

** PISF: Probable in some field, but unlikely in others

*** To be prevalent, especially in longer introductions

Bhatia's (1993) Move Structure

The following review focuses on another move structure of Bhatia (1993). It has been pointed out, by Bhatia (1993), that although abstracts and introductions seem to be very similar in their context or positioning of the research setting at the beginning part of research article, they differ in terms of their communication

purposes. The American National Standard Institute (ANSI) defines abstract, quoted in Bhatia (1993:78) as "Abstract is an abbreviated, accurate representation of the contents of a document, preferably prepared by its authors for publication with it."

Bhatia's (1993) book described abstract genre as "a short summary of the lengthy report into four aspects related to the answers of these four questions: what the author did, how the author did it; what the author found and what the author concluded". For this reason, four moves are as follows:

Move 1: Introducing purpose
Move 2: Describing methodology
Move 3: Summarizing results
Move 4: Presenting conclusion

These four moves are explained below:

Move 1: Introducing purpose

'Introducing purpose' move defined as 'Introduction' move that is introduced by a number of studies on abstracts. This move aims to provide the basic concept, including goals or intentions of the researcher. However, there is much underlying thought appeared in this move and as a matter of fact, this move is rather problematic compared to other sections as Swales (1990) quoted in Martin (2003: 31) that introductions are known to be troublesome. The opening paragraphs somehow present the writer with an unnerving wealth of options: decisions have to be made about the amount and type of background knowledge to include; about an authoritative versus a sincere stance.

Move 2: Describing methodology

Methods and/or procedures are usually pointed in this move and, occasionally data specifications including scope of the research are indicated

Move 3: Summarizing results

This move is the most important element of the abstract genre. Results move generally reveals findings in addition to solutions of the problems or questions that may be previously mentioned in the introduction move. Obviously, this summarizing results move distinguishes the abstract genre from other genres in research article, particularly the similar genre as the introduction genre. This is because it is uncommon to see the results or findings in the research article introduction genre.

Move 4 Presenting conclusions

This move is a short form of the conclusions and judgments of findings and typically includes some applications of the findings.

Santos' Move Pattern (5 moves)

Santos (1996) is one of the linguists who have been studying of move analysis to emphasize the organization of text analysis. Santos attempted to develop a move analysis which reflects the characteristics of the genre itself especially the discourse organization of research article abstracts in the applied linguistic field. He studied organization of 94 abstracts in three journals from the applied linguistics field following the work of Swales (1990), Dudley-Evan (1986), and Crookes (1986). In his data analyses, he related each sentence with the four components which are introduction, methods, results, and discussion. He indicated that all abstracts he examined followed five move patterns. The five move models are presented in Table 3 as follow:

Table 3 Santos' move pattern (1996)

The Five Move
Move 1: Situating the research
Submove 1 A - Stating current knowledge And/or
Submove 1 B - Citing previous research And/or
Submove 1 C - Extended previous research
Submove 2 - Stating the problem
Move 2: Presenting the research
Submove 1 A - Indicating main features And/or
Submove 1 B - Indicating the main purposesAnd/or
Submove 2 B - Hypothesis raising
Move 3: Describing the methodology
Move 4: Summarizing the results
Move 5: Discussing the research
Submove 1 - Drawing conclusions And/or
Submove 2 - Giving recommendations

Santos (1996) gave more details of each move occurring within abstracts

Move 1: Situating the research

To attract the attention from the readers as the goal of writing, the writers may need to characterize the opening move by situating the research. Move 1 provides orientation and motivation to the readers to decide to read the whole research. Move 1 contains submove 1 A, submove 1 B, and submove 1 B, and submove 1 C in sequence.

Move 1: Submove 1 A – Stating current knowledge

Santos (1996) claimed that the writers may (1) identify the field by stating that a given topic is of considerable professional concern. (2) The writers may also state current ideas or practice in teaching and research. (3) The writers may offer readers generalizations regarding the state of the art. The example of (1), (2), and (3) are as below.

(1) *Cloze tests have been the focus of considerable interest in recent years* as easily constructed and scored measures of integrative proficiency.

(2) *Current research has supported the existence of* a critical period for the acquisition of the grammar of a second language

(3) *The meaning and forms of tenses are complex and often difficult for nonnative speakers to acquire*

Move 1: Submove 1 B – Citing previous research

Sub move 1 A is accompanied by the naming of specific researchers. In order to avoid the problem in which the text elements lose their *stating current knowledge status* and are assigned the status of citing *previous research*, submove 1 B may be most suit as writers attempt to give further credibility to the claim outlined in submove 1 A by relating *what* has been claimed to the person *who* has claimed it. The example is given below.

Enpty pronouns are not only acceptable in finite clauses of Spanish and Chinese but are pragmatically more natural (Rizzi, 1982; Huang, 1984, 1985).

Move 1: Sub move 1 C – extending previous research

Santos found that there seemed to be writers who provided a weak challenge to previous research while presenting their research. Thus, the example below might be interpreted in terms of writers' efforts to make clear that the current research is part of an ongoing debate.

Extending the research done the effects of different types of task and Different participant arrangements used to foster negotiated interaction Among L2 learners, we attempt to …

Move 1: Sub move 2 – Stating the problem

There were problem statements offering some evaluation of the current state of knowledge as outlined in sub move 1 and pointing out that previous research has not been thoroughly successful or complete. Some examples are given below.

1. … *Few* studies have been done on …

2. Empirical studies designed to … have *provoked wildly conflicting* results

3. *This empirical investigation sought to* determine the attitudes of both L1 and L2 listeners toward specific regional accents of US English and to compare and/or contrast those attitudes.

Move 2: Presenting the research

This move is to make a kind of announcement that justifies the articles in the case of describing the key features of the research in question, or presenting its purpose. The results showed that move 2 can take one of the two forms which are a *descriptive* form or a purposive form. Some examples are given in submove 1 A and sub move 1 B as follows:

Move 2: Sub move 1 A – Indicating main features

There is a clearly predominating formula-like pattern employed by the authors in the corpus to signal their move 2. Sub moves 1 A seem to contain a restriction concerning the verb tense, and the noun phrase. The examples are as follows:

1. *This study investigates* …
2. *In this study, we investigate* …

Move 2: Sub move 1 B – Indicating the main purposes

Sub moves contained a mixture of forms that essentially carry the purposive nature via the verb phrase as the following examples.

1. This empirical investigation *sought to* …
2. The *purpose* of this study was to …

The author outlines their research hypotheses or questions. It would seem that this sub move plays a supporting role in the presentation of research as it helps further detail the main features of the work in question due to the presence of a modal verb. For example, the corpus contained *would, could, can, may, and will*.

Move 3: Describing the methodology

Move 3 occurred by it and merged with other moves in some cases, and move 3 occupied considerable textual spaces. It can be assumed that (1) some authors delay the occurrence of move 3, by placing it entirely in a post-move 2 sentence; (2) others anticipate that information somehow by merging it with move 2, although in a quick *passim* fashion; and, (3) still others may see the opening statement as a privileged window to project the bulk of information as early as possible. Some examples are given below.

1. This study examines the responses of 60 Spanish, Chinese, and German L2 learners to English sentences with empty pronominal categories (ECs).

2. This paper is concerned with how advanced L2 learners of English Interpret reflexive anaphors and pronominal.

3. This study investigate the listening comprehension of 388 high-intermediate Listening proficiency (HILP) and low-intermediate listening proficiency (LILP) Chinese students of English as a foreign language.

4. Using three information transfer tasks and interviewing discussion sessions, we attempted to investigate the actual communicative outcomes of interaction prompted by the tasks.

5. Over a two-week period, …

6. Using a qualitative discourse-analytic framework …

7. The first phase of the study …

8. The *second* phase of the study …

Move 3 as the discourse move used to retell the story of the research proper, is almost exclusively in the past tense. Thus, researchers might use tense-voice correlation to establish their readership the point they have reached in the abstracts.

Move 4: Summarizing the results

Move 4 is used to summarize briefly the main findings of the research, and indicates how the data were manipulated. Some examples are given below.

1. *Results showed* that moderately fast speech rates resulted in …
2. *A factor analysis* of the ESL teacher's data revealed five factors …
3. *A factor analysis* of non-teacher's data *yielded* four factors …
4. *A factor analysis* of the combined group data *revealed* five factors …
5. *A MANOVA and a series of univariate analysis* of … *show* …
6. … *revealed greater and more* consistent growth in … *than* for …

Move 5: Sub move 1 – Drawing conclusions

Conclusion statements meant to answer the questions are clearly signaled in a number of ways, using verbs like *suggest*, or *interpret*, as shown below.

1. The result *suggest* that misunderstanding of …

2. *It is concluded* that large scale testing of oral communication is …

3. *These findings* lend strong support to our hypothesis that …

4. The *research* provides evidence of the importance of case studies in verifying critical assumptions about …

5. The main *conclusions* of this study are: …

'Move 5: Sub move 2 – Giving recommendations

Sub move 2 may briefly outline suggestions for future study. The example is given below.

Implications and conclusions of the results to foreign language learning are drawn.

Santos' (1996) move pattern has been adopted to explore the organization of abstract in linguistic field. Cross and Oppenheim's (2006) study of a genre analysis of scientific abstracts analyze the data by adopting Santos's move pattern as a framework to study. Also, see Vongvanit (2001), who investigated the organization and linguistic features of genres: research article abstracts in the field of English Language Learning and Teaching (ELLT).

The above outlined theories of Move structure is considered to be wildly acknowledged among ESP interests and other researchers.

A major problem in most studies of abstracts (and also in studies of research articles following Swales's, 1990, approach) is that the identification of moves seems to be based on both a bottom-up approach and a top-down approach. The description 'bottom-up' means that researchers distinguish moves on the basis of certain linguistic signals. Top-down means they do this on the basis of content. For example, Anderson (1997) identifies the Conclusion move of the medical abstract by signals such as present tense and certain nouns and verbs. At the same time, they also rely on their intuitive interpretations of content. They then point to those particular lexical and grammatical items as characteristic of this move. This results in a circularity of the identification of rhetorical moves and linguistic realizations. The two processes bottom-up and top-down, therefore, need to be separated.

Santos's (1996) model is used as the analytical framework for the rhetorical structure of the abstracts in the present study for two reasons. First, this model hasbeen applied to abstracts in applied linguistics, and it includes all the moves identified in other studies of abstracts. Second, the labels of the five moves (as shown in table below) are more meaningful than those in other studies such as introduction or conclusion. However, unlike Santos's study, the present study does not divide the moves further into sub moves. The subdivision of move 1 and move 2 in Santos's study of abstracts is mainly based on Swales's 1990) CARS model for the introduction section of the article with moves and sub moves. Yet, the sub moves in

this CARS model are not clearly distinguished, as admitted by Swales (2004) himself in his latest version of the CARS model.

Although this top-down approach, which is mainly based on content or function through the asking of questions, can be criticized for its subjectivity (Paltridge, 1994), it can avoid the circularity of a combined approach of function and form. Moreover, the subjectivity of the content-based approach can be reduced if, as suggested by Crookes (1986) a satisfactory level of reliability can be obtained.

Table 4 Santos' framework for abstract analysis

Moves	**Function/description**	**Question asked**
Move 1: Situating the research <STR>	Setting the scene for the current research (topic generalization)	What has been known about the field/topic of research?
Move 2: Presenting the research <PTR>	Stating the purpose of the study, research questions and/or hypotheses	What is the study about?
Move 3: Describing the Methodology <DTM>	Describing the materials, subjects, variables, Procedures …	How was the research done?
Move 4: Summarizing The findings <STF>	Reporting the main findings of the study	What did the researcher find?
Move 5: Discussing the research <DTR>	Interpreting the results/findings and/or giving recommendations, implications/applications of the study	What do the results mean? So what?

Linguistic Realization

Epistemic Modality and Interpersonal Linguistic Features in Academic Writing

According to pragmatic linguistic analyses, language has to be analyzed and interpreted in relation to the social context which generates and uses it. Language is not to be considered an isolated system of either symbols or mental rules, but a system used in a specific setting and for specific communicative purposes. It is within this paradigm that English for Specific Purposes (ESP) develops in the 60's and continues to the present.

Actually, the macro structural descriptions represent a major feature of RAs as a genre, but there are other linguistic and communicative phenomena which differentiate the RAs from other genres which have not been analyzed in such detail, especially having in mind disciplinary variation. For instance, some other authors have studied alternative discourse functions of RAs, such as the use of citations and references (Jordan, 1990), or the use of argumentation (Hyland, 1996; Thompson, 1993).

Alcaraz (2000: 139-140) considers that RAs are defined by four major features: (a) a specific macrostructure, (b) modalization (i.e., the use of modalized or hedged statements), (c) their main communicative purpose (i.e., scientific claim), and (d) academic politeness (i.e., acknowledging other scientists' research by menas of references). The macro structural component has been widely studied (see references above). However, modalization, or the use of hedges, has also become a major line of investigation in relation to RAs, both from a synchronic (Gosden, 1995; Grabe and Kaplan, 1997; Gledhill, 2000) as well as from a diachronic perspective (Atkinson, 1992; Salager-Meyer, 1998). There is also a recent interest in the disciplinary variations to be detected regarding the use of hedging in RAs, as the works of Hyland (1994, 1996), Crompton (1997), and Lewin (1998) illustrate.

However, most of these studies have not taken into consideration a significant linguistic realization of modalized or hedged statements which is to be found in linguistic theory since the late 70's, namely the division of modalized statements into epistemic and demotic assertions- with the exception of Simpson's (1990) study, as indicated below, and more recently, Vihla's (1999) research on medical writing. Mood and modality express the speaker's attitude or opinion regarding "the contents or the sentence" (Palmer, 1986: 14) or "the proposition that the sentence expresses" (Lyons, 1977: 452). Palmer (1986: 21) defines mood as realized by the verbal morphology, whereas modality appears as a linguistic feature generated by a variety of linguistic phenomena among which modal verbs play a special role, as Downing and Locke (1992: 383-384) describe. Quirk *et al.* (1985: 219), discussing modality, speak of "constraining factors of meaning" namely in terms of intrinsic and extrinsic modality. In other words the meaning of some kind of human control over events would signify "permission", obligation" and "validation", (deontic, according to Lyons, Palmer, and Downing and Locke). On other hand, where such intrinsic control is not involved, the meaning would indicate "possibility", "necessity", and "prediction"(epistemic, using Lyons' Palmer's, and Downing and Locke's terminology).

More specifically, deontic modality (DeM) means that the speaker "intervene [s] in the speech event by laying obligations or giving permission" (Downing and Locke, 1992: 382), as in *One must look into this matter in detail* …, Shall *we negotiate peace now?* Or *this experiment should be repeated*. On the other hand, epistemic modality (EpM) implies that the speaker assesses "the probability that the proposition is true in terms of the modal certainty, probability or possibility" (ibid), as in *It may be the case that Results might change if certain conditions* …, or *The concert must be over.* Simpson's (1990) study, which takes into account this epistemic versus deontic distinction, has noted that DeM is a distinguishing feature of, for example, literary criticism.

Hyland (1998) provides the most comprehensive account of surface realizations of hedging in scientific article, categorizing them into two classes: lexical and non-lexical features. Lexical features include modal auxiliaries (*may* and *might* being the strongest indicators), epistemic verbs, adjectives, adverbs and nouns. Some common examples of these feature types are given in Table 5.

Table 5 Lexical surface features of hedging

Feature Type	Examples
Modal auxiliaries	*may, might, could, would, should*
Epistemic judgment verbs	*suggest, indicate, speculate, believe, assume*
Epistemic evidential verbs	*appear, seem*
Epistemic deductive verbs	*conclude, infer, deduce*
Epistemic adjectives	*likely, probable, possible*
Epistemic adverbs	*probably, possibly, perhaps, generally*
Epistemic nouns	*possibility, suggestion*

Verb tenses: Tense, Voice and Aspect in English Verbs

There are 12 different tenses in English, considered traditionally. An easy way to remember them is that there is a simple present, simple past and simple future tense, and for each of these there is a perfect form of the tense. Then, there is a progressive form that corresponds to each of these six tenses. So, the sequence goes as follows:

- A Perfect Tense is formed with some part of the verb HAVE (have, had, has).

- A Progressive Tense is formed with some a part of the verb IS (is, am, are, was, were, etc.).

- A Present Progressive tense is formed both with HAVE and BE.

- *In addition to TENSE, Verbs have three other qualities:*

- *Aspect*. This refers to whether the action was completed or not. A verb's aspect can be progressive or non-progressive.

- *Voice*. Voice can be either active or passive. If the voice of the verb is passive, it will be formed with some part of the verb BE. What distinguishes the passive from the active voice is that in the active voice, the DOER of the action (of the verb) is subject of the verb ("Sophie ate her food."). If the DOER of the verb is not the subject of the sentence, the verb is in the passive voice. ("The food was eaten by Sophie.") Caution: Always determine the voice of the verb first. Because the passive voice is always formed by the verb BE followed by the past participle of the verb, it can be confused with one of the progressive tenses. keep in mind that the concept of voice is separated from the concept of tense

Reporting Verbs

Reporting verbs are verbs that can be used to report the speech of others (Atkinson, 1992). The importance of reporting verbs for computational linguistics lies in their extremely frequent occurrence in American newspaper articles. Both direct and indirect reported speech are used to establish the source for almost any information or commentary on events, thus in a frequency count of words on a corpus of Wall Street Journal articles, and said was the 16th most frequent word. Considering that this is only one form of one reporting verb, the importance of the phenomenon for the newspaper domain is obvious.

There are a lot of other verbs one can use to describe or summarize what people say without repeating the same thing over and over again. These verbs give the meaning of the original words without actually using them all.

The section below shows some of these 'reporting verbs' with meanings and grammatical structures. One can often use verbs which wouldn't normally associate with reported speech, but if ones describe the meaning of the original words then use them.

'Accuse'
"It was you who ate my chocolate, Elvira, wasn't it?"
He accused Elvira of eating his chocolate.

'Admit'
"OK, it was me. I ate your chocolate"
Elvira admitted eating the chocolate.
Elvira admitted that she had eaten the chocolate.

'Advise'
"Well, if I were you I'd start saving for my retirement."
He advised me to start saving for my retirement.

'Agree'
"Yes, you're right, it's a terrible problem."
She agreed that it was a terrible problem.

'Apologize'
"I'm sorry I didn't get to the meeting."
He apologized for not going to the meeting.

Self-Reference Words

Whether working within scientific disciplines, the social sciences, or the humanities, writers often struggle with how to infuse academic material with a unique, personal "voice." Many writers have been told by teachers not to use the first-person perspective (indicated by words such as *I, we, my, and our*) when writing academic papers. However, in certain rhetorical situations, self-references can strengthen an argument and clarify our perspective. Depending on the genre and discipline of the academic paper, there may be some common conventions for use of the first person that the writer should observe (Jane, 2008).

Developing a personal voice within an academic paper involves much more than simply mentioning yourself. Writing in a personal voice can mean using language that comes naturally, allowing the writer to clearly express personal opinions, or emotions on a subject. Writing in an overly emotional style can detract from an argument's logical or ethical appeals. On the other hand, writing that omits personal or emotional content often results in less compelling statements, and it may appear to straddle issues indecisively rather than staking a strong claim.

As in the humanities, writers of scientific papers have traditionally avoided the first person, but the first-person perspective has grown more acceptable in recent years. Because experiments in physics, biology, engineering, and other sciences are often undertaken as collaborative efforts, the first-person perspective in scientific papers in more likely to appear as we than I. This emphasis on collaborative investigations—signified by the plural us—may be adopted as stylistic preference, even when the author actually conducted certain experiments alone (Gesa, 1994).

When scientists use first-person pronouns, they tend to show up most often toward the end of the Introduction and in Results and Discussion sections; they are also increasingly common in abstracts. Professor Cary Moskovitz, director of Duke's Writing in the Disciplines program, notes that "scientists typically use first person when discussing the intellectual aspects rather than the material: 'We hypothesized

that the product would be …,' but not ' We washed the pipettes.'" For example, one biologist explains in her journal article Summary that "[i]n characterizing Aven protein, a previously reported apoptotic inhibitor, Aven can function as an ATM activator to inhibit G2/M progression" (Guo, 2008: 933-942). Thus plural first-person reference (we have found) communicates the collaborative nature of the study and may even remind readers that scientific research is conducted by living, breathing people.

Science writers are also more likely to employ the passive voice, removing first-person references simply by excluding the actor altogether. Therefore, the comment "We measured the thickness of the cell wall" might also be stated as "The cell wall was measured" or merely "Measurements were taken. (James,1993). The structure of these latter statements reflects a purportedly objective focus on the subject of inquiry rather than a focus on the investigator, as if to suggest that it is not important who took the measurements; what matters is the data that was recorded. The writer of a scientific paper that reports the results of a study may also take it for granted the reader knows. However, even in such a case, a strict reliance on the passive voice can create ambiguities, if the more natural way to describe a specific action is to use the first person. (Jane, 2008).

Authorial Stance

Authorial stance can be regarded as the ways in which writers reveal personal thought and feeling within their texts (Hyland, 2002: 1091).

A framework for the Study of Stance

Many of the lexico-grammatical features in English can be used to indicate the personal stance of the speaker or writer: 'personal feelings, attitudes, value judgments, or assessments' (LGSWE: 966). Stance expressions can convey many different kinds of personal feelings and assessments, including attitutudes that a speakers has about

certain information, how certain they are about its veracity, how they obtained access to the information, and what perspective they are taking.

Stance can be expressed through grammatical devices, value-laden word choice, and paralinguistic devices. For example, two common grammatical devices used to mark stance are adverbials and complement clause constructions. Stance adverbials express the attitude or assessment of the speaker/writer with respect to the proposition contained in the matrix clause:

Obviously you don't have to come to class on May eighth.

With complement clauses, the matrix clause verb expresses a stance with respect to the proposition in the complement clause:

I doubt [that they've published this].

Stance can also be conveyed through value-laden word choice and paralinguistic devices. However, these devices are often less explicit because they do not overtly express an evaluative frame for some other proposition Grammatical stance devices range along a continuum, from those that are explicitly attributed to the speaker/writer (1st person), to those that are explicitly attributed to a 2nd or 3rd person. Stance structures with a 1st person subject are the most overt expressions of speaker/author stance:

1st person pronoun+ stance verb+ that-clause:

I know a lot of people avoid Sacramento because of the deadly smog.

1st person pronoun+stance adjective +that-clause:

We are becoming increasingly certain that the theory has far reaching Implications…

In contrast, stance expressions that are attributed to the addressee (2nd person) or to a 3rd person are excluded from the study, because they do not necessarily reflect the personal stance of the speaker/writer. For example:

You think I did a bad job

They needed to rebuild the entire government system.

In between these two extremes are a number of grammatical stance devices with no explicit attribution, the normal inference is that these devices express the stance of the speaker/writer. These devices include modal verbs, stance adverbials, and extraposed complement clauses. For example:

Modal verb:
Both of those things might be true.

Stance adverbial:
Maybe someone mentioned this in speaking about it.

A Review of Related Studies

There have been several studies undertaken in last decades that approach the subject of abstracts. Abstracts have been an important part of research articles; very few scholarly journals, either in English or in other language, would not require an abstract to be submitted with the original research article (Martin, 2003).

One of the important works which is worth mentioning here is Pho (2008) aimed at exploring not only the rhetorical moves of abstracts in the field of applied linguistics and educational technology, but also the linguistic relations of moves and authorial stance in different abstract moves. She used Santos's (1996) model for the analytical framework for the rhetorical structure of the present study. Also, she used approach of analyzing of linguistic realizations of moves and authorial stance by

identifying the features that had the potential of distinguishing moves and indicating authorial stance. Her study thus used a combination of quantitative and qualitative approaches to identify linguistic features typical of each rhetorical move. Pho (2008) findings found that the analysis of the rhetorical structure of abstracts in the three journals revealed that Presenting the research move, the Describing the Methodology move and Summarizing the finding move are obligatory move in abstracts in all three journals. Whereas the Discussing the research move is fairly common in the abstracts from two journals in applied linguistics, the Situating the research move is the least frequent move in abstracts from all the journals. The distribution patterns of linguistics features in the same move are quite similar across the journals. There is the correlation between move types and linguistic features in the same move are quite similar across the journals. Authorial stance is expressed through the use of stance words in the Situating the research move and the Summarizing the findings move, the author's findings move, the author's stance is move likely to be shown through the use of first-person pronouns in the Presenting the research move, and also through the use of modal verbs in the Discussing the research move. By contrast, the Describing the Methodology move is distinguished by the lack of first-person pronouns, modal verbs and stance words, and is more impersonal than all the other moves.

Tseng's (2008) work aimed at extending Santos' work (1996) by examining 90 applied linguistics abstracts in three applied linguistic journals (i.e., TESOL Quarterly, Applied linguistics and Language Learning) from two dimensions: the move features of move structure and the verb tense of each move. He analyzed the features of move structure by adapting five-move patterns for abstract from Santos's (1996) as the framework for move analysis in his study. Among the five moves for the abstracts which are Background, Aim, Method, Results, and Conclusion. The abstracts in the corpus tended to take a four-move structure, with the first move: Background being optional. Moreover, most of the abstracts usually opened with the second move: Aim or the first move: Background, and ended with the fifth move: Conclusion or the fourth move: Results. Concerning verb tense in each move, the preferred pattern was as follows: the present tense usually occurred in the first, second, and fifth moves, while the past tense was often used in the third and fourth

moves. The study, employing both qualitative and quantitative measures, has thus extended Santos's (1996) five-move patterns for abstract.

MacDonald (1990) brought up another important feature in text analysis. Academic writing was characterized by longer sentences. Within academic writing, she focused on literary criticism, where the average sentence length is greater than in other disciplines reaching, as was the case with the two RAs. She also reported the widely share opinion that two features of sentence structure might affect readability in a negative way, on the one hand, excessive clause length: on the other, excessive nominalization (1990: 34). She further emphasized the idea that both features were connected and therefore longer than average sentences were likely to contain more nominations as they involved more complex transformations. MacDonald also referred to concept of 'grammar of clarity' which advised reducing sentence length and nominalization by using a verbal rather than a nominal style.

Martin (2003) pursued his main interest about linguistics by conducting a research paper specifically on the topic of "A genre analysis of English and Spanish research paper abstracts in experimental social sciences". He investigated comparatively the rhetorical structure of RA abstracts written in English for international scientific journals and the abstracts written in Spanish and published in Spanish journals in the field of experimental sciences. Samples were gathered from texts belonging to two representative discipline of the experimental branch of social science: experimental phonetics and psychology. A total of 80 Spanish RA abstracts from leading international journals were selected equally from both fields. The structural units that comprise of the macrostructure of these texts have been comparatively analyzed. Martin's (2003) findings show that the rhetorical structure of abstracts written in Spanish in the area of experimental social sciences generally reflect the international conventions based on the norm of the English academic discourse community, as the four basic structural units (Introduction, Methods, Results, and Conclusion) which are presented in his research article. However, the strong tendency to omit the results section in the Spanish abstracts is about twice as much as in the international abstracts written in English.

Betty Samraj's research interests are genre analysis and writing across the disciplines. Samraj (2005) compared the generic structure of RA introductions and abstracts, which form a genre set, from two related fields, Conservation Biology and Wildlife Behavior. Twelve research article introductions and abstracts were randomly selected from two journals, Animal Behavior and Conservation Biology, considered key in these two disciplines Wildlife Behavior and Conservation Biology by specialists in the areas. Typically, the structure of research article abstracts has been discussed for the most part in terms of macro-structure of research article abstracts has been discussed for the most part in terms of macro-structure of the research article, resulting in four moves, introduction, methods, results and conclusions, which have been employed in a number of studies on abstracts such as Bhatia's (1993).

In Samraj's (2005) study, these tow genres, RA introductions and abstracts, appear related. Both genres are related to the research article: one genre is central to the research article itself, and the other has been said to be an article synopsis (Bhatia 1993). Bhatia has stated that these two genres fulfill different communicative purposes and hence possess different macro-organizations. The results of the study indicate that in Conservation Biology abstracts, in addition to the traditional IMRC moves also contain moves from the CARS model, such as "background information". "Centrality claim" and "gap indication". It shows that generic interrelatedness may also vary across disciplines, her study reveals more than variation in abstract or introduction structure across disciplines. It shows that generic interrelatedness may also vary across disciplines. Conservation Biology abstracts are more similar to RA introductions than Wildlife Behavior abstracts.

Cross and Oppenheim (2006) conducted a genre analysis of scientific abstracts. The structure of a small number of abstracts that have appeared in the Commonwealth Agricultural Bureax International (CABI) database over a number of years, during which time the authorship of the abstracts changed from CABI editorial staff to journal article authors themselves were analyzed. In addition, their paper reported a study of the semantic organization and thematic structure of twelve scientific abstracts from the field of protozoology. The intention of their study was to

offer a systematic linguistic analysis of how scientific abstracts fulfill function as condensed document representations. Moreover, their study attempted to gauge whether abstracts follow the advice stipulated in abstracting guidelines. The abstracts in their corpus followed a five-move pattern described by Santos (1996). Findings found that in the corpus, only move 3, Describes the methodology and Move 4, States the results appear all the time, with the other moves only being used to suit the communicative needs of the author. Furthermore, thematic analysis shows that scientific abstract authors thematic their subject by referring to the discourse domain or the "real" world.

Connor and Halleck (2006) described the genre characteristics of the one-page "summary" in the TESOL conference proposal, using a corpus of proposals submitted to the 1996 TESOL conference. They note that conference proposals are a genre of persuasive writing. Because of their communicative purpose to "sell an idea," conference abstracts have a great deal in common with three promotional genres studied namely sales letters, job applications and grant proposals. They also identified rhetorical moves in each proposal using the genre-analytic system of "moves" developed by Swales (1981, 1990) and applying to grant proposals by Connor& Mauranen (1999) as follows territory, gap, goal, means 1, mean 2, reporting previous research, outcomes, benefits, competence claim, and important claim. In addition, they compared the use of use of these moves in proposal of three different sub-genres (Research, Pedagogical and Administrative). Although they found certain combinations of moves in all three sub-genres, they also found that differences in the use of the move depended not only on the specific audience but also on writers' individual style. The move-step scheme they identified suggests that CARS structure is also an important element of this genre, and the whole idea of CARS is also a major concern of grant writers.

According to Chan and Foo (2004: 101), abstract studies became interesting to ESP practitioners, who had to teach science and technical subjects in English. One of them was Graetz (1985). Her intention was to investigate abstracts based on a learner-centered grammar approach. Later there was a shift from a grammar based approach

to genre analysis which was initiated by Swales (1990). Swales (1990) firstly analyzed the introduction section for research articles, then abstracts in various disciplines were analyzed, such as in the medical field by Salager-Meyer (1992). Those studies aimed to discover and investigate the conventional rhetorical structure of abstracts in order to help second language learners. They present an important discussion of the impact of technology information retrieval to the abstract genre. In this article, two types of abstracts have been characterized: informative and indicative. They suggest that informative abstracts would be more specific than indicative abstracts. Also, the result and conclusion sections are often included in informative abstracts to which science and technology are preferred.

Kanoksilapatham (2005) conducted the study of rhetorical structure of research articles in biochemistry field to present a complete guided model of this particular discipline. Fifteen moves consisted of three moves for the introduction section and other twelve moves from the method, result and discussion sections were investigated in a relatively large corpus of sixty biochemistry research articles. One of her findings indicates that there was little use of Move Two, to prepare for the present study. This is possibly because first, the conducting study is similar with the previous studies in the approach, thus there has not been a gap to indicate. Second, Kanoksilapatham (2005) state that this move may be defined as a fault finding strategy which could lead to face-threatening in one culture. Therefore, apart from variation among disciplines there is also the variation among cultures that plays a crucial role in the rhetorical moves selected by the writer.

Pupipat (1998) examined the scientific article written by Thai scientists in English and then interviewed both ESP specialists or editors and scientists to explore their perceptions. He finds that the effective strategies that Thai scientists employed in their research articles are, such as using graphics as an outline, revising, writing the literature review in Thai language to avoid plagiarism. Other inefficient strategies are, such as writing with a rigid linear sequence, using cut-and-paste technique in drafting and revising. Apart from grammatical difficulties which are the main problem, how to write in each section of research articles such as the discussion, abstract and

introduction is respectively perceived the most difficult genre for Thai scientists. According to Pupipat (1998), these three sections should be given priority in the EST pedagogical system for Thai scientists.

John and Swales (2002) emphasized the importance of shifting the corpus from published dissertation into student's dissertation. They studied the rhetorical and other difficulties of both undergraduate and dissertation students. Overall dissertations were analyzed to find their patterns and student's difficulties were then discussed. Results revealed that there seem to be the similar problems, for both levels in spite of huge differences in the degree of knowledge. As a result, they suggest that, in addition to general practices in classroom, EAP pedagogy should provide the sufficient disciplinary practices for students as much as possible and raise them the awareness of text in different disciplines so that they will have experience to assist them coping with their specific disciplinary text.

CHAPTER III

METHODOLOGY

This study aims to investigate and analyze the abstracts produced by Kasetsart University. In this part of the research, the researcher shows how the study was conducted in order to achieve the objectives. Thus, all steps are covered in this section. Thus, this chapter is set out as follows:

1. Background of *the Kasetsart Journal*
2. Framework of the study
3. The data collection procedure
4. The data analysis
5. Random Sampling
6. Validity and Reliability Assurance

Background of the Kasetsart Journal

The Kasetsart University Research and Development Institute (KURDI) on behalf of Kasetsart University publish two journals - Kasetsart Journal: Natural Science and Kasetsart Journal: Social Sciences - to disseminate scientific research results both within Thailand and internationally. The first volume of *the Kasetsart Journal* was published in March 1961. In 1980, the Journal was expanded into two separate publications. Currently Kasetsart Journal: Natural Science is produced bimonthly issues a year and is issued in February, April, June, August, October and December.

Beginning with this first issue of volume 44, *the Kasetsart Journal* (Natural Science) will be published six times per year (February, April, June, August, October and December). *The Kasetsart Journal* (Natural Science) is accepted as an international journal based on the standard of the Commission on Higher Education of Thailand Currently, the journal can be accessed and downloaded online via the

internet (website: http://kasetsartjournal.ku.ac.th/). From mid-year in 2008 until December 2009, there were about 400,000 visits to and downloads from the website.

Procedures of the Study

In order to achieve the research objectives, the overall framework of the study was first constructed to show how the research was carried out.

1. The researcher studied the related literature and research about corpus based analyses of textual organization to gain more understanding of information about the topic. Moreover, it provided knowledge of the recent developments in the field of the recent developments in the field for the researcher to conduct quality research

2. The researcher decided the main corpus for analysis to be thirty abstracts produced by *the Kasetsart Journal* of Kasetsart University. These abstracts can be easily accessed from the internet.

3. The researcher constructed the analysis criteria for the text corpus, according to the research objectives. For this, Santos (1996) theory for abstract analysis was chosen to be a guideline of the analysis. There were five moves altogether. After the criteria were constructed, three specialists received an explanation of how to analyze the data in order to ensure that they understood the analysis procedure.

4. Random sampling was used to select the abstracts in order to gather the samples according to the criteria. Thirty abstracts were selected from the most recent ones.

5. The researcher downloaded and saved the thirty abstracts samples selected from *the Kasetsart Journal* of Kasetsart University. Each abstract was run ordered chronologically.

6. The researcher proofread the downloaded texts and edited the errors because the downloaded the errors because the downloaded documents may have been changed when opened with a different application to the original one. For example, opening PDF FILE with Microsoft Word application, the symbols of Mathematics or Science may be represented with other symbols because of different fonts. Therefore, it was important to proofread the errors especially the fonts of the text.

7. The researcher printed out and made four copies for the researcher and three specialists. Before working on analyzing the data, the specialists were asked to practice analyzing a task in order to ensure that they could analyze the data without any problems.

Data Collection Procedure

A total of 30 research article abstracts was selected from *the Kasetsart University Journal* in the area of Natural Science. The journal was chosen as it reaches the international standard. According to Science Citation Index (SCI) has surveyed and ranked Thai journal for citation between 2001-2004. The result has revealed that *the journal of Kasetsart University* is well-known among international journals. The journal has been ranked the sixth place from the total number thirty-five of having been cited in large number of scientific academic papers.

Considering that the rhetorical structure and linguistic features of empirical research article abstracts can be very different from those of theoretical research articles, only abstracts of data-based research articles was used. The collection of research article abstracts started from the most recent issue of each journal accessible online at the time of data collection and stopped when 10 research article abstracts from each journal of the three chosen have been collected from the journals, resulting in a total of 30 research article abstracts. All the research article abstracts taken come from three journals which are: volume 42 number 1 of January-March 2008, volume 42 number 2 of April-June 2008, and volume 42 number 3 of July-September 2008.

Data Analysis

The data analysis procedure was divided into two main processes; (1) Approach to the analysis of rhetorical structure/move structure. (2) Approach to the analysis of linguistic realizations of moves and authorial stance.

Approach to the Analysis of Rhetorical Structure/Move Structure

A major problem in most studies of abstracts (and also in studies of research articles following Swales's, 1990 approach) is that the identification of moves seems to be based on both a bottom-up approach and a top-down approach. The description 'bottom-up' means that researchers distinguish moves on the basis of certain linguistic signals. 'Top-down' means they do this on the basis of content. The two processes, bottom-up and top-down, therefore, need to be separated. In the present study, the identification of moves is based solely on the function or content of the text (i.e. using a top down approach). After the moves are identified, the typical linguistic features in each move are investigated.

Santos's (1996) model was used as the analytical framework for the rhetorical structure of the abstracts in the present study for two reasons. First, this model has been applied to abstracts of *the Kasetsart journal*, and it includes all the moves identified in other studies of abstracts. Second, the labels of the five moves (as shown in Table 6) are more meaningful than those in other studies such as Introduction of Conclusion. However, unlike Santos's study, the present study does not divide the moves further into sub moves. The subdivision of Move1 and Move 2 in Santos's study of abstracts was mainly based on Swales's (1990) CARS model for the introduction section of the article with moves and sub moves. Moreover, the observation of move cycles & move sequences, exceptional move cycle, and converse linear move cycle were investigated and discussed. The final framework used for the present study is thus as given in Table 6.

Some previous researchers on rhetorical moves (e.g. Mizuta *et al*., 2004) claimed that segments of text smaller than a clause should not be counted as moves. However considering the fact that abstracts are very condensed texts, such exclusion does not seem to be reasonable. Therefore, for the corpus of research article abstracts in the present study, a move can be realized by structures ranging from several sentences to a phrase or a word, although the most common realization of moves is in a sentence.

Table 6 Santos's framework for abstract analysis

Moves	Function/description	Question asked
Move 1: Situating the research <STR>	Setting the scene for the current research (topic generalization)	What has been known about the field/topic of research?
Move 2: Presenting the research <PTR>	Stating the purpose of the study, research questions and/or hypotheses	What is the study about?
Move 3: Describing the Methodology <DTM>	Describing the materials, subjects, variables, Procedures …	How was the research done?
Move 4:Summarizing The findings <STF>	Reporting the main findings of the study	What did the researcher find?
Move 5: Discussing the research <DTR>	Interpreting the results/findings and/or giving recommendations, implications/applications of the study	What do the results mean? So what?

Approach to the Analysis of Linguistic Realizations of Moves and Authorial Stance

An initial analysis of the linguistic features of the research article abstracts will be carried out to identify the features that have the potential of distinguishing moves and indicating authorial stance. A list of linguistic features as follows:

- Grammatical subjects

- Verb tense and aspect

- Voice

- Modal auxiliaries and semi-modal verbs (e.g. may, can, should, have to)

- Epistemic adjectives, adverbs and nouns (e.g. likely, possible, probably, generally, Possibility, assumption, tendency, need)

- Attitudinal adjectives, adverbs and nouns (e.g. important, significant, surprisingly, Curiously, importance, significance)

- Self-reference words (e.g. I, we, our, the author (s), the researcher)

- Reporting verbs (e.g. suggest)

- That-complement clauses

Random Sampling

In random sampling, each member of the population has an equal chance of being selected. Furthermore, the selection of respondents is independent. To select a random sample, the following steps were used in this research:

1. The researcher first identified every member of the population (N=57).

2. The researcher went to a random numbers table and used that table to assign each member of the population to a random number

3. Then, the researcher ranked each member from the lowest to highest based on the size of the random number.

4. To determine an appropriate sampling size, the researcher dealt with each abstract separately. Each abstract was numbered starting from 1 as to find the total number of the abstract. Next, the sample size was determined. A number in one column of the table of random numbers of Dawin Hendel (1977) was then selected by a random procedure. The total number of abstract was a one and two digit number, so the last one and two digits of the number chosen from the table of random numbers could not be more than the total number of the population. If the last one and two digits of the first chosen random number were greater than the total number of the population, the next number in the same column was chosen. This process went on until the last one and two digits of a number was less than or equal to the number of sampling (N=30) of the whole population (N=57). The population consisted of 57 and the researcher wanted to be 95% confident that the results would be within 5% of the true percentage in the population, so the researcher needed to randomly sample of 30.

5. Despite the hassles involved with random sampling, the researcher willingly used it because random sampling allows the researcher to generalize the results of one study to a larger population. To be more specific, the researcher used

statistic to infer the characteristics of a population from a random sample of that population.

Validity and Reliability Assurance

The approach to the analysis of move pattern of scientific abstracts of Kasetsart Journal appears to be subjective, and therefore, a process to minimize this problem was essential. The validity of the study was established because the researcher has confidence that the conclusions drawn are warranted from the corpus collected since the whole population was used in this study. Such confidence derived from the research methods that were designed to ensure content validity.

In addition to the validity of the study, the researcher enhanced the reliability of the study in the way that the conclusions were drawn from the representative samples of the scientific abstracts of *the Kasetsart Journal* on the basis feedback from specialist informants. For the trial, ten abstracts in the corpus were first randomly selected. Next, photocopies of the sample abstracts on which the moves had been marked and a summary of criteria for the identification of the moves were presented three Thai instructors in the Department of Foreign Languages, Faculty of Humanities, Kasetsart University who have taught an ESP graduate students and had been well-trained in genre analysis. They were then asked for their opinions on the appropriateness of the analysis of the moves in the scientific abstracts. The analysis was then refined based on the feedback received in discussion with these specialists.

CHAPTER IV

RESULTS

This chapter contains four main sections of research findings. The first section presents the move frequency. The second section discusses the linguistic realizations of abstract moves. The third section presents the move sequences and move cycles. The final section presents the converse linear move cycles.

Move Frequency

Most of the abstracts in *the Kasetsart Journal* had four to five moves. A closer look at the occurrence frequency of the moves in the corpus revealed that almost all the abstracts from the journal contained the *Presenting the research* (PTR) move (83.33%), the *Describing the methodology* (DTM) move (93.33%), the *Summarizing the finding (STF)* move (100%), and the *Discussing the research* (DTR) move (83.33%) (See table 7). The fewer moves in *the Kasetsart Journal* abstracts can thus be attributed to the lowest frequency of occurrence of the *Situating the research* (STR) moves (23.33%). Such findings are in line with those of Santos's (1996) with the *DTM (Describing the methodology)* move occurring in almost all the abstracts. The only difference is that the *STF (Summarizing the finding)* move in the present corpus was present in all the abstracts (100%), whereas only 80 percent of the abstracts in Santos's corpus (75 out of 94 abstracts) contained this move. This discrepancy can be explained by the fact that the corpus in the present study includes only empirical articles, thus reporting the results in an important part of the study. The type of research articles include in Santos's corpus was not clearly identified, but it is likely that he included both primary and secondary research articles. Secondary or theoretical research articles are less likely to have a results or findings section.

Table 7 Patterns of occurrence of moves in the abstracts from the journal

Moves	Number of KU abstracts containing move(N=30)
Situating the research <STR>	7 (23.33%)
Presenting the research <PTR>	25 (83.33%)
Describing the methodology <DTM>	28 (93.33%)
Summarizing the finding <STF>	30 (100%)
Discussing the research <DTR>	25 (83.33%)

Linguistic Realizations of Abstract Moves

1. Linguistic Realizations of Move 1- Situating the Research

The main target of the *STR (Situating the research)* move mainly emphasizes upon the function/description that sets the scene for the current research (topic generation). Also, the related question which clearly reflects the working atmosphere of this move can also be 'What has been known about the field/topic of research?' The total number of this move is 23.33% of the corpus. As shown in the examples below, the writers of the abstracts mention previous research or studies in the field as a way of leading into their own study.

(1) **<STR>** The lightning arrester models are based on the Ohio Brass: PDV-100, 9 kv and Precise: Precise PAZ-A09_110 ka. Class 1,130 kv…**(KJ 6)**

(2) **<STR>** The proposed method extents on the concept oyf Maa-Yescas and Aguilar (2003) (**KJ 9)**

A closer look at the context and use of these verb forms revealed that the use of a specific tense and aspect is controlled by the grammatical subject with which it is associated. Different sub-categories of subjects in this class favor different verb tenses and aspects. For example, the present simple tense tends to occur with grammatical

subjects that indicate a general topic in the field, whereas the past tense tends to be used for verbs with subjects indicating a specific researcher or a specific research object or outcome mentioned in previous research.

(3) **<STR>** Satay is one of the ten most popular foods for US consumers visiting Thailand. **(KJ 3)**

(4) **<STR>** The total suspended solid (TSS) dispersion model was based on the principle of conservation of mass. **(KJ 13)**

In this move, the present perfect tense was not found at all. The observation of the correlation between tense and grammatical subject is in line with Malcolm's (1987), Swales' (1990), and Salager-Meyer's (1992) findings which suggest that subject tends to guideline the use of tense which comes after each grammatical subject.

Similarly, the choice of voice was controlled by the subject category in that more active verbs than passive verbs were found. There was a correlation not only between subject category and verb tense and aspect but also between these two features and the voice of the verb.

(5) **<STR>** Natural rubber ribbed smoked sheet (RSS) production process involves a dry step in a wood smoke dryer. **(KJ 18)**

Finally, authorial stance was not expressed explicitly in this move by the use of the first person pronouns "I" or "we", nor was it shown through the use of attitudinal stance adjectives and adverbs.

2. Linguistic Realizations of Move 2- Presenting the Research

The clear function/description related to this move cycle is to state the purpose of the study/research questions and/or hypotheses. The questions help to see the whole picture of this move is and determine 'What is the study about?' The majority of Move 2 of the abstracts in *the Kasetsart Journal* was clearly signaled by a grammatical subject that refers to the study itself. The total number of this move found is 83.33% in the corpus. Also, the grammatical subjects in the *Presenting the research (PTR)* move emphasize the writer's own work as seen in the following examples:

(6) **<PTR>** This article presents an approach on controllability of nonlinear chemical processes based on passivity. **(KJ 9)**

(7) **<PTR>** This study produced the 6XHis-tag fusion protein. **(KJ 26)** There is, however, a difference between the two subjects in these examples. While "this article" refers to the physical object in front of the reader, "this study" refers to the more abstract concept of the study. 'This study' in example (7) is a more direct way of introducing the present study than 'this article reports on a study …', thus making the sentence sound less personal and more objective. The present perfect tense was not found at all in *the Presenting the research (PTR) moves*. Only the past simple and, to a lesser extent, the present simple were found in this move. 'This article' or 'this paper' gives the sense of the immediate physical object in front of the reader and thus takes a present tense verb, whereas 'this study' signals a report about what the research was and thus takes a past tense verb.

(8) **<PTR>** This article presents an approach on controllability of non-linear chemical processes based on passivity. **(KJ 9)**

(9) **<PTR>** This study consisted of a comparative study between unsmoked sheet (USS) and ribbed smoked sheet (RSS) obtained from monoclonal lattices from RRIM600, BPM24 and PB235 clones. **(KJ 18)**

'This study' can also be used to refer to the present study or simply to refer to the purpose of the current study, in which case it tends to take the past tense verb.

(10) **<PTR>** This study produced the 6XHis-tag fusion protein. **(KJ 26)**

Active and passive voice in this move is equally appeared. Modal auxiliaries were hardly found in *the PTR (Presenting the research) move*, the type of modal verb used in this move typically indicated hypotheses or assumptions (e.g. can):

(11) **<PTR>** The model has memory and can distinguish between historical volatility (HV) and implied volatility (IV).**(KJ 8)**

The presentation of hypotheses in combination with such modal verbs makes the researcher appear confident about the outcome of the study. As a result, hardly any evaluative words were found such as need, understand, consider, acknowledge, etc. Finally, authorial stance was not explicitly found in this move by the use of the first person pronouns "I" or "we", nor was it shown through the use of attitudinal stance adjectives and adverbs.

3. Linguistic Realization of Move 3 – Describing the Methodology

This move indicates how the research was conducted. The researcher, therefore, needs to offer some description for the readers to know how the research was actually carried out in relation to the research design, subjects, procedures, materials, instruments, and variables according to the type of experiment. This move appeared for 93.33% of abstracts in *the Kasetsart journal*. This move focuses on the participants being the most frequent realization. For example,

(12) **<DTM>** Sampling was carried out monthly during November 2002 to December 2003. (**KJ 1)**

Similar to the *Presenting the research (PTR) move*, the predominant tense used in *the DTM (Describing the methodology) move* across the journal was the past tense. This is not surprising as the purpose of *the DTM (Describing the methodology) move* is to report the research methodology that was already employed in the study, as seen in the following example:

(13) **<DTM>** The PCR products were cloned sequenced and subject to BLAST search at NCBI. **(KJ 2)**

In addition to the use of objectified subjects, *the Describing the methodology* (DTM) move of the abstracts was also kept retatively impersonal with the presence of more passive verbs in this move than in the other moves of the abstract. One possible explanation is that *the DTM (Describing methodology)* move of the abstracts more often starts with a subject referring to a research object followed by what was done to the object. Also, abstracts tend to emphasize reporting what the subjects of the research did. It thus seems that this move in the abstracts is more impersonal than other moves. Examples from the corpus regarding the use of active verbs and passive verbs in *the DTM (Describing the methodology) move* are given below:

(14) **<DTM>** The method divides the model system into controllable and uncontrollable and uncontrollable parts. **(KJ 9)**

(15) **<DTM>** The full length DNA sequence of Cry IC was cloned by PCR walking technique, sequenced, and analyzed. **(KJ 2)**

The impersonal character of *the DTM (Describing methodology) move* was strengthened even further by the absence of modal verbs and evaluative words. The first-person pronouns and their derived forms were also hardly found in this move throughout the journal.

4. Linguistic Realization of Move 4 – Summarizing the Findings.

The main concern of this move is to report the main findings of the study. In other words, this move summarizes briefly the main findings of the research and indicates how the data was handled. The simplest question which helps to see the whole picture of this move is 'what did the researcher find?' This move appeared for 100% of the abstracts in *the* Kasetsart *Journal*. Unlike *the DTM (Describing the methodology) move*, the subject types in the *Summarizing the findings (STF) move* tend to focus on the reference to writer's own work, the objects of research and their attributes. Objects of research and their attributes subjects prevailed in this move. The following extracts from the corpus illustrate the most common types of subjects in the STF move:

(16) **< STF>** The results showed that the large crabs with a carapace width greater than 8 cm, the weight of male is greater than that of female. **(KJ 1)**

(17) **<STF>** The results demonstrated that hardwood and softwood pulp mixed with washed-WWFSs recycled pulp could produce higher apparent density handsheets than those mixed with WWFSs recycled pulp, even though the increased amount of WWFSs and washed-WWFSs recycled pulp used for making handsheets decreased the apparent density and tensile strength of handsheets.**(KJ 5)**

As shown in the above examples, the phrase like 'the results showed that' tends to occur at the beginning of *the STF (Summarizing the finding) move* to signal the move. By comparison, the grammatical subjects of subsequent sentence/clauses in the move are more likely to show objects of research and their attributes (including nouns referring to people or objects studied, properties, action, behavior, or motivations and thoughts). The change of grammatical subjects in some STF moves of the present corpus is in line with what Lores (2004: 291) refers to as 'the simple linear TP [thematic progression] pattern', where the theme of the first sentence becomes the theme of the second sentence. The following example is taken from the present corpus.

(18) **<STF>** Based on seed yield per set as the selection criterion, MSL and RSL Were more effective than the other two methods. However, seed yield of the parent and the selection method did not imply the quality of fresh yield in the corresponding hybrid. **(KJ 28)**

The distribution pattern of verb tenses in *the Summarizing the finding (STF) move* was similar to that of *the Describing the methodology (DTM) move*, that is, there was preference for past tense over present tense. The use of past tense when reporting the results of the study leaves the reader with the impression that the writer is being objective and that he/she is plainly reporting the findings of the research. On the other hand, the present tense gives the idea that the writer is generalizing beyond the results of the study – the impression is that these are widely accepted findings. In terms of voice used in this move, the use of the passive was clearly evident in the expression 'it is found that.'

The presence of the author in this move was also sometimes indicated by the use of epistemic stance words (e.g. possible, likely, certainly, need, assume) and attitudinal stance words (e.g. successful, useful, better). In this move, the use of modal verbs (can, could) are widely used. For example,

(19) **<STF>** The results showed that the polyhistidine-tagged NS1 fusion protein was successfully expressed in bacterial cells, but the fusion protein accumulated in in the inclusion bodies. **(KJ 26)**

Some reporting verbs are found in this move such as consider, reveal, indicate. In agreement with Stotesbury's (2003 a) claim that persuasion in research article abstracts is sometimes expressed by means of using reporting verbs. Also, the modal verbs only found in this move were can, could.

Like in *the Describing the methodology (DTM) move*, the use of self-reference words was not found in *the Summarizing the findings (STF) move* throughout the journal. This finding is different from Hyland's (2003) findings. In his study, he found that the most common function of self-reference words in applied linguistics abstracts

is ‘stating results or claims’ (Hyland, 2003: 258). This difference may be due to the type of research article abstracts in his corpus. It was not stated clearly in Hyland’s study whether the abstracts in his corpus were taken from empirical research articles or theoretical research articles. As mentioned before, linguistic features in these two types of research articles can be very different from each other. Theoretical research articles tend to be more argumentative and thus the writer may need to be more assertive, whereas empirical research articles tend to be more objective and impersonal. For example,

(20) **<STF>** The result showed that chromosomal cry 1c gene consisted of 3,507 Bp encoded for 1,169 of amino acid and the plasmid DNA cry 1c gene had 3,450 Bp encoded for 1,160 of amino acid in length. **(KJ 2)**

This findings coincides with Hyland and Tse’s (2005b) observation that most that- constructions in abstracts referred to the writer’s own findings. The pattern as shown in example (20), the noun clause in the STF move is controlled by a past tense contains a past tense verb itself.

5. Linguistic Realizations of Move 5 – Discussing the Research

This move is designated to interpret the results/findings and/or give recommendations, implication/applications of the study. In other words, this move contains elements relating the results to previous research or giving implications of the results obtained. In some cases, the discussion may advance to draw conclusions, and to give recommendations. This move appeared for 83.33% of the present study’s corpus. The subjects of this move tend to focus on reference to writer’s own work or research outcome and their subject attributes. For example,

(21) **<DTR>** In this study, it is especially noteworthy to demonstrate that without any inorganic materials retained in handsheets, both the handsheets printed on the top and the bottom side had the same amount of curl. **(KJ 5)**

The past tense was used in this move together with the use of present tense. As this move discusses the meaning of the results and makes generalizations based on the findings in the previous move, the use of present tense makes the sentence sound more general. Also, the past tense used in this move helps the readers' sense of continuity from the last move. The change from past tense in *the STF (Summarizing the finding) move* to present tense in *the DTR (Discussing the research) move* help to signal the change of move and thus makes the abstract clearer to the reader. In term of voice, both active and passive were used in this move.

There was also a strong preference for the use of modal verbs as hedging or boosting devices in the DTR move (could, should, will, can, would, may, might), as illustrated in the following extract:

(22) **<DTR>** The results indicated that the NS1 protein may be useful for further application. **(KJ 26)**

(23) **<DTR>** In addition, focus should also be given to the area around the Pra Wet canal because of their low remediation potential during the dry period. **(KJ 27)**

Moreover, like *the STF (Summarizing the finding) move*, *the DTR (Discussing the research) move* was indicated by the use of epistemic stance words (e.g. possible, need), and attitudinal stance words (better, noteworthy, useful, beneficial). For example,

(24) **<DTR>** It appeared that it might be possible to obtain TSS dispersion and the simulated result was quite similar. **(KJ 26)**

Another common strategy that writer presented in this move was the use of self-reference word 'we' or 'our' accompanied by the use of reporting verb. Also, that-complement clause is widely used in this move. For example,

(25) **<DTR>** Here we report a quick, simple, reliable and inexpensive DNA extraction procedure for a duck's feather. **(KJ 7)**

(26) **<DTR>** Our findings clearly demonstrate that the domestic native Thai ducks derive their origin from the Mallard group A haplotypes. **(KJ 7)**

This finding is in line with Hyland's (2003) observation that writers tend to use self-mentioning for self-promotion. The use of "we" or "our" emphasizes the researchers' own findings; at the same time, the writers take on the responsibility for the claim that they make.

The reporting verbs 'suggest, report, consider, indicate' were the most common place found in *the DTR (Discussing the research) move*. This can be attributed to the tentativeness of researchers who are here interpreting their research findings. For example,

(27) **<DTR>** Comparison between treatments with and without the pavilions among cultivars suggested that cuttings placed in pavilions increased the number of emerged buds and roots earlier than those without pavilions. **(KJ 15)**

(28) **<DTR>** The results suggested that these selected wax apple cultivars and Malay apple tolerated to flooding differently and flooding tolerance was not generally associated with the ability to form adventitious roots under flooding conditions. **(KJ 16)**

The use of the reporting verb 'suggest' and other reporting verbs in example (28), signals the DTR move. Moreover, the use of future and continuous forms is only found in this move.

Move sequences & Move cycles

In this section, the move sequences & move cycles will be discussed. From table 8, thirteen types of cycles are found in the corpus taken from *the Kasetsart Journal*. The PTR-DTM-STF-DTR was found the most (36.66%) followed by the DTM-STF-DTR (10%). Next, the PTR-STR-DTM-STF-DTR and STR-PTR-DTM-

STF-DTR appeared equally (6.66%). Interestingly, the DTM-STF-DTM-STF-DTR, STR-PTR-STF-DTR, STR-STF-DTM-STF-DTR, PTR-DTM-STF-PTR-STF-DTR, PTR-DTM-STF-DTM-STF-DTM-STF-DTR, STR-PTR-DTM-STF, PTR-STF-DTM-STF-DTR, and PTR-STF-DTR-STF-DTR appeared equally in number (3.33%).

Table 8 Move sequences and move cycles

Number	Move cycles	Number of occurrence N=30	Percentage 100%
1.	PTR-DTM-STF	4	13.33%
2.	DTM-STF-DTM-STF-DTR	1	3.33%
3.	STR-PTR-STF-DTR	1	3.33%
4.	STR-STF-DTM-STF-DTR	1	3.33%
5.	PTR-DTM-STF-DTR	11	36.66%
6.	PTR-STR-DTM-STF-DTR	2	6.66%
7.	PTR-DTM-STF-PTR-STF-DTR	1	3.33%
8.	STR-PTR-DTM-STF-DTR	2	6.66%
9.	DTM-STF-DTR	3	10%
10.	PTR-DTM-STF-DTM-STF-DTM-STF-DTR	1	3.33%
11.	STR-PTR-DTM-STF	1	3.33%
12.	PTR-STF-DTM-STF-DTR	1	3.33%
13.	PTR-STF-DTR-STF-DTR	1	3.33%
	Total	**30**	**100%**

The move sequences and moves cycles stated by the framework of Santos (1996) are STR-PTR-DTM-STF-DTR respectively. The three sub-topics which could be found were move sequences and move cycles, exceptional move cycles, and converse linear move cycles. Those three types of move cycles are discussed separately below.

Move Sequences and Move Cycles

As stated clearly by the framework of Santos (1996), the move sequence given by the framework is the STR-PTR-DTM-STF-DTR move sequence respectively. The move sequence and move cycle mentioned were also found in *the Kasetsart Journal* which took the data directly from Table 8. It was found that there were six move sequences and move cycles (as shown in Table 9).

Table 9 Move sequences and move cycles

Number	Move sequences and move cycles	Number found	Percentage
1.	PTR-DTM-STF	4	13.33%
2.	STR-PTR-STF-DTR	1	3.33%
3.	PTR-DTM-STF-DTR	11	36.66%
4.	STR-PTR-DTM-STF-DTR	2	6.66%
5.	DTM-STF-DTR	3	10%
6.	STR-PTR-DTM-STF	1	3.33%
	Total	**23**	**73.31%**

Table 9 presented the whole picture of the move sequences and move cycles. It was regrouped from Table 8. The criterion which was used for regrouping into Table 9 was the specific gathering of the occurring move sequences and move cycles together. From Table 9, it is found that which directly reflected the whole picture of move sequences and move cycles was directly reflected the move cycle of PTR-DTM-STF-DTR tended to appear the most (36.33%) followed by the move cycle of PTR-DTM-STF (13.33%), then the move cycle of DTM-STF-DTR (10%), and the move cycle of STR-PTR-DTM-STF-DTR (6.66%). Equally, the two move cycles and move sequences of STR-PTR-STF-DTR and STR-PTR-DTM-STF were 3.33% respectively. The totally percentage found for this move was 73.31%, which was very

high when compared with the exceptional move cycle and the converse linear move cycle which are the move cycles which do not follow the move sequence suggested by Santos (STR-PTR-DTM-STF-DTR). This clearly reflected that (based on the total of 73.31% of the move sequences and move cycles) *the Kasetsart Journal* tended to follow the Santos' framework with the asserted number of 73.31%.

Next, the move sequences and move cycles will be discussed below:

1. There were six move sequences and move cycles.

1.1 PTR-DTM-STF Move Cycle

The move sequence and move cycle above suggested by Pho (2008) asserted that non-native speakers should include at least this move sequence and cycle in the abstract. Taking *the PTR (Presenting the research) move* firstly means that the writer wanted to state the purpose of the study, research questions and/or hypotheses (Santos, 1996) in order to link directly to *the DTM (Describing the methodology) move*, and *the STF (Summarizing the finding) move*.

(29) **<PTR>** Population structure and size at maturity of the orange mud crab Scylla olivacea in Klong Ngao mangrove swamp, Ranong Province, Thailand was investigated to derive information for its management. **<DTM>** Sampling was carried out monthly during November 2002 to December 2003. **<STF>** The results showed that the large crabs with a carapace width greater than 8 cm, the weight of male is greater than that of female….. **(KJ 1).**

Interestingly, the strategy used for the *PTR (Presenting the research) move* was stated at the beginning of writing the abstract. The writer tends to report findings from the previous studies and then gives the readers some background information about the study and then indicates the importance of the field.

(30) **<PTR>** This paper considers the new dynamic model, namely, the Anh-Inoue dynamic model of complete markets in which the prices of European calls and puts are given by the Black-Scholes formula… **(KJ 8).**

When the writer of *the Kasetsart journal* used the move cycle above, the writer tended to give the quick picture to the readers by presenting *the DTM (Describing the methodology) move* right after *the PTR (Presenting the research) move* in order that the readers might visualize by linking the background of the research into *the DTM (Describing the methodology) move*.

(31) **<PTR>** This paper considers the new dynamic model, namely, the Anh-Inoue dynamic model of complete markets in which the prices of European calls and puts are given by the Black-Scholes formula. **<PTR>** The model has memory and can distinguish between historical volatility (HV) and implied volatility (IV). **<DTM>** A new method is provided to estimate the implied volatility. **(KJ 8)**

The STF (Summarizing the finding) move reported the specific result after *the DTM (Describing the methodology) move*. As stated in Table 7, 100% of *the* corpus containing the *STF (Summarizing the finding) move* appeared in *the Kasetsart Journal*. The results and conclusions are the major points of interest to the readers.

(32) **<PTR>** This paper considers the new dynamic model, namely, the Anh-Inoue dynamic model of complete markets in which the prices of European calls and puts are given by the Black-Scholes formula. **<PTR>** The model has memory and can distinguish between historical volatility (HV) and implied volatility (IV). **<DTM>** A new method is provided to estimate the implied volatility. **<STF>** It is clear evidence that the historical volatility of Straits Times Index (STI) of Singapore Stock Exchange (SGX) is not constant while the volatility parameter, ó, of the Black-Scholes model is assumed to be constant throughout the duration in time. **(KJ 8).**

1.2 STR-PTR-STF-DTR Move Cycle

The writer began the abstract by having *the STR (Situating the research) move* at the beginning. This move cycle directly helped the abstract in setting the scene for the current research (topic generalization) (Santos, 1996) followed by *the PTR (Presenting the research) move*, which supported *the STR (Situating the research) move* in establishing the purpose of the study, research questions and/or hypotheses (Santos, 1996). Both *the STR (Situating the research) move* and *the PTR (Presenting the research) moves* supported the moves that came later which were *the STF (Summarizing the finding) move* and *the DTR (Discussing the research) moves*. The occurrence of this move cycle was only 3.33%, which was the least occurring among the different move cycles. It is rare for an abstract to not contain *the DTM (Describing the methodology) move*.

(33) **<STR>** Satay is one of the ten most popular foods for US consumers visiting Thailand. **<STR>** American consumer acceptance for the convenience products resulted in the development of aprocess for ready to eat satay sauce. **<PTR>** The objectives of this research were to determine the consumer acceptance and texture measurements of satay sauce as affected by peanut grinding methods, the one-step and multi-step process, and processing time, using consumer tests. **<STF>** Results showed that there were no significant differences in the overall acceptance from two replications (á>0.05), two processes (á>0.10) and two peanut grinding methods (á>0.10). **<STF>** There were significant differences in the overall acceptance (á<0.10) from three processing times because the effect of consumer liking scores of appearance and overall flavor were significant when increasing processing time. **<DTR>** The significance of processing times and convenience of peanut grinding method and suitability of process indicated that satay sauce should be prepared using a one-step process and processed for 45 min, and peanuts should be ground in a peanut butter machine. **(KJ 3).**

Interestingly, according to Pho (2008), whose research related to the field of Educational Technology and Applied Linguistics, 70% of the corpus (Educational Technology) and 85% of the corpus (Applied Linguistics) included *the DTM (Describing the methodology)*. At the point mentioned, it did not appear in *the DTM (Describing the methodology)* move in *the Kasetsart journal*, especially in the move cycle of STR-PTR-STF-PTR.

1.3 PTR-DTM-STF-DTR Move Cycle

The style of writing of this move cycle was slightly different from the move cycle of PTR-DTM-STF (in 1.1) because it had *the DTR (Discussing the research) move. The DTR (Discussing the research) move* aimed to support this abstract by interpreting the results/findings and/or giving recommendations, implications/applications of the study. The occurrence of this move cycle was 36.33%. The occurrence mentioned showed remarkable proportion in that *the Kasetsart journal* tended to opt for this move cycle as the preferred way of writing the abstract.

(34) **<PTR>** The objectives of this study were to determine the physical and optical properties of handsheets and also to ascertain the behavioral phenomena of their curl due to laser printing. **<DTM>** Handsheets were separately produced from beaten hardwood, softwood and recycled pulp and also from various mixing ratios of the beaten pulp. **<DTM>** The recycled pulp was derived from white wood-free shavings (W WFSs) and washed-WWFSs pulp slurries. **<STF>** The results demonstrated that hardwood and softwood pulp mixed with washed-WWFSs recycled pulp could produce higher apparent density handsheets than those mixed with WWFSs recycled pulp, even though the increased amount of WWFSs and washed-WWFSs recycled pulp used for making handsheets decreased the apparent density and tensile strength of handsheets. **<STF>** Most of the various ratios of WWFSs recycled pulp mixed with hardwood and softwood pulp could give slightly higher brightness and opacity handsheets than most of those of washed-WWFSs recycled pulp mixed with the same hardwood and softwood pulp. **<STF>** With laser printing,

handsheets printed on their bottom side were curlier than those printed on their top side. **<DTR>** This is possibly because a greater amount of inorganic materials, which was demonstrated in terms of ash content, derived from fillers and coating pigments were retained in the top side of the handsheets.**<DTR>** The increase in ash content of handsheets also decreased the amount of curl. **<DTR>** In this study, it is especially noteworthy to demonstrate that without any inorganic materials retained in handsheets, both the handsheets printed on the top and the bottom side had the same amount of curl. **(KJ5).**

When the comparison was made to the Santos's framework, it was found that *the STR (Situating the research) move* wasn't included in this move cycle. It might be considered that *the STR (Situating the research) move* tried to establish the precedent for the current research which might not need to be employed at the content being presented. According to Hyland (2005), his study suggested that only about half of the abstract needed *the STR (Situating the research) move* when applied to research in the broader field.

1.4 STR-PTR-DTM-STF-DTR Move Cycle

This move sequence and move cycle was slightly different from the move cycle of STR-PTR-STF-DTR (in 1.2) by having added *the DTM (Describing the methodology) move* which helped the readers in capturing the sense of how the research was done by describing the materials, subjects, variables, and procedures (Santos, 1996). This move cycle was exactly in line with the Santos (1996)'s framework for abstract analysis with the occurrence of 6.66%.

(35) **<STR>** The total suspended solid (TSS) dispersion model was based on the principle of conservation of mass. **<PTR>** The model was used to study the TSS concentration fields in the immediate vicinity of the rivers mouth and in the Upper Gulf of Thailand. **<DTM>** The verification had been done by comparing the predicted diffusion patterns with the satellite image. **<DTM>** There was 10 cruises survey in the Upper Gulf of Thailand by Kasetsart 1. **<DTM>** Total suspended solid

were analyzed by the gravimetric method. **<STF>** The comparison of the TSS dispersion pattern between the observed TSS dispersion and the simulated result was quite similar. **<DTR>** It appeared that it might be possible to obtain TSS information in the Upper Gulf of Thailand by using the TSS dispersion model. **(KJ 13).**

According to Santos (1996), all five moves give the complete picture of the abstract by providing enough details for the reader to understand the full extent of the abstract for *the STR (Situating the research) move*, the writer would like to make it clear that the current research is part of an ongoing debate as shown in the example below:

(36) **<STR>** The highly pathogenic avian influenza (HPAI) is a viral disease of poultry and is a zoonosis. **(KJ 26).**

The PTR (Presenting the research) move is to make an announcement that justifies the abstract, either by describing the key features of the research in question or by presenting its purpose.

(37) **<PTR>** This study produced the 6xHis-tag fusion protein. **(KJ 26).**

The DTM (Describing the methodology) move indicates the design of the study in terms of subjects, procedures, materials, instruments, and variables, according to the type of experimentation. The example is demonstrated below:

(38) **<DTM>**The full length NS1 cDNA of A /Chicken/TH/KU14 / 04 (H5N1) was cloned into an expression vector, pQE80L. **(KJ 26).**

The STF (Summarizing the finding) move contains answers to questions such as "What was the problem?", "How did you study the problem?" *The STF (Summarizing the finding) move* provides an answer to the question of "What did you find?" *The STF (Summarizing the finding) move* thus summarizes briefly the main findings of the research, and indicates how the data was manipulated. A typical example of a results statement is given below:

(39) **<STF>** The results showed that the polyhistidine-tagged NS1 fusion protein was successfully expressed in bacterial cells, but the fusion protein accumulated in the inclusion bodies. **(KJ 26).**

The DTR (Discussing the research) move is about making claims which are relative to the value or implications of the results obtained. This expression in some respect covers both the evaluation of findings.

(40) **<DTR>** The results indicated that the NS1 protein may be useful for further applications.

1.5 DTM-STF-DTR Move Cycle

The style of writing this move sequence and cycle was close to the move cycle of PTR-DTM-STF-DTR (in 1.3). The PTR (Presenting the research) move did not appear in the move cycle of DTM-STF-DTR. According to Santos (1996), *the DTM (Describing the methodology) move* is aimed at describing the materials, subjects, variables, and procedures. By employing *the DTM (Describing the methodology) move* at the beginning, this abstract was likely to streamline the research process in order to show the readers how it was performed. The frequency of occurrence of this move cycle was 10%. The move sequence for this move cycle is in line with Santos's framework for abstract analysis, but this move lacked *the STR (Situating the research)* and *the PTR (Presenting the research) moves*.

(41) **<DTM>** The detection of cryI, cryII and cryV genes in chromosomal and plasmid DNA of Bacillus thuringiensis JC 590 was done using polymerase chain reaction (PCR). **<DTM>** The PCR products were cloned sequenced and subject to BLAST search at NCBI. **<STF>** The results revealed that 5 genes of cry1 namely cry1Ab, cry1C, cry1D, cry1E and cry1I and 1 gene of cry2 namely cry2A were in both chromosomal and plasmid DNA. **<DTM>** The full length DNA sequence of cryIC was cloned by PCR walking technique, sequenced, and analyzed.**<STF>** The result showed that the chromosomal cry1C gene consisted of 3,507 bp encoded for

1,169 of amino acid and the plasmid DNA cry1C gene had 3,450 bp encoded for 1,160 of amino acid in length. **<STF>** Sequence comparison with other cry1C genes in database at NCBI showed these sequences had highly homology with cry1C genes in other B. thuringiensis strains. **<DTR>** The investigation of cry 1C in B. thuringiensis JC 590 could be the basic knowledge for future application in biocontrol because of its high toxicity. **(KJ 2).**

Interestingly, the writer of the abstract chose not to write about the first two moves. According to Pho (2008), *the DTM (Describing the methodology) move* tends to describe data collection procedure and how the data is analyzed. At the point mentioned, the writer of *the Kasetsart journal*, who made use of this move cycle, might have wanted to try to attract the readers by providing *the DTM (Describing the methodology) move* first.

(42) **<DTM>** Improvements of fig (Ficus carica L.) cutting propagation with and without using plastic pavilions were conducted at the Inthanon Royal Project Research Station (Khun Huai Hae area) as experiment 1 and at Pang Dah Royal Project Research Station as experiment 2, both in Chiang Mai province, at the elevation of 1,300 and 720 m above mean sea level, respectively. **<STF>** From experiment 1, larger cutting sizes in comparison with those of 0.6 – 0.8 and 1.0 – 1.2 cm was partially attributable to increased bud and root growth, as indicated by the number of emerged buds and roots in the "Brown Turkey" cultivar. **<STF>** In experiment 2, "Brown Turkey" was the most feasible cultivar for the region when using plastic pavilion, followed by "Dauphine" and "Lisa". **<DTR>** Comparison between treatments with and without the pavilions among cultivars suggested that cuttings placed in pavilions increased the number of emerged buds and roots earlier than those without pavilions. **<DTR>** The results indicated that using plastic pavilion increased the temperature that promotes early callus formation of buds and roots in the propagation of fig cutting in cool area such as the Inthanon Royal Project Research Station. **(KJ 15).**

In the example shown above, the writer provided the *STF (Summarizing the finding) move* right after *the DTM (Describing the methodology) move* in order that the readers could understand the findings, which was the consequence of *the DTM (Describing the methodology) move*.

As mentioned for this move cycle DTM-STF-DTR, *the DTR (Discussion the research) move* was required to complete the abstract by providing the discussion which was related to the first two moves.

1.6 STR-PTR-DTM-STF Move Cycle

The pattern of writing this move sequence and cycle was slightly different from the move cycle of STR-PTR-STF-DTR (in 1.2). In this move cycle, there was not any *the DTR (Discussing the research) move*. According to Pho (2008), the writer might omit *the DTR (Discussing the research) move*. This came from the completion of *the STF (Summarizing the finding) move* which had already provided results and support for all the conclusions, using evidence from the experiment. Also, the occurrence of this move cycle was 33.33%. The number of occurrences mentioned clearly showed that this move cycle was not popular in writing the abstract of *the Kasersart journal*.

(43) **< STR>** Natural rubber ribbed smoked sheet (RSS) production process involves a drying step in a wood smoke dryer. **<PTR>** The purpose of this work was to know whether this smoke drying step affected the lipid composition and the properties of sheet rubber. **<PTR>** This study consisted of a comparative study between unsmoked sheets (USS) and ribbed smoked sheets (RSS) obtained from monoclonal latices from RRIM600, BPM24 and PB235 clones. **<DTM>** The rubber was sampled in Chantaburi province, Thailand. **<STF>** It was found that the smoking process increased significantly the amount of lipid extract but decreased significantly the free fatty acid content. **<STF>** No significant effect of smoking was detected on macromolecular parameters such as gel content or molar mass distribution and on rheological parameters such as initial plasticity (P0) and Mooney viscosity

(ML(1+4)100). **<STF>** In terms of resistance to thermal oxydation estimated by Plasticity retention index (PRI), smoked sheets displayed a tendency to have lower PRI than unsmoked sheets. **<STF>** This difference was significant for PB235 clone. **<STF>** A clonal effect was detected for most of thevmeasured parameters. **<STF>** Indeed, PB235 clone displayed a higher lipid extract, higher P0, higher ML(1+4)100, higher molar mass than those of the other studied clones while its PRI was lower. **(KJ 18).**

Next, 'exceptional move cycle', they are move cycles which do not follow the move sequence (STR-PTR-DTM-STF-DTR) suggested by Santos (1996). The move cycle as seen in the corpus did not follow the Santos's order of move cycle (STR-PTR-DTM-STF-DTR). The exceptional move cycle accounted only for 6.66% in the present corpus (PTR-STR-DTM-STF-DTR) as shown in Table 10 below.

Table 10 Exceptional move cycle

Number	The exceptional move	Number found	Percentage
1	PTR-STR-DTM-STF-DTR	2	6.66%
	Total	2	6.66%

The total percentage found for this exceptional move cycle was 6.66% which was quite low when compared to the move sequences and move cycles (73.31%) as shown in Table 9.There was only one exceptional move cycle (PTR-STR-DTM-STF-DTR) found which could draw the exception to the other types of move cycle presented. The feature which appeared is called the 'exceptional move cycle'. In this exceptional move cycle, it can be seen from the order of the move that *the PTR (Presenting the research) move* came before *the STR (Situating the research) move*. The percentage of the occurrence was only 6.66% when compared with other move cycles and move sequences (73.31%) as shown in Table 9, and with the converse linear move cycle (19.98%), as shown in Table 11. This clearly showed that the linear move cycle was not popular in *the Kasetsart Journal* when applied into use.

2. PTR-STR-DTM-STF-DTR Move Cycle

The writer of this exceptional move cycle stated *the PTR (Presenting the research) move* was positioned first so as to state the purpose of the study, research questions and/or hypotheses. Also, the writer wanted to focus on the preliminary understanding as an important point of the research followed by the background support of the STR (Situating the research) move in order to boost more understanding.

(44) **<PTR>** This article presents an approach on controllability of nonlinear chemical processes based on passivity.**<STR>** The proposed method extents on the concept of Maya-Yescas and Aguilar (2003). **<DTM>** The method divides the model system into controllable and uncontrollable parts.**<DTM>** A controller can be designed by setting the controllable part equal to zero, so-called the perfect controller.**<DTM>** For uncontrollable part, the storage and the supply rate functions are defined by implementing the same perfect controller to analyze the stability.**<DTM>** If the uncontrollable part has the Kalman-Yacubovich-Popov (KYP) property, it is guaranteed to be stable and, therefore, the overall system would be controllable. **<STF>** The applications of proposed method are illustrated with two examples: 1) the four available control structures of heat exchanger network for one hot stream and two cold streams; and 2) the two process variables of continuous fermentation. **<DTR>** The simulation results imply that the stability and the steady state of uncontrollable part can be considered only as the Lie derivative of a storage function. **<DTR>** This technique can be extended to other nonlinear chemical processes as a tool for selecting the best input-output pairing to design the control structure. **(KJ 9).**

The occurrence of this exceptional move cycle was 6.66%. According to Santos (1996), *the PTR (Presenting the research)* move tends to indicate the main features, purpose or even raise hypotheses. From the example given below, the choice of positioning *the PTR (Presenting the research) move* first was because the writer wanted to present the whole research first by having used the phrase ‘this paper’. This

would help the readers to understand the whole picture of the research, which might benefit in understanding *the STR (Situating the research) move* better. Also, the writer wanted to raise the main features, purpose of the research followed by *the STR (Situating the research) move*, which gave the current knowledge related to the background of the work in order to boost the understanding of the readers.

(45) **<PTR>** This paper describes operating analysis of metal oxide surge arrester, model and the new model proposed, using ATP-EMTP. **<STR>** Nowadays the utilities in Thailand such as the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA) mostly use lightning arrester from Ohio Brass and precise brands… **(KJ 6).**

The Converse Linear Move Cycle

In this section, the converse linear move will be discussed. The converse linear move cycle is the repetitive occurrence of move cycle which seems not to follow a pattern in the organization of their rhetorical move by using the same move structure (Hirano, 2009). According to the framework for abstract analysis of Santos (1996), a pattern in the organization of the abstract rhetorical move cycle is STR-PTR-DTM-STF-DTR. The converse linear move cycles also appeared in *the Kasetsart Journal* for 6 patterns which were shown in Table 11 below taken from Table 8 showing the whole picture of the converse linear move cycles.

Table 11 The converse linear move cycles

Number	Converse linear move	Number found	Percentage
1.	DTM-STF-DTM-STF-DTR	1	3.33%
2.	STR-STF-DTM-STF-DTR	1	3.33%
3.	PTR-DTM-STF-PTR-STF-DTR	1	3.33%
4.	PTR-DTM-STF-DTM-STF-DTM-STF-DTR	1	3.33%

Table 11 (Continued)

Number	Converse linear move	Number found	Percentage
5.	PTR-STF-DTM-STF-DTR	1	3.33%
6.	PTR-STF-DTR-STF-DTR	1	3.33%
	Total	**6**	**19.98%**

Table 11 reflects the whole picture of the converse linear move cycle; it was found from the table above that 19.98% from the corpus belonged to the converse linear move cycle. In the converse linear move, it was found that all the occurrences was appeared only one (3.33% each, respectively) when this type of move was compared with other moves cycles (73.31%), and the exceptional move cycle (6.66%). Those results confirm that this type of move cycle was chosen in writing the abstract of *the Kasetsart Journal* in the second place of frequency with the percentage of 19.98%

1. There were six converse linear moves cycles in the Kasetsart Journal corpus.

1.1 DTM-*STF*-*DTM*-*STF*-*DTR* Move Cycle

From the converse linear move cycle above, the motive of repetition of both *the DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move* was the picture of how scientific research is produced by linking to the type of research design of experimental modes which are separated into phases. With this, the researcher is likely to explain the method of experimental research into phases. In each phase, the methodology is explained, and then followed by the result (Shuttleworth, 2009). The repetitive appearance of *the DTM (The describing the methodology) move* and *the STF (Summarizing the finding) move* was found. At this point, it showed the intention of the writer who wanted to present the processes of describing the methodology followed by the result derived from the methodology. Again, it repeated the process of describing the methodology followed by the result derived from the methodology. In the manner mentioned, there were two separate

issues in which it was easy to see the whole picture followed by *the DTR (Discussing the research) move*; it discussed the result at the end. The percentage of occurrence was only 3.33% which was a small proportion when compared with the whole abstract.

(46) **<DTM>** The detection of cryI, cryII and cryV genes in chromosomal and plasmid DNA of Bacillus thuringiensis JC 590 was done using polymerase chain reaction (PCR). **<DTM>** The PCR products were cloned, sequenced and subject to BLAST search at NCBI. **<STF>** The results revealed that 5 genes of cry1 namely cry1Ab, cry1C, cry1D, cry1E and cry1I and 1 gene of cry2 namely cry2A were in both chromosomal and plasmid DNA. **<DTM>** The full length DNA sequence of cryIC was cloned by PCR walking technique, sequenced, and analyzed. **<STF>** The result showed that the chromosomal cry1C gene consisted of 3,507 bp encoded for 1,169 of amino acid and the plasmid DNA cry1C gene had 3,450 bp encoded for 1,160 of amino acid in length. **<STF>** Sequence comparison with other cry1C genes in database at NCBI showed these sequences had highly homology with cry1C genes in other B. thuringiensis strains. **<DTR>** The investigation of cry 1C in B. thuringiensis JC 590 could be the basic knowledge for future application in biocontrol because of its high toxicity. **(KJ 2).**

1.2 *STR-STF-DTM-STF-DTR Move* Cycle

From the converse linear move cycle above, there was a repetition of *the STF (Summarizing the finding) move*. This could yield a straightforward commentary of exactly what one observed and found. This should aim to narrate each finding to each experiment without trying to interpret or evaluate them, other than to provide a link to the discussion section (Shuttleworth, 2009). It was found that by taking *the STR (Situating the research) move* firstly, the writer would like to make clear that the current research is the part of an ongoing debate. This helped to link the whole picture of the abstract to the background. This directly benefited in understanding moves with *the STF (Summarizing the finding) move*. The writer then took *the STF (Summarizing the finding) move* after *the STR (Situating the research) move* by emphasizing the

move which contained the answers to the questions such as *the STF (Summarizing the finding) move* "What was the problem?", and "How did you study the problem?" Thus, the main findings was briefly summarized in the research, and indicated how the data was manipulated. The possible reason for repeating *the STF (Summarizing the finding) move* was to emphasize the importance of *the STF (Summarizing the finding) move* towards the core of the research. The percentage of occurrence was only 3.33% which was a small proportion when compared with the whole corpus.

(47) <STR> Fermented fish products (Pla-ra) were produced from 4 species of marine fish. **<STF>** The results showed that Pla-ra from Rastrelliger neglectus and Rachycentron canadus with 25 percent and 30 percent salt added followed by fermenting at room temperature (28°C-30°C) for 18 months had the highest acceptability scores on color, odor and appearance by the organoleptic test. **<DTM>** Preservation of those Pla-ra was studied by sterilizing the products, then packing into glass bottles, tin cans and retort pouches. **<DTM>** The samples were determined by organoleptic test and compared with normal Pla-ra after being preserved for 6 months. **<STF>** The results showed that Pla-ra preserved in polyethylene plastic jar at room temperature had the highest acceptability. **<DTR>** However, Pla-ra kept in a glass-bottles were more popular than Pla-ra kept in a tin cans and retort pouches. **(KJ 4).**

1.3 PTR-*DTM*-*STF*-*PTR*-*STF*-*DTR* Move Cycle

This converse linear move cycle was similar to the move cycle discussed in 1.2 by having *the STF (Summarizing the finding) move* repeated. The motive of having repeated *the STF (Summarizing the finding) move* was mentioned previously in 1.2, which could yield a straightforward commentary of exactly what one observed and found. This should aim to narrate each finding to each experiment without trying to interpret or evaluate them, other than to provide a link to the discussion section (Shuttleworth, 2009). As given in the last move, the writer wanted to emphasize *the STF (Summarizing the finding) move* which contained the answer to the question. Also, the main findings briefly summarized the research, and indicated how the data

was manipulated. Interestingly, this move was different from the previous move cycle by providing *the DTM (Describing the methodology) move* earlier. By this, the writer might have wanted to show/describe the methodology which indicated the design of the study in terms of subjects, procedures, materials, instruments, and variables, according to the type of experimentation. As with information mentioned earlier, it benefited the readers well in understanding the major concerns of the research in terms of the whole procedure. Moreover, *the PTR (Presenting the research) move* also came after *the first STF (Summarizing the finding) move*. This would empower the research to be well understood by providing the purpose of the study, research questions and/or hypotheses. The percentage of occurrence was only 3.33%, which was a small proportion when compared with the whole abstract.

(48) **<PTR>** A simple low-cost method for extracting mitochondrial DNA (mtDNA) from a single plucked feather for a non-invasive genetic study of ducks is described. **<DTM>** The mtDNA was isolated via alkaline lysis, and after neutralization, the crude DNA-containing lysate was used directly for PCR. **<STF>** It has had a 100% (30/30) success in amplification of a 710-bp fragment of the mtDNA control D-loop region. **<PTR>** Sequence analysis and phylogenetic relationship of the 667-bp D-loop segments of the two domestic native Thai ducks, Nakorn-Pathom (NP) and Park-Nam (PN), was further investigated. **<STF>** Two breeds exhibited 100% identity over the entire 667-bp products, although several types of mtDNA polymorphism were detected. **<STF>** Comparing the 667-bp D-loop sequence data with those of Anas ducks and Muscovy duck used as an outgroup showed that both native Thai ducks and Mallard (Anas platyrhynchos) haplotype A clustered together (bootstrap support 91%), indicating that there was common ancestor for those breeds. **<DTR>** Here we report a quick, simple, reliable and inexpensive DNA extraction procedure for a duck's feather. **<DTR>** Our findings clearly demonstrate that the domestic native Thai ducks derive their origin from the Mallard group A haplotypes. **(KJ 7)**.

1.4 PTR-*DTM*-*STF*-*DTM*-*STF*-*DTM*-*STF*-*DTR* Move Cycle

From the above converse linear move cycle, the feature of this linear move cycle was the repetition of each *DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move*. The motive of this might come from the nature of scientific research by having consisted of much sub-experimentation in each research. Also, the repetition of *the DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move* was similar to the linear move cycle of 1.1 (DTM-STF-DTM-STF-DTR). It was found that the rate of appearance of *the DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move* within each move cycle was equal. Interestingly, both of *the DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move* happened switchingly. About this point mentioned, the clear picture is that the writer began writing the abstract by having *the PTR (Presenting the research) move* first. Based on Santos (1996), *the PTR (Presenting the research) move* being in this position could be explained by the writer's effort to incorporate the abstract into the body of the paper. When *the PTR (Presenting the research) move* was placed before *the DTM (Describing the methodology) move*, the readers could understand what was going on. As mentioned earlier, the duty of *the DTM (Describing the methodology) move* was designed for stating how the research was conducted. According to the abstract given below as the example of this linear move cycle, it could be described that *the DTM (Describing the methodology) move* was separated into three steps followed by the three steps of *the STF (Summarizing the finding) move* so as to separate each step of *the DTM (Describing the methodology) move* and *the STF (Summarizing the finding) move* to be easy to understand. The percentage of occurrence was only 3.33% which was a small proportion when compared with the whole corpus.

(49) **<PTR>** Growth, leaf chlorophyll concentration and morphological adaptation of young wax apple (Syzygium samarangense (Blume) Merrill & Perry) cvs. Plastic (PT), Thunklao (TK), Phetnamphueng (PP) and Thapthimchan (TC) and Malay apple (Syzygium malaccense) (MA) plants under flooding conditions were investigated. **<DTM>** Potted wax apple and Malay apple plants were flooded to 5 cm

above the soil surface for 70 days continuously. **<STF>** MA, TK, PP and TC plants survived under this flooding duration while PT plants had gradually died after flooding for 30 days. **<DTM>** Vertical splitting of the outer bark was observed immediately above and below the flood level in all cultivars after flooding for 12 – 21 days followed by a development of adventitious roots at stem base below the flood level in most cultivars except for MA plants. **<STF>** Flooded PT plants formed adventitious roots faster than other cultivars while flooded TC plants had greatest mass of adventitious roots. **<STF>** Flooding significantly decreased shoot length, leaf number, leaf area, leaf chlorophyll concentration and dry weight of leaves and roots but increased shoot to root ratio. **<DTM>** Severe growth restriction was observed in flooded MA and PT plants. **<STF>** Based on the ability to maintain growth under flooding conditions, PP was the most flood tolerance cultivar with profuse adventitious roots followed by TK and TC, respectively, while PT was the least flood tolerance in this study. **<STF>** MA plants restricted their growth and maintained leaf chlorophyll level to survive flooding without adventitious root formation. **<DTR>** The results suggested that these selected wax apple cultivars and Malay apple tolerated to flooding differently and flooding tolerance was not generally associated with the ability to form adventitious roots under flooding conditions. **(KJ 16).**

1.5 PTR-STF-DTM-STF-DTR Move Cycle

From the converse linear move cycle above, there was a repetition of *the STF (Summarizing the finding) move*. This converse linear move cycle was close to the converse linear move cycle in 1.3 (PTR-DTM-STF-PTR-STF-DTR). But, the motive of this converse linear move cycle was slightly different from the converse linear move cycle of 1.3 (PTR-DTM-STF-PTR-STF-DTR). In this converse linear move cycle, *the STF (Summarizing the finding) move* was presented before *the DTM (Describing the methodology) move*. This motive might come from the influence of *the PTR (Presenting the research) move* being presented in form of an introduction which rose from the form of the research experiment. As stated earlier, the duty of *the STF (Summarizing the finding) move* is to yield a straightforward commentary of exactly what one observed and found. This should aim to narrate each finding to each

experiment without trying to interpret or evaluate them, other than to provide a link to the discussion section (Shuttleworth, 2009). It was found that the occurrence of *the STF (Summarizing the finding) move* happened twice. Based on the purpose of *the STF (Summarizing the finding) move*, this move mainly summarizes briefly the main findings of the research and indicates how the data was handled. As mentioned earlier the writer began writing the abstract by having *the PTR (Presenting the research) move* first, which could explain this part by the writer's effort to incorporate the abstract into the body of the paper. When *the PTR (Presenting the research) move* was placed before *the STF (Summarizing the finding) move*, the readers could understand the background of the research as a whole. After having placed *the PTR (Presenting the research) move*, *the STF (Summarizing the finding) move* was placed next in order to present the finding. In this manner, the writer wanted only to present the finding which could be visualized as the whole research by itself. *The DTM (Describing the methodology) move* was placed after *the STF (Summarizing the finding) move*, which helped explain the factors/materials that linked to the next *STF (Summarizing the finding) move* this move was then put behind *the DTM (Describing the methodology) move*. This helped avoid the occurring confusion between the first and the second *STF (Summarizing the finding) move*. The percentage of occurrence was only 3.33% which was a small proportion when compared with the whole corpus.

(50) **<PTR>** Absorbency and other physical properties of three different rodent bedding materials in Thailand corncob, woodchips, and para-rubber-were tested to find the most appropriate rodent bedding for the NLAC-MU colony. **<STF>** Corncob had the maximum volumetric absorbency after 48 to 72 soaking in saline. **<STF>** The volumetric absorbency, mass, and density of corncob were significantly higher ($p<0.05$) than for woodchips and para-rubber (1.5 to 2.5 times). **<STF>** In contrast corncob had the lowest ($p<0.05$) mass absorbency when compared to woodchips and para-rubber, due to its mass. **<STF>** Autoclaving influenced some properties of corncob bedding due to a reduction in the mass, density, and absorbency. **<STF>** However similar change was not found in woodchips or para-rubber. **<STF>** Woodchips generated significantly more ($p<0.05$) dust particles than para-rubber and corncob respectively. **<DTM>** Perimeter (mm) /area (mm2), and wood fiber space

were used to measure the altered shape after soaking in saline. **<STF>** The results showed that all the bedding used in this study did not significantly change ($p>0.05$) in shape and preserved its hardness after soaking. **<DTR>** The study concluded that corncob and para-rubber were more appropriate for use as rodent bedding than woodchips. **<DTR>** Further studies were needed to carry out toxicity, gas production and preference testing. **(KJ 25).**

1.6 *PTR-STF-DTR-STF-DTR Move* Cycle

In this converse linear move cycle, it was similar to the previous move (1.5), but the prominent difference was the presenting of *the DTR (Discussing the research) move* before *the STF (Summarizing the finding) move*. This motive came from the duty of *the DTR (Discussing the research) move* itself being to interpret the results/ findings and/or give recommendations, implications/applications of the study. Then, the move cycle of *the STF (Summarizing the finding) move* followed by *the DTR (Discussing the research) move* was repeated. This came from the nature of scientific research, which contains various steps of the experimental process in each type of research (Shuttleworth, 2009). As mentioned earlier about the purpose of *the STF (Summarizing the finding) move*, this move mainly summarizes briefly the main findings of the research and indicates how the data was handled. The writer began writing the abstract by having *the PTR (Presenting the research) move* first, which could be explained by the writer's effort to incorporate the abstract into the body of the paper. In this manner, the writer wanted to deliver the first part of the finding followed by *the DTR (Discussing the research) move* – based on Santos (1996), mainly for covering the evaluation of the finding. By doing this, the writer wanted to link to the second finding. Lastly, the writer placed *the DTR (Discussing the research) move* at the end. This was designed for directing the discussion to the research as the whole. The percentage of occurrence was only 3.33%, which was a small proportion when compared with the whole corpus.

(51) **<PTR>** This research investigated the influence of NaCl salt concentrations on the build-up properties of the selected warm- (Remazol Red RGB and Sumifix Supra Red 3BF) and hot- (Procion Red H-E3B and Drimarene Red X-6BN) dyeing reactive dyes on cotton. **<STF>** The results showed that an increment in the NaCl salt concentration in the dyebath influenced the visual color yields of the dyes on cotton. **<STF>** Too high a salt content led to a decline in the visual color yields. **<DTR>** This may have been explained by the formation of larger dye aggregates, being enhanced by the higher salt content. **<DTR>** Too large aggregates were considered to lead to a lower number of dyes diffusing into the fiber and so they would mostly remain on the fiber surface, thereby reducing the visual color yield. **<STF>** A significant reduction in visual color yield of the dyes on cotton occurred at 300 g/l salt. **<STF>** Among the dyes studied, Drimarene Red X-6BN was less affected by the salt concentration changes. **<STF>** From the study of the aggregation of the dye molecules in solution, it was found that increasing the salt concentrations enhanced the aggregation of the dye molecules. **<STF>** In the presence of salt, less dye in monomeric form existed in the solutions. **<STF>** When salt concentrations increased, the absorbance peaks responsible for the dye aggregates increased compared with those of the dyes in monomeric form. **<STF>** In addition, a bathochromic shift was also observed. **<STF>** With increasing salt concentrations, Drimarene Red X-6BN exhibited less reduction in the absorbance peak of the dye aggregates compared with the other dyes. **<STF>** This was in agreement with the build-up results. **<DTR>** From this research, it showed that almost all recommended salt concentrations used in the reactive dyeing were not the optimum concentrations delivering the ultimate build-up of the dyes on cotton. **(KJ 29).**

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter comprises three sections. The first section shows the conclusions of the study. The second section is the implications from the study. In the last section, the recommendations for the further studies are shown.

Conclusions of the Study

This study was conducted to explore the organization of rhetorical structure, linguistic realizations and authorial stance of abstracts of Kasetsart University in the field of Natural Science. Thirty abstracts were analyzed based on the framework for abstract analysis by Santos (1996). The abstracts were selected from the year of 2008 (N=30). The results of the study can be summarized as follows:

There were five moves found in the analyzed abstract suggested by Santos (1996): *Situating the research (STR) move*, *the Presenting the research (PTR) move*, *the Describing the methodology (DTM) move*, *the Summarizing the findings (STF) move*, and *the Discussing the research (DTR) move*.

Next, the brief functions and percentage of occurrence of each move are summarized by ranging from most often occurring to the least often occurring as follows: *the Summarizing the finding (STF) move* (100%) is to set the scene for the current research (topic generalization). *The Describing the methodology (DTM) move* (93.33%) is to report the main findings of the study. *The Presenting the research (PTR) move* (83.33%) is to state the purpose of the study, research questions and/or hypotheses. *The Discussing the research (DTR) move* (83.33%) is to interpret the results/findings and/or giving recommendations, implications of the study. The lowest frequency of occurrence can thus be attributed to *the Situating the research (STR) move* (23.33%).

Three additional topics were also studied in this abstract which were move sequences & move cycles, exceptional move cycle, and converse linear move cycles. There were six move sequences and move cycles found in total (73.31%): PTR-DTM-STF (13.33%), STF-PTR-STF-DTR (3.33%), PTR-DTM-STF-DTR (36.66%), STR-PTR-DTM-STF-DTR (6.66%), DTM-STF-DTR (10%), and STR-PTR-DTM-STF (3.33%). There was only exceptional move cycle found in total (6.66%): PTR-STR-DTM-STF-DTR (6.66%). There were six converse linear move cycles found six in total (19.98%); DTM-STF-DTM-STF-DTR (3.33%), STR-STF-DTM-STF-DTR (3.33%), PTR-DTM-STF-PTR-STF-DTR (3.33%), PTR-DTM-STF-DTM-STF-DTM-STF-DTR (3.33%), PTR-STF-DTM-STF-DTR (3.33%), and PTR-STF-DTR-STF-DTR (3.33%). The three move cycles mentioned (the move sequences & move cycles, the exceptional move, and the converse linear cycles moves) were compared with one another. As it for the frequency of occurrence was found that the most the descending order was move sequences and move cycles (73.31%) followed by the converse linear move cycles (19.98%), and the least was the exceptional move cycle (6.66%).

When it comes to the correlation between move types and linguistic features, the linguistic realization related to verb tense is summarized in the following sentences. First, the present simple tense appeared in five moves, which were *the STR (Situating the research) move*, *the PTR (Presenting the research) move*, *the DTM (Describing the methodology)*, *the STF (Summarizing the finding) move*, and *the DTR (Discussing the research) move*. The major differences of using were: *the STR (Situating the research) move* used the present simple for indicating a general topic in the field *the PTR (Presenting the research) move* was influenced by the use of the subject “this paper”. *The DTM (Describing the methodology) move* used the present tense mainly for proposing of fact towards the procedures being done. *The STF (Summarizing the finding) move* used the present tense for giving the idea that the writer is generalizing beyond the results of the study ,and *the DTR (Discussing the research) move* used the present tense as the signal for changing moves from *the STF (Summarizing the finding) move* to *the DTR (Discussing the research) move*. And it makes the sentence sounds more general. Second, the use of past tense verbs appeared

this in five moves which were *the STR (Situating the research) move*, *the PTR (Presenting the research) move*, *the DTM (Describing the methodology) move*, *the STF (Summarizing the finding) move*, and *the DTR (Discussing the research).* The major difference of use between those four moves mentioned were: *the STR (Situating the research) move* used the past tense verb with the subjects indicating specific researcher and specific research object or outcome mentioned in the previous research, *the PTR (Presenting the research) move* was influenced by the use of the subject "this study" to signal a report of what the research was about, *the DTM (Describing the methodology) move* used the past tense the most because it represents the research methodology, and *the DTM (Describing the methodology) move* was similar to *the STF (Summarizing the finding) move*. This comes from its duty which is to report the results of the study, the use of past tense in *the DTR (Discussing the research) move* helps the readers' sense of continuity from the last move. Third, the use of perfect tense verb was not found at all in *the STR (Situating the research) move*, *the PTR (Presenting the research) move*, and *the DTR (Discussing the research) move*, whereas the perfect tense verb use was found in *the DTM (Describing the mythology) move* and *the STF (Summarizing the finding) move*. Moreover, the use of future and continuous forms can only be found in *the DTR (Discussing the research) move*. Fourth, the use of active and passive voice was found in every move, but the most outstanding use of this was in *the DTM (Describing the methodology) move*. The reason comes from the nature of this move, which keeps fairly impersonal with the presence of more passive verbs in this move than in other moves of the corpus. Fifth, the use of modal auxiliary verbs found in the study contributed to *the PTR (Presenting the research) move, the STF (Summarizing the finding) move* and *the DTR (Discussing the research) move*. The use of modal in *the PTR (Presenting the research) move* emphasized hypotheses or assumptions directly (e.g. can), the modal verbs 'can, could' could also be found in *the STF (Summarizing the finding) move*, and in *the DTR (Discussing the research) move*, there was a strong preference for the use of modal verbs (e.g. could, should, will, can, would, may, might). Sixth, the use of 'that'-complement clauses was a dominant syntactic structure in *the STF (Summarizing the finding) move* and 'that'-complement is widely used in *the DTR (Discussing the research) move* such noun clauses occurred most frequently

followed by modal verbs. Seventh, the use of reporting verbs was found mainly in *the STF (Summarizing the finding) move*; consider, reveal, indicate, and in *the DTR (Discussing the research) move*; report, consider, suggest were found.

In contrast to the general assumption that abstracts are objective and impersonal, this study suggests that authorial stance does exist in abstracts although the extent of the author's involvement varies from move to move. This study separated the use of authorial stance into two main findings which are: firstly, authorial stance is expressed through the use of stance words, and modal verbs as hedging devices. This was found in *the STF (Summarizing the finding) move*, and *the DTR (Discussing the research) move*. *The STF (Summarizing the finding) move* and *the DTR (Discussing the research) move* tended to have the general modal verbs. The presence of the author indicated by the use of epistemic stance words in *the STF (Summarizing the finding) move* was possible, likely, certainly, need, and attitudinal stance words in *the STF (Summarizing the finding) move* were e.g. successful, useful, better. Similarly, *the DTR (Discussing the research) move* which was indicated by the use of epistemic stance words (e.g. possible, need), and attitudinal stance words (e.g. better, noteworthy, useful, beneficial). In *the DTR (Discussing the research) move*, there was a strong preference for the use of modal verbs as hedging or boosting device (such as may, could, should, will, can, would, may, might). Secondly, the use of author's stance is shown through the use of first-person pronouns only in *the DTR (Discussing the research) move*. In this move, another strategy that the writer presented was the use of self-reference words "We" or "Our".

Implications from the Study

This present study shows the rhetorical organization of scientific abstracts, linguistic realization of moves, and authorial stance. The analysis reveals certain similarities and differences in abstracts. In addition, this present study's outcome has similar results to the studies by Santos which were used as a theory framework.

First, this awareness of prevailing rhetorical patterns, linguistic realizations, and authorial stance has some pedagogical significance and can be explained. First, English is important to the extent that it is now the lingua franca. Consequently, non-native speakers of English (NNSs) are at a disadvantage with respect to reading published journals and publishing their own work in English. The insights into how abstracts are constructed from this study can increase and facilitate accessibility to academic information for NNSs.

Second, the rhetorical structure, linguistic realizations, and authorial stance gained from this study can help formulate strategies in teaching the reading and writing of abstracts. Teaching techniques and procedures in a genre-based classroom is dependent on the aim and general focus of the lesson. Some procedures might focus on certain aspects of language, whereas others might focus on the context of language use. In particular, the main purposes of English language teaching of this level should prepare advanced learners adequately for future academic writing as well as to mirror the actual requirements of their academic work in their respective disciplines. EFL/ESL students who have to write their own theses would discover that this study can be a useful resource in producing their own abstracts. Learners need to have an understanding of how features of a situation such as the participants involved in the communication, the specific purpose (s) of the communications exchange, and a discourse community's values, priorities, and expectations, may have an impact on the choices they make in the formulation and production of a particular genre.

Third, the rhetorical structure, linguistic realizations, and authorial stance described in this study provides a flexible paradigm regarding an approach to writing an abstract for scientists as to which rhetorical moves, linguistic realizations, and authorial stance could or should be used and in what content and order.

Fourth, Flowerdew (2001) stated that writers who were non-native speakers had difficulty in expressing authorial stance. This present study whose corpus data were based on abstracts of Kasetsart University Journal. This research found that the abstracts written by non-native speakers showed the use of authorial stance although

in one abstract only. The authorial stance in this research was manifested through the use of the first person pronoun (I and we) which was one of the most basic methods for a writer to show an authorial stance.

Fifth, the move sequence and move cycle of PTR-DTM-STF has been recommended by Pho (2008) for writers who a non-native speaker as these three moves contain basic and essential information. However, the move sequence and cycle of PTR-DTM-STF-DTR is the most prominent cycle found in the present corpus and they were all written by non-native speakers of English. Therefore, I would like to make a suggestion to any researcher to add the DTR (Discussing the research) move at the end of his abstract. This move involves interpreting the results/findings and/ or giving recommendations, implications/applications to the study. By this mean, the prospective reader can get the full picture of his study and it enables his abstract to be more meaningful.

In summary, this study increases the understanding of academic writing and broadens the perspectives of abstract writing including linguistic realizations, and authorial stance. The study highlights the fact that writing is a complex construct, consisting of a range of knowledge sets and processes. In addition, rhetorical organizations, linguistic realizations, and authorial stance are not static but dynamic, impacted by many factors, including disciplinary conventions, nature of the research, and status of the researchers. Therefore, learners should be trained and encouraged to be observant, analytical, and sensitive to rhetorical patterns, linguistic realizations, and authorial stance when faced with research article abstracts in their respective disciplines.

Recommendations for Further Studies

From the findings of the present study, further studies should be carried out to gain a deeper understanding and application as recommended below:

1. Genre study

1.1 There should be an investigation of scientific abstracts in order to get the whole picture of how scientific abstracts are constructed. To produce a useful pedagogical resource for scientists, scholars, and interested parties who wish to write an abstract.

1.2 There should be an investigation of the abstract in term of comparison and contrast with other disciplines. Knowing the similarities and differences of these abstracts will be helpful for writing more effective abstracts.

1.3 Other sources of abstract writing should be conducted in a field other than science in order to provide a valuable resource for ESL/EFL students who have to deal with abstract writing when thesis writing time comes.

2. The results from this study provide useful pedagogical and authentic material for teachers who teach academic writing for EFL/ESL. There should be an experimental study using commercial material and the outcomes from research teaching abstract writing in order to find out the effective teaching method or approach to abstract writing.

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APPENDICES

Appendix A

Table of move analysis

Appendix Table A Table of move analysis

	Sentences	STR	PTR	DTM	STF	DTR
J 1	1. Population structure and size at maturity of the orange mud crab Scylla olivacea in Klong Ngao mangrove swamp, Ranong Province, Thailand was investigated to derive information for its management.		✓			
	2. Sampling was carried out monthly during November 2002 to December 2003.			✓		
	3. The results showed that the large crabs with a carapace width greater than 8 cm, the weight of male is greater than that of female.				✓	
	4. Small sized mud crabs of both male and female accounted for the major catches while large crabs dominated the lower catches.				✓	
	5. The size frequency distribution of S. olivacea indicated that the recruitment of this species was continuous throughout the year with males being recruited in larger numbers than females.				✓	
	6. The proportion of males was significantly higher than that of females with a ratio of 1.3:1 (male: female).				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	7. Sex ratio of large sized females, with a carapace width greater than 9 cm, varied depending on the spawning period.				✓	
	8. When 50% of females were mature for the first time their carapace width was 9.55 cm, as estimated from a logistic model.				✓	
J 2	1. The detection of cryI, cryII and cryV genes in chromosomal and plasmid DNA of Bacillus thuringiensis JC 590 was done using polymerase chain reaction (PCR).			✓		
	2. The PCR products were cloned, sequenced and subject to BLAST search at NCBI.			✓		
	3. The results revealed that 5 genes of cry1 namely cry1Ab, cry1C, cry1D, cry1E and cry1I and 1 gene of cry2 namely cry2A were in both chromosomal and plasmid DNA.				✓	
	4. The full length DNA sequence of cryIC was cloned by PCR walking technique, sequenced, and analyzed.			✓		
	5. The result showed that the chromosomal cry1C gene consisted of 3,507 bp encoded for 1,169 of amino acid and the plasmid DNA cry1C gene had 3,450 bp encoded for 1,160 of amino acid in length.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6. Sequence comparison with other cry1C genes in database at NCBI showed these sequences had highly homology with cry1C genes in other B. thuringiensis strains.				✓	
	7. The investigation of cry 1C in B. thuringiensis JC 590 could be the basic knowledge for future application in biocontrol because of its high toxicity.					✓
J 3	1. Satay is one of the ten most popular foods for US consumers visiting Thailand.	✓				
	2. American consumer acceptance for the convenience products resulted in the development of a process for ready to eat satay sauce.	✓				
	3. The objectives of this research were to determine the consumer acceptance and texture measurements of satay sauce as affected by peanut grinding methods, the one-step and multi-step process, and processing time, using consumer tests.		✓			
	4. Results showed that there were no significant differences in the overall acceptance from two replications (á>0.05), two processes (á>0.10) and two peanut grinding methods (á>0.10).				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	5. There were significant differences in the overall acceptance (á<0.10) from three processing times because the effect of consumer liking scores of appearance and overall flavor were significant when increasing processing time.				✓	
	6. The significance of processing times and convenience of peanut grinding method and suitability of process indicated that satay sauce should be prepared using a one-step process and processed for 45 min, and peanuts should be ground in a peanut butter machine.					✓
J 4	1. Fermented fish products (Pla-ra) were produced from 4 species of marine fish.	✓				
	2.The results showed that Pla-ra from Rastrelliger neglectus and Rachycentron canadus with 25 percent and 30 percent salt added followed by fermenting at room temperature (28°C-30°C) for 18 months had the highest acceptability scores on color, odor and appearance by the organoleptic test.				✓	
	3. Preservation of those Pla-ra was studied by sterilizing the products, then packing into glass bottles, tin cans and retort pouches.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. The samples were determined by organoleptic test and compared with normal Pla-ra after being preserved for 6 months.			✓		
	5. The results showed that Pla-ra preserved in polyethylene plastic jar at room temperature had the highest acceptability.				✓	
	6. However, Pla-ra kept in a glass-bottles were more popular than Pla-ra kept in a tin cans and retort pouches.					✓
J 5	1. The objectives of this study were to determine the physical and optical properties of handsheets and also to ascertain the behavioral phenomena of their curl due to laser printing.		✓			
	2. Handsheets were separately produced from beaten hardwood, softwood and recycled pulp and also from various mixing ratios of the beaten pulp.			✓		
	3. The recycled pulp was derived from white wood-free shavings (W WFSs) and washed-WWFSs pulp slurries.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. The results demonstrated that hardwood and softwood pulp mixed with washed-WWFSs recycled pulp could produce higher apparent density handsheets than those mixed with WWFSs recycled pulp, even though the increased amount of WWFSs and washed-WWFSs recycled pulp used for making handsheets decreased the apparent density and tensile strength of handsheets.				✓	
	5. Most of the various ratios of WWFSs recycled pulp mixed with hardwood and softwood pulp could give slightly higher brightness and opacity handsheets than most of those of washed-WWFSs recycled pulp mixed with the same hardwood and softwood pulp.				✓	
	6. With laser printing, handsheets printed on their bottom side were curlier than those printed on their top side.				✓	
	7. This is possibly because a greater amount of inorganic materials, which was demonstrated in terms of ash content, derived from fillers and coating pigments were retained in the top side of the handsheets.					✓
	8. The increase in ash content of handsheets also decreased the amount of curl.					✓

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	9. In this study, it is especially noteworthy to demonstrate that without any inorganic materials retained in handsheets, both the handsheets printed on the top and the bottom side had the same amount of curl.					✓
J 6	1. This paper describes operating analysis of metal oxide surge arrester, Model and the new model proposed, using ATP-EMTP.		✓			
	2. Nowadays the utilities in Thailand such as the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA) mostly use lightning arrester from Ohio Brass and Precise brands.	✓				
	3. The lightning arrester models are based on the Ohio Brass: PDV-100, 9 kV and Precise: Precise PAZ-A09_1 10 kA. Class 1, 30 kV.	✓				
	4. The tests are performed by applying standard impulse current wave (8/20).			✓		
	5. It is found that the models can predict the operation of the metal oxide surge arrester in the system with error of less than 1% at 10 kA.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6. The percentages of error developed by the model using ATP-EMTP show that it can be use to predict or calculate energy consumption in each type of surge arresters.				✓	
	7. The percentage of error of this model is less than that of the other two models.				✓	
	8. From this reason, the result of prediction or estimation will be close to the real value of surge arrester in the normal condition of system.					✓
J 7	1. A simple low-cost method for extracting mitochondrial DNA (mtDNA) from a single plucked feather for a non-invasive genetic study of ducks is described.		✓			
	2. The mtDNA was isolated via alkaline lysis, and after neutralization, the crude DNA-containing lysate was used directly for PCR.			✓		
	3. It has had a 100% (30/30) success in amplification of a 710-bp fragment of the mtDNA control D-loop region.				✓	
	4. Sequence analysis and phylogenetic relationship of the 667-bp D-loop segments of the two domestic native Thai ducks, Nakorn-Pathom (NP) and Park-Nam (PN), was further investigated.		✓			

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	5. Two breeds exhibited 100% identity over the entire 667-bp products, although several types of mtDNA polymorphism were detected.				✓	
	6. Comparing the 667-bp D-loop sequence data with those of Anas ducks and Muscovy duck used as an outgroup showed that both native Thai ducks and Mallard (Anas platyrhynchos) haplotype A clustered together (bootstrap support 91%), indicating that there was common ancestor for those breeds.				✓	
	7. Here we report a quick, simple, reliable and inexpensive DNA extraction procedure for a duck's feather.					✓
	8. Our findings clearly demonstrate that the domestic native Thai ducks derive their origin from the Mallard group A haplotypes.					✓
J 8	1. This paper considers the new dynamic model, namely, the Anh-Inoue dynamic model of complete markets in which the prices of European calls and puts are given by the Black-Scholes formula.		✓			

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	2. The model has memory and can distinguish between historical volatility (HV) and implied volatility (IV).		✓			
	3. A new method is provided to estimate the implied volatility.			✓		
	4. It is clear evidence that the historical volatility of Straits Times Index(STI) of Singapore Stock Exchange(SGX) is not constant while the volatility parameter ,ó, of the Black-Scholes model is assumed to be constant throughout the duration in time t.				✓	
	5. Furthermore, this model can capture some movement of Straits Times Index (STI) of Singapore Stock Exchange(SGX) reasonably well.				✓	
J 9	1. This article presents an approach on controllability of nonlinear chemical processes based on passivity.		✓			
	2. The proposed method extents on the concept of Maya-Yescas and Aguilar (2003).	✓				
	3. The method divides the model system into controllable and uncontrollable parts.			✓		

Appendix Table A (Continued)

Sentences	STR	PTR	DTM	STF	DTR
4. A controller is designed by setting the controllable part equal to zero, so-called the perfect controller.			✓		
5. For uncontrollable part, the storage and the supply rate functions are defined by implementing the same perfect controller to analyze the stability.			✓		
6. If the uncontrollable part has the Kalman-Yacubovich-Popov (KYP) property, it is guaranteed to be stable and, therefore, the overall system is controllable.			✓		
7. The applications of proposed method are illustrated with two examples: 1) the four available control structures of heat exchanger network for one hot stream and two cold streams; and 2) the two process variables of continuous fermentation.				✓	
8. The simulation results imply that the stability and the steady state of uncontrollable part can be considered only as the Lie derivative of a storage function.					✓
9. This technique can be extended to other nonlinear chemical processes as a tool for selecting the best input-output pairing to design the control structure.					✓

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
J 10	1. Performance of 20 periparturient Holstein Friesian dairy cows fed alfalfa hay-base total mixed rations during transition and lactation periods was studied in a commercial dairy farm. From 7 d prior to anticipated calving date until 7 d after calving, all cows were also drenched with 400 ml of propylene glycol once daily.		✓			
	2. Blood samples were collected at -2, 1, 2, 3 and 4 wk from parturition.			✓		
	3. Milk yields were recorded daily, and milk samples were collected twice a week to determine milk compositions.			✓		
	4. Compared with the concentrations at -2 wk, serum glucose and urea nitrogen concentrations decreased whereas serum non-esterified fatty acid and â-hydroxybutyrate concentrations increased after calving.				✓	
	5. These results indicated that these cows entered some degrees of negative energy balance. Average milk production during 30 d postpartum was 34.8 ± 8.7 kg/d.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6. Average days from calving to first service was 86 ± 24 d, and 55% of 20 cows were conceived at first service.				✓	
	7. In conclusion, cows fed alfalfa hay-base diet and drenched with propylene glycol during periparturient period could improve negative energy balance, milk yield and conception rate.					✓
	8. However, replacing roughages from agro-industry by product with alfalfa hay in Thai dairy farms would depend on the economical analysis because most alfalfa hay was imported from foreign country.					✓
J 11	1. The study was carried out at Gewane Agricultural Technical and Vocational Education Training Collage, Gewane district, Ethiopia.		✓			
	2. Two local breeds of sheep, Afar and Blackhead, were experimental animals.		✓			
	3. Twelve each of Afar and Blackhead sheep aged between 5-6 months were assigned and each breed was divided by sex into two groups of 6 animals.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. All sheep was naturally exposed to infection with *Fasciola* spp. for 5 months from contaminated pasture near the Awash River path.			✓		
	5. The animals were regularly monitored for any evidence of disease.			✓		
	6. It was found that the overall prevalence of *Fasciola* spp. infection was 54%.				✓	
	7. Prevalence of infection by breeds was 37.5% for Blackhead and 33.3% for Afar breed.				✓	
	8. Prevalence of the infection by sex group was 61.5% for female and 38.5% for male group.				✓	
	9. There was no significant difference of the prevalence for different breeds and sex groups.				✓	
	10. The health status of these sheep was reduced in body weight, red cell count (RBC), packed cell volume (PCV), total protein (TP) and hemoglobin (Hb) and this condition was obviously seen in severe infected sheep.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	11. Severe infection of *Fasciola* spp. started from fourteen weeks after the exposure to the end of the experiment.				✓	
	12. Breeds resistant potency occurred at sixteen weeks for infected breeds and the shedding rates were higher in the Blackhead sheep.				✓	
	13. On the basis of egg per gram and clinicalpathology parameters, the Blackhead breed was considered more susceptible to *Fasciola* spp. infection than the other.				✓	
	14. The Afar breed may be better adapted in the study area as shown in PCV and another blood parameters.					✓
	15. However, there was no significant difference between the two breeds and sex groups.					✓
J 12	1.The experiment on effects of fertilizer and irrigation on yield and quality of rubber (Heveabrasiliensis) grown at Chanthaburi province is an on-farm research conducted at the Rubber Plantation of Sindane Thai Rubber Co, Ltd.		✓			
	2. The objective of the experiment was to investigate the effect of irrigation and fertilizer on yield and quality of rubber.		✓			

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	3. Experimental design used was a split plot with three replications, having irrigation and non irrigation as main plots and three formulas of NPK fertilizer of 15-7-18, 30-5-18 and 23-5-18 as subplots factorially arranged within each main plot.			✓		
	4. The trial was conducted on the clay loam soil of Klongluk series having the pH of 5.0 with 1.6% organic matter, 80.9 and 134 ppm of P and K respectively.			✓		
	5. The result of the experiment revealed that irrigation treatment increased the yield per tree per tapping, monthly production and also total rubber production per year.				✓	
	6. Latex yield also increased as the result of irrigation treatment. Under non-irrigation, the percentage of dry rubber content (DRC) was higher than those of irrigation treatment.				✓	
	7. Percentage of DRC was negatively correlated with both rubber yield and latex yield only under non-irrigation treatments.				✓	
	8. Result of latex diagnosis analysis showed that sucrose and total solid content (TSC) of samples were not affected by irrigation and fertilizer treatments.				✓	
	9. Inorganic phosphate (Pi) increased in the irrigated plot than those of non-irrigation but was not significantly differed (P>0.05) among others.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	10. Thiol content in latex samples showed the significant different (P<0.05) between irrigated and non-irrigated plots.				✓	
	11. Girth of rubber increased as the result of irrigation application while the percentage of tapping panel dryness (%TPD) was higher in non-irrigation treatment.				✓	
	12. The result of this study did not show the effect of fertilizer treatments in any of the parameters measured.					✓
	13. It may be possible that it would take a longer time than the experimental period before the effect of fertilizer will be pronounced.					✓
J 13	1. The total suspended solid (TSS) dispersion model was based on the principle of conservation of mass.	✓				
	2. The model was used to study the TSS concentration fields in the immediate vicinity of the rivers mouth and in the Upper Gulf of Thailand.		✓			
	3. The verification had been done by comparing the predicted diffusion patterns with the satellite image.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. There was 10 cruises survey in the Upper Gulf of Thailand by Kasetsart 1.			✓		
	5. Total suspended solid were analyzed by the gravimetric method.			✓		
	6. The comparison of the TSS dispersion pattern between the observed TSS dispersion and the simulated result was quite similar.				✓	
	7. It appeared that it might be possible to obtain TSS information in the Upper Gulf of Thailand by using the TSS dispersion model.					✓
J 14	1. Seroprevalence of bovine leukemia virus (BLV) infection was studied in replacement dairy heifers.		✓			
	2. Blood samples were collected from 80 pregnant heifers raised in 8 dairy farms in Saraburi province, the central part of Thailand and serum samples were tested for antibodies against BLV infection using commercially available ELISA test kits.			✓		
	3. The results revealed that 26 (32.5%) pregnant heifers were positive reactors, which was higher than seroprevalence of BLV in lactating dairy cows previously reported in Thailand.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. This study provided an evidence of a high seroprevalence of BLV in replacement heifers raised in areas of Saraburi province.					✓
	5. It was crucial to the dairy farmers to be aware of this disease in replacement heifer rearing.					✓
	6. Although serological test does not provide information of the infection at the early stage and is not sensitive enough to detect every infected animals, elimination of seropositive animals and prohibition of introduction of seropositive animals are sufficient to promote BLV-free herds in Thailand.					✓
J 15	1.Improvements of fig (Ficus carica L.) cutting propagation with and without using plastic pavilions were conducted at the Inthanon Royal Project Research Station (Khun Huai Hae area) as experiment 1 and at Pang Dah Royal Project Research Station as experiment 2, both in Chiang Mai province, at the elevation of 1,300 and 720 m above mean sea level, respectively.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	2.From experiment 1, larger cutting sizes in comparison with those of 0.6 – 0.8 and 1.0 – 1.2 cm was partially attributable to increased bud and root growth, as indicated by the number of emerged buds and roots in the "Brown Turkey" cultivar.				✓	
	3. In experiment 2, "Brown Turkey" was the most feasible cultivar for the region when using plastic pavilion, followed by "Dauphine" and "Lisa".				✓	
	4. Comparison between treatments with and without the pavilions among cultivars suggested that cuttings placed in pavilions increased the number of emerged buds and roots earlier than those without pavilions.					✓
	5. The results indicated that using plastic pavilion increased the temperature that promotes early callus formation of buds and roots in the propagation of fig cutting in cool area such as the Inthanon Royal Project Research Station.					✓
J 16	1. Growth, leaf chlorophyll concentration and morphological adaptation of young wax apple (Syzygium samarangense (Blume) Merrill & Perry) cvs. Plastic (PT), Thunklao (TK), Phetnamphueng (PP) and Thapthimchan (TC) and Malay apple (Syzygium malaccense) (MA) plants under flooding conditions were investigated.		✓			

Appendix Table A (Continued)

Sentences	STR	PTR	DTM	STF	DTR
2. Potted wax apple and Malay apple plants were flooded to 5 cm above the soil surface for 70 days continuously.			✓		
3. MA, TK, PP and TC plants survived under this flooding duration while PT plants had gradually died after flooding for 30 days.				✓	
4. Vertical splitting of the outer bark was observed immediately above and below the flood level in all cultivars after flooding for 12 – 21 daysfollowed by a development of adventitious roots at stem base below the flood level in most cultivars except for MA plants.			✓		
5. Flooded PT plants formed adventitious roots faster than other cultivars while flooded TC plants had greatest mass of adventitious roots.				✓	
6. Flooding significantly decreased shoot length, leaf number, leaf area, leaf chlorophyll concentration and dry weight of leaves and roots but increased shoot to root ratio.				✓	
7. Severe growth restriction was observed in flooded MA and PT plants.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	8. Based on the ability to maintain growth under flooding conditions, PP was the most flood tolerance cultivar with profuse adventitious roots followed by TK and TC, respectively, while PT was the least flood tolerance in this study.				✓	
	9. MA plants restricted their growth and maintained leaf chlorophyll level to survive flooding without adventitious root formation.				✓	
	10. The results suggested that these selected wax apple cultivars and Malay apple tolerated to flooding differently and flooding tolerance was not generally associated with the ability to form adventitious roots under flooding conditions.					✓
J 17	1. The method for protein hydrolysate production from Eri silk pupae (Philosamia ricini), waste from silk reeling process, was investigated.		✓			
	2. The appropriate process started by blending fresh pupa into fine particles and water was added to adjust final protein concentration to 4.6%.			✓		
	3. The pH was adjusted to 7.5 to accommodate the enzyme activity.			✓		
	4. Commercial enzyme Alcalase was added to 0.5% and the process was carried out at 50°C for 120 min with stirring.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	5. The protein hydrolysate from silk pupa was freeze-dried, ground into fine powder and analysed for compositions.			✓		
	6. The maximum degree of hydrolysis (DH) resulted from this condition was 73.27% with nitrogen recovery 62.82%.				✓	
	7. The hydrolysate product was water soluble and was rich in essential amino acids.				✓	
J 18	1. Natural rubber ribbed smoked sheet (RSS) production process involves a drying step in a wood smoke dryer.	✓				
	2. The purpose of this work was to know whether this smoke drying step affected the lipid composition and the properties of sheet rubber.		✓			
	3. This study consisted of a comparative study between unsmoked sheets (USS) and ribbed smoked sheets (RSS) obtained from monoclonal latices from RRIM600, BPM24 and PB235 clones.		✓			
	4. The rubber was sampled in Chantaburi province, Thailand.			✓		
	5. It was found that the smoking process increased significantly the amount of lipid extract but decreased significantly the free fatty acid content.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6.No significant effect of smoking was detected on macromolecular parameters such as gel content or molar mass distribution and on rheological parameters such as initial plasticity (P0) and Mooney viscosity (ML(1+4)100).				✓	
	7. In terms of resistance to thermal oxydation estimated by Plasticity retention index (PRI), smoked sheets displayed a tendency to have lower PRI than unsmoked sheets.				✓	
	8. This difference was significant for PB235 clone.				✓	
	9. A clonal effect was detected for most of the measured parameters.				✓	
	10. Indeed, PB235 clone displayed a higher lipid extract, higher P0, higher ML(1+4)100, higher molar mass than those of the other studied clones while its PRI was lower.				✓	
J 19	1. Enumeration of mesophilic bacteria and thermophilic bacterial spores from thirty-seven plantation white sugar factories were investigated.		✓			
	2. The total mesophilic count at 35°C and thermophilic flat sour spores count at 55°C were range from 0-670 CFU/10 g of sugar and 0-1,470 spores/10 g of sugar respectively.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	3. Thermophilic anaerobes were not observed where as yeast and mold count and pathogenic bacteria were undetectable in all samples.			✓		
	4. Eighty-four isolates of thermophilic bacteria were found in samples of twenty-seven factories.				✓	
	5. Based on physiological, biochemical and phenotypic characteristics, most of isolates were classified as Bacillus coagulans which were being the dominant species.				✓	
	6. B.circulans and B.brevis were found in the samples of two factories where as B.macerans was found in the only one factory.				✓	
J 20	1. The efficacy of calcium hypochlorite for controlling microsporidian (Thelohania or Agmasoma) infection by treating the water before stocking Pacific white shrimp, Litopenaeus vannamei, postlarvae (PL) was studied in intensively cultured ponds.		✓			
	2. Five ponds (of 4 rai each) were used as the treatment group in which calcium hypochlorite at a concentration of 18 mg/l was added into the ponds while all the aerators were operating.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	3. In the control group, no calcium hypochlorite was used. PL10 were stocked at a density of 80 PL/m2 and shrimp were fed with commercial pelleted feed throughout the 120-day culture period.			✓		
	4. Results showed that the prevalence of microsporidian (Thelohania, Agmasoma) infection of shrimp in the treatment group was significantly lower than that of the control group (P<0.05).				✓	
	5. At day 50, the average highest percentage of microsporidian infection in the treatment ponds was 5.40% compared with 25.16% in the control ponds.				✓	
	6. The infected shrimp gradually died off or were eaten by the healthy shrimp so that after harvesting only a few infected shrimp were found.				✓	
	7.In conclusion, in shrimp culture areas where microsporidian outbreaks previously occurred, calcium hypochlorite at the concentration of 18 mg/l should be used for water treatment before stocking the PL.					✓
J 21	1. The application of an electrolytic water treatment technique in a Pacific white shrimp (Litopenaeus vannamei) closed hatchery system was investigated in three experiments.		✓			

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	2. The first experiment studied the chlorine concentrations produced from an electrolytic system with different electric current and water salinity levels in a static water system.			✓		
	3. The second experiment studied the optimal electric currents and water flow rates for water treatment.			✓		
	4. The last experiment compared the closed hatchery system with an electrolytic system to an open system using chlorine powder for water treatment.			✓		
	5. It was found that in the static closed-water system, chlorine concentration increased with an increase of the duration of flow electric current and water salinity.				✓	
	6.While in the lotic condition, the optimal flow rate of water into the electrolytic system was 2.5 l/min and produced 11.4 mg/l of chlorine with an applied amperage of 1.6 A.				✓	
	7. This level was suitable for water treatment and could be applied in the Litopenaeus vannamei closed hatchery system for at least three crops.					✓
	8. Although the system could reduce the usage of chlorine powder, it had a lower survival rate and a greater nitrite-nitrogen level than the control.					✓

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
J 22	1.Extractions of biologically active chemical constituents from the leaves, bark and stem of Suregada multiflorum with a polarity sequence of hexane, dichloromethane and methanol were conducted.		✓			
	2. Antibacterial activities of the crude extracts were examined by paper disc agar diffusion and spread plate methods with Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Mycobacterium lacticola, Pseudomonas aeruginosa and Xanthomonas campestris.			✓		
	3. The crude extracts of the greatest inhibition activities, i.e. dichloromethane extracts, were chromatographed over a silica gel column using a single solvent and solvent mixtures of increasing polarity as the eluents.			✓		
	4. The bacterial growth inhibitions of the pure fractions were also examined to find out the most active fractions.			✓		
	5. The chemical constituents extracted from various parts of Suregada multiflorum provided high yields of polar fractions.				✓	
	6. The crude and pure fractions, particularly the polar compounds, of each part of the plant inhibited several tested bacteria.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	7. The purified fractions exhibited stronger inhibition than the crude extracts.				✓	
	8. The inhibition of Xanthomonas campestris growth indicated the potential of chemical constituents from Suregada multiflorum to inhibit plant bacterial diseases such as citrus canker and that they would probably be useful for canker prevention in replacing chemical pesticides.					✓
J 23	1. A greenhouse experiment was conducted to evaluate the effects of soil amendment on growth, performance and the accumulation of primary nutrients as well as Fe, Zn, Mn and Cu in vetiver.		✓			
	2. Ratchaburi vetiver ecotype plantlets were planted on iron ore tailings amended with compost and chelating agents (EDTA and DTPA).			✓		
	3. The results indicated that iron ore tailings contained high concentrations of heavy metals with total Fe, Zn, Mn and Cu concentrations of 63,920, 190, 3,220 and 190 mg kg-1, respectively and low contents of primary nutrients and organic matter. T				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	4. The combination of soil amendment materials, especially DTPA and compost, was more effective than sole chelating agents and sole compost in enhancing vetiver growth, nutrient and heavy metals uptake.				✓	
	5. The soil amendments used in this study did not affect Fe and Zn translocation from vetiver roots to shoots.				✓	
	6. However, chelating agent amendment could increase Cu translocation, especially in combination with compost, while it slightly decreased Mn translocation.				✓	
	7. The average mean translocation factors of Mn, Fe, Zn and Cu were 0.86, 0.71, 0.69 and 0.55, respectively.				✓	
	8. These results indicated that vetiver is a potential plant for phytostabilization and rehabilitation of iron ore mine areas.					✓
J 24	1. The relationship between the sodium nitroprusside (SNP) test for ketone bodies in urine and concentrations of serum ß-hydroxybutyrate (ß-HB) was studied in 50 Holstein Friesian cows on a commercial dairy farm, including 10 cows in the dry period, and 22, 8 and 10 cows and in week 2, 4 and 8 of lactation, respectively.			✓		

Appendix Table A (Continued)

Sentences		STR	PTR	DTM	STF	DTR
	2. Urine and blood samples were collected from all cows and were transported to the laboratory on the sampling date.			✓		
	3. Urine samples were analyzed for ketone bodies using the SNP test within 24 hours after collection.			✓		
	4. Serum samples were analyzed for the concentration of ß-HB.			✓		
	5.Results of the SNP test for ketone bodies were classified as either N (negative), +1 or + 2 based on the color reaction of SNP with a known amount of acetone in aqueous solution at 0 mmol (N), 1 to 5 mmol (+1) and 6 to 10 mmol (+2) respectively.				✓	
	6. Results of the SNP test for ketone bodies in urine were highly correlated with the concentrations of ß-HB in the serum (r = 0.82). Concentrations of serum ß-HB were 0.46 ± 0.03, 0.98 ± 0.10 and 2.63 ± 0.34 mmol/L for cows with the SNP test results of N (n = 31), +1 (n = 10) and +2 (n = 9), respectively.				✓	
	7. Concentrations of serum ß-HB were 0.42 ± 0.04, 0.97 ± 0.21, 1.48 ± 0.44 and 0.89 ± 0.12 mmol/L for cows in the dry period and in week 2, 4 and 8 of lactation, respectively.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	8. The method was practical, simple and inexpensive and therefore, it would be very beneficial for the diagnosis of subclinical ketosis or the early detection of ketosis in dairy cows, particularly on smallholder farms.					✓
J 25	1. Absorbency and other physical properties of three different rodent bedding materials in Thailand corncob, woodchips, and para-rubber-were tested to find the most appropriate rodent bedding for the NLAC-MU colony.		✓			
	2. Corncob had the maximum volumetric absorbency after 48 to 72 h soaking in saline.				✓	
	3. The volumetric absorbency, mass, and density of corncob were significantly higher ($p<0.05$) than for woodchips and para-rubber (1.5 to 2.5 times).				✓	
	4. In contrast corncob had the lowest ($p<0.05$) mass absorbency when compared to woodchips and para-rubber, due to its mass.				✓	
	5. Autoclaving influenced some properties of corncob bedding due to a reduction in the mass, density, and absorbency.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6. However similar change was not found in woodchips or para-rubber.				✓	
	7. Woodchips generated significantly more ($p<0.05$) dust particles than para-rubber and corncob respectively.				✓	
	8. Perimeter (mm) /area (mm2), and wood fiber space (ìm) were used to measure the altered shape after soaking in saline.			✓		
	9. The results showed that all the bedding used in this study did not significantly change ($p>0.05$) in shape and preserved its hardness after soaking.				✓	
	10. The study concluded that corncob and para-rubber were more appropriate for use as rodent bedding than woodchips.					✓
	11. Further studies were needed to carry out toxicity, gas production and preference testing.					✓
J 26	1. The highly pathogenic avian influenza (HPAI) is a viral disease of poultry and is a zoonosis.	✓				
	2. This study produced the 6xHis-tag fusion protein.		✓			

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	3. The full length NS1 cDNA of A/Chicken/TH/KU14/04 (H5N1) was cloned into an expression vector, pQE80L.			✓		
	4. The recombinant NS1 was expressed in the E. coli strain DH5.			✓		
	5.The results showed that the polyhistidine-tagged NS1 fusion protein was successfully expressed in bacterial cells, but the fusion protein accumulated in the inclusion bodies				✓	
	6. The fusion protein was isolated as either a native or denatured form and further purified by precipitation or immobilization on a nickel ion affinity column.				✓	
	7. Purification using affinity chromatography under denaturing conditions yielded greater amounts of purer NS1 protein.				✓	
	8. However, sufficient purity and concentration of the native NS1 protein was obtained after purification using a precipitation method.				✓	
	9. Both native and denatured, purified NS1 protein reacted specifically with the anti-NS1 chicken serum in a western blot assay.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	10. The results indicated that the NS1 protein may be useful for further applications.					✓
J 27	1. This research was carried out in the Ban Pho Town ship, Chachoengsao Province in the eastern part of Thailand, an important area for aquaculture.		✓			
	2. The objectives of the study were to assess the aquatic status and its potential carrying capacity for pollution and to understand the ecosystem responseto human and natural impacts leading to a proposal for an appropriate zone management approach for sustainable utilization of the area.		✓			
	3. Information on community-based utilization patterns was obtained through surveys using questionnaires.			✓		
	4. Field conditions were monitored by 2-monthly surveys from August 2004 to August 2005.			✓		
	5. The survey areas covered 12 stations in the middle zone of the Bangpakong River, 12 stations at adjacent canal mouths that received pollution loads from a nearby community and 29 stations at pollution point sources.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	6. Results indicated that Bangpakong River was eutrophic all year round.				✓	
	5. High nutrient loads from Ban Pho community continuously flow into the aquatic environment.				✓	
	6. The highest concentration of NH4 + nutrients came from crocodile farms (5,408 mg/m3), whereas maximum total loads (299×109 mg) during the year were from domestic sources.				✓	
	7. Total nutrient loads varied temporally and were different among zones.				✓	
	8. Almost all nutrient levels were high during highloading periods while the remediation potential was generally low.				✓	
	9. Land remediation potential with respect to NH4 + and PO4 3- was inexcess of 30 times more efficient in areas with comparatively high flow rates and more mangrove vegetation. I				✓	
	10. In terms of river-water remediation potential, the efficiency of NH4 + elimination was less during the dry period.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	11. It was observed that the Na Lang, Nong Bua and Yai Loy canals were affected by some human and environmental impacts.				✓	
	12. These areas needed more attention with regard to monitoring and management.					✓
	13. In addition, focus should also be given to the areas around the Pra Wet canal because of their low remediation potential during the dry period.					✓
	14. Results of multivariate analysis on the ecosystem responses indicated that functions of NH4 + and total suspended solids in the aquatic system significantly influenced chlorophyll a changes.					✓
	15. Based on the overall results, area zonation of the Ban Pho Town was being proposed and problems were being prioritized					✓
	16. Moreover, the application of integrated models suggested the need for better water quality control and/or management.					✓
J 28	1. The waxy, inbred line was crossed onto two inbred lines and one single cross of shrunken, super-sweet corn.			✓		

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	2. They were then backcrossed onto the corresponding super-sweet parents.			✓		
	3. Following consecutive selfing up to BC1S4, 15 ears from each BC1S4 family were selected and then transformed into composite–sibbed lines by four different methods: consecutive selfing within family line (SFL), topcross within line (TCL), selective mass sibbing within line (MSL) and recurrent–sibbed line (RSL).			✓		
	4. Based on seed yield per se as the selection criterion, MSL and RSL were more effective than the other two methods.				✓	
	5. However, seed yield of the parent and the selection method did not imply the quality of fresh yield in the corresponding hybrid.				✓	
	6. Occasionally, some of the high seed yield lines from MSL and RSL not only gave high fresh-ear yield hybrids, but also an exceptional quality of fresh ears.				✓	
	7. The results reflected the possibility of using a composite–sibbed line method to improve the yield and quality of parent lines in sweet corn which could then be transmitted to the corresponding single cross hybrids.					✓

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
J 29	1.This research investigated the influence of NaCl salt concentrations on the build-up properties of the selected warm- (Remazol Red RGB and Sumifix Supra Red 3BF) and hot- (Procion Red H-E3B and Drimarene Red X-6BN) dyeing reactive dyes on cotton.		✓			
	2. The results showed that an increment in the NaCl salt concentration in the dyebath influenced the visual color yields of the dyes on cotton.				✓	
	3. Too high a salt content led to a decline in the visual color yields.				✓	
	4. This may be explained by the formation of larger dye aggregates, being enhanced by the higher salt content.					✓
	5. Too large aggregates were considered to lead to a lower number of dyes diffusing into the fiber and so they would mostly remain on the fiber surface, thereby reducing the visual color yield.					✓
	6. A significant reduction in visual color yield of the dyes on cotton occurred at 300 g/l salt.				✓	
	7. Among the dyes studied, Drimarene Red X-6BN was less affected by the salt concentration changes.				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	8. From the study of the aggregation of the dye molecules in solution, it was found that increasing the salt concentrations enhanced the aggregation of the dye molecules.				✓	
	9. In the presence of salt, less dye in monomeric form existed in the solutions.				✓	
	10. When salt concentrations increased, the absorbance peaks responsible for the dye aggregates increased compared with those of the dyes inmonomeric form.				✓	
	11. In addition, a bathochromic shift was also observed.				✓	
	12. With increasing salt concentrations, Drimarene Red X-6BN exhibited less reduction in the absorbance peak of the dyeaggregates compared with the other dyes.				✓	
	13. This was in agreement with the build-up results				✓	
	14. From this research, it showed that almost all recommended salt concentrations used in the reactive dyeing were not the optimum concentrations delivering the ultimate build-up of the dyes on cotton.					✓

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
J 30	1. This paper presents the simulation results of the heat and mass transfer characteristics of corrugated packing in a counter-flow cooling tower.		✓			
	2. The numerical analysis has been partially validated by comparing the experimental data from a testing apparatus of a cooling tower under the same conditions at inlet dry bulb temperature of 32.3°C, inlet wet bulb temperature of 25.2°C and inlet water temperature of 40°C.			✓		
	3. Due to the complicated configuration of the packing surface and its installation, it was not able to measure the temperature of the air and water in the intermediate section, but only the exit air temperature and exit water temperature.			✓		
	4. It was found that the errors between the calculated and measured temperature of the exit air were less than 2.5% for the exit dry bulb temperature, less than 2.2% for the exit wet bulb temperature and for the exit water were less than 1.3% (by testing at L/G=1.800, 2.171 and 2.820).				✓	

Appendix Table A (Continued)

	Sentences	STR	PTR	DTM	STF	DTR
	5. A comparison of the volumetric heat transfer coefficients derived from the experiment and the simulation using the Tchebycheff method found that all the errors were less than 4.8%.				✓	
	6. Consequently simulation can be used as a tool for studying the phenomenon of heat and mass transfer in corrugated packing.					✓

Appendix B

The abstracts of Kasetsart University Journal

Journal 1

1. Population Structure and Size at Maturity of the Orange Mud Crab *Scylla olivacea* in Klong Ngao Mangrove Swamp,Ranong Province, ThailandKanchana Jirapunpipat

ABSTRACT

Population structure and size at maturity of the orange mud crab *Scylla olivacea* in KlongNgao mangrove swamp, Ranong Province, Thailand was investigated to derive information for its management. Sampling was carried out monthly during November 2002 to December 2003. The results showed that the large crabs with a carapace width greater than 8 cm, the weight of male is greater than that of female. The small sized mud crabs of both male and female accounted for the major catches while large crabs dominated the lower catches. The size frequency distribution of *S. olivacea* indicated that the recruitment of this species was continuous throughout the year with males being recruited inlarger numbers than females. The proportion of males was significantly higher than that of females with a ratio of 1.3:1 (male: female). The sex ratio of large sized females, with a carapace width greater than 9 cm, varied depending on the spawning period. When 50% of females were mature for the first time their carapace width was 9.55 cm, as estimated from a logistic model.

Key words: population structure, size at maturity, *Scylla olivacea*, Klong Ngao mangrove swamp, Thailand

2. Identification and Characterization of *cry* Genes Coding forInsecticidal Crystal Protein in *Bacillus thuringiensis* JC 590 Yaowaluk Poojitkanont1, Suttipun Keawsompong1, 2* and Jariya Chanpaisaeng3

ABSTRACT

The detection of *cry*I, *cry*II and *cry*V genes in chromosomal and plasmid DNA of *Bacillus thuringiensis* JC 590 was done using polymerase chain reaction (PCR). The PCR products were cloned, sequenced and subject to BLAST search at NCBI. The results revealed that 5 genes of *cry*1 namely *cry*1Ab, *cry*1C, *cry*1D, *cry*1E and *cry*1I and 1 gene of *cry*2 namely *cry*2A were in both chromosomal and plasmid DNA. The full length DNA sequence of *cry*IC was cloned by PCR walking technique, sequenced, and analyzed. The result showed that the chromosomal *cry*1C gene consisted of 3,507 bp encoded for 1,169 of amino acid and the plasmid DNA *cry*1C gene had 3,450 bp encoded for 1,160 of amino acid in length. Sequence comparison with other *cry*1C genes in database at NCBI showed these sequences had highly homology with *cry*1C genes in other *B. thuringiensis* strains. The investigation of *cry* 1C in *B. thuringiensis* JC 590 could be the basic knowledge for future application in biocontrol because of its high toxicity.

Key words: *cry* genes, *Bacillus thuringiensis,* diamondback moth

3. American Consumer Acceptance of Satay Sauce as Affected byDifferent Peanut Grinding Methods, the Multi-step and One-stepProcesses, and Processing Times Chompunut Sihsobhon1, Penkwan Chompreeda1*, Vichai Haruthaithanasant2, Thongchai Suwonsichon1 and Anna Resurrreccion3

ABSTRACT

Satay is one of the ten most popular foods for US consumers visiting Thailand. American consumer acceptance for the convenience products resulted in the development of a process for ready to eat satay sauce. The objectives of this research were to determine the consumer acceptance and texture measurements of satay sauce as affected by peanut grinding methods, the one-step and multi-step process, and processing time, using consumer tests. Results showed that there were no significant

differences in the overall acceptance from two replications (>0.05), two processes (>0.10) and two peanut grinding methods (>0.10). There were significant differences in the overall acceptance (<0.10) from three processing times because the effect of consumer liking scores of appearance and overall flavor were significant when increasing processing time. The significance of processing times and convenience of peanut grinding method and suitability of process indicated that satay sauce should be prepared using a one-step process and processed for 45 min, and peanuts should be ground in a peanut butter machine.

Key words: consumer acceptance, satay sauce, grinding, process, time

4. (Pla-ra) from Marine Fish and Preservation Mathana Sangjindavong*, Pranisa Chuapoehuk, Jiraporn Runglerdkriangkrai, Wanwimol Klaypradit and Daungdoen Vareevanich

ABSTRACT

Fermented fish products (Pla-ra) were produced from 4 species of marine fish.The resultsshowed that Pla-ra from *Rastrelliger neglectus* and *Rachycentron canadus* with 25 percent and 30 percent salt added followed by fermenting at room temperature (28C-30C) for 18 months had the highest acceptability scores on color, odor and appearance by the organoleptic test. Preservation of those Pla-ra was studied by sterilizing the products, then packing into glass bottles, tin cans and retort pouches. The samples were determined by organoleptic test and compared with normal Pla-ra after being preserved for 6 months. The results showed that Pla-ra preserved in polyethylene plastic jar at room temperature had the highest acceptability. However, Pla-ra kept in a glass-bottles were more popular than Pla-ra kept in a tin cans and retort pouches.

Key words: Pla-ra, marine fish, traditional food

5. Effects of the Various Mixing Ratios of Recycled Pulp on the Physical and Optical Properties of Handsheets and their Curl due to Laser Printing

Somwang Khantayanuwong*, Phornwilai Nithisoonthornphong, Warakorn Thunyakhunakornsakool and Sawitree Pisuttipiched

ABSTRACT

The objectives of this study were to determine the physical and optical properties of handsheets and also to ascertain the behavioral phenomena of their curl due to laser printing. Handsheets were separately produced from beaten hardwood, softwood and recycled pulp and also from various mixing ratios of the beaten pulp. The recycled pulp was derived from white wood-free shavings (WWFSs) and washed-WWFSs pulp slurries. This paper describes operating analysis of metal oxide surge arrester, IEEE Model, Pinceti the results demonstrated that hardwood and softwood pulp mixed with washed-WWFSs recycled pulp could produce higher apparent density handsheets than those mixed with WWFSs recycled pulp, even though the increased amount of WWFSs and washed-WWFSs recycled pulp used for making handsheets decreased the apparent density and tensile strength of handsheets. Most of the various ratios of WWFSs recycled pulp mixed with hardwood and softwood pulp could give slightly higher brightness and opacity handsheets than most of those of washed-WWFSs recycled pulp mixed with the same hardwood and softwood pulp. With laser printing, handsheets printed on their bottom side were curlier than those printed on their top side. This is possibly because a greater amount of inorganic materials, which was demonstrated in terms of ash content, derived from fillers and coating pigments were retained in the top side of the handsheets. The increase in ash content of handsheets also decreased the amount of curl. In this study, it is especially noteworthy to demonstrate that without any inorganic materials retained in handsheets, both the handsheets printed on the top and the bottom side had the same amount of curl.

Key words: curl, laser printing, recycled pulp

6. The Lightning Arrester Modeling Using ATP-EMTP Trin Saengsuwan* and Wichet Thipprasert

ABSTRACT

Model and the new model proposed, using ATP-EMTP. Nowadays the utilities in Thailand such as the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA) mostly use lightning arrester from Ohio Brass and Precise brands. The lightning arrester models are based on the Ohio Brass: PDV-100, 9 kV and Precise: Precise PAZ-A09_1 10 kA. Class 1, 30 kV. The tests are performed by applying standard impulse current wave (8/20). It is found that the models can predict the operation of the metal oxide surge arrester in the system with error of less than 1% at 10 kA. The percentages of error developed by the model using ATP-EMTP show that it can be use to predict or calculate energy consumption in each type of surge arresters. The percentage of error of this model is less than that of the other two models. From this reason, the result of prediction or estimation will be close to the real value of surge arrester in the normal condition of system.

Key words: lightning arrester modeling, zinc oxide, EMTP, metal oxide surge arrester, overvoltage, frequency-dependent model

7. A Simple Method to Extract Mitochondrial DNA in a Non-invasive Phylogenetic Study of Domestic Native Thai Ducks Piyanan Leekaew1, Thaweesak Songserm2, Apassara Choothesa1 and Ukadej Boonyaprakob1*

ABSTRACT

A simple low-cost method for extracting mitochondrial DNA (mtDNA) from a single plucked feather for a non-invasive genetic study of ducks is described. The mtDNA was isolated via alkaline lysis, and after neutralization, the crude DNA-containing lysate was used directly for PCR. It has had a 100% (30/30) success in

amplification of a 710-bp fragment of the mtDNA control D-loop region.Sequence analysis and phylogenetic relationship of the 667-bp D-loop segments of the two domestic native Thai ducks, Nakorn-Pathom (NP) and Park-Nam (PN), was further investigated. Two breeds exhibited 100% identity over the entire 667-bp products, although several types of mtDNA polymorphism were detected. Comparing the 667-bp D-loop sequence data with those of *Anas* ducks and Muscovy duck used as an outgroup showed that both native Thai ducks and Mallard (*Anas platyrhynchos*) haplotype A clustered together (bootstrap support 91%), indicating that there was common ancestor for those breeds. Here we report a quick, simple, reliable and inexpensive DNA extraction procedure for a duck's feather. Our findings clearly demonstrate that the domestic native Thai ducks derive their origin from the Mallard group A haplotypes.

Key words: alkaline extraction, *Anas platyrhynchos*, Mallard, mtDNA, phylogenetics

8. Volatility Estimation of Straits Times Index Based on the Anh-Inoue Model

Chatchai Pesee

ABSTRACT

This paper considers the new dynamic model, namely, the Anh-Inoue dynamic model of complete markets in which the prices of European calls and puts are given by the Black-Scholes formula.The model has memory and can distinguish between historical volatility (HV) and implied volatility (IV). A new method is provided to estimate the implied volatility. It is clear evidence that the historical volatility of Straits Times Index(STI) of Singapore Stock Exchange(SGX) is not constant while the volatility parameter, of the Black-Scholes model is assumed to be constant throughout the duration in time t. Furthermore, this model can capture some movement of Straits Times Index (STI) of Singapore Stock Exchange(SGX) reasonably well.

Key words: European calls and puts, memory, implied volatility, historical volatility, Anh-Inoue dynamic Model

9. Controllability Studies of Chemical Processes Based on the Concept of Passivity Bundit Boonkhao, Thongchai Srinophakun* and Rungroat Sirisak

ASTRACT

This article presents an approach on controllability of nonlinear chemical processes based on passivity. The proposed method extents on the concept of Maya-Yescas and Aguilar (2003). The method divides the model system into controllable and uncontrollable parts. A controller is designed by setting the controllable part equal to zero, so-called the perfect controller. For uncontrollable part, the storage and the supply rate functions are defined by implementing the same perfect controller to analyze the stability. If the uncontrollable part has the Kalman-Yacubovich-Popov (KYP) property, it is guaranteed to be stable and, therefore, the overall system is controllable. The applications of proposed method are illustrated with two examples: 1) the four available control structures of heat exchanger network for one hot stream and two cold streams; and 2) the two process variables of continuous fermentation. The simulation results imply that the stability and the steady state of uncontrollable part can be considered only as the Lie derivative of a storage function. This technique can be extended to other nonlinear chemical processes as a tool for selecting the best input-output pairing to design the control structure.

Key words: controllability, passivity, nonlinear process, Kalman-Yacubovich-Popov (KYP) property, guaranteed stability

10. Performance of Periparturient Dairy Cows Fed Alfalfa Hay in Total Mixed Ration : A Field Trial in ThailandTheera Rukkwamsuk1,*, Sunthorn Rungruang2, Apassara Choothesa1 and Theo Wensing3

ABSTRACT

Performance of 20 periparturient Holstein Friesian dairy cows fed alfalfa hay-base total mixed rations during transition and lactation periods was studied in a commercial dairy farm. From 7 d prior to anticipated calving date until 7 d after calving, all cows were also drenched with 400 ml of propylene glycol once daily. Blood samples were collected at -2, 1, 2, 3 and 4 wk from parturition. Milk yields were recorded daily, and milk samples were collected twice a week to determine milk compositions. Compared with the concentrations at 2 wk, serum glucose and urea nitrogen concentrations decreased whereas serum non-esterified fatty acid and hydroxybutyrate concentrations increased after calving.These results indicated that these cows entered some degrees of negative energy balance. Average milk production during 30 d postpartum was 34.8 8.7 kg/d. Average days from calving to first service was 86 24 d, and 55% of 20 cows were conceived at first service. In conclusion, cows fed alfalfa hay-base diet and drenched with propylene glycol during periparturient period could improve negative energy balance, milk yield and conception rate. However, replacing roughages from agro-industry by product with alfalfa hay in Thai dairy farms would depend on the economical analysis because most alfalfa hay was imported from foreign country.

Key words: alfalfa, dairy cow, negative energy balance Received date

Journal 2

1. **Parasitological and Hematological Study on *Fasciola* spp. Infections in Local Breeds of Sheep in Middle Awash River Basin, Afar Region, EthiopiaEndris Feki Ahmed1, Kanchana Markvichitr2*, Sornthep Tumwasorn2,Skorn Koonawootrittriron2, Apassara Choothesa3 and Sathaporn Jitapalapong4**

ABSTRACT

The study was carried out at Gewane Agricultural Technical and Vocational Education Training Collage, Gewane district, Ethiopia. Two local breeds of sheep, Afar and Blackhead, were experimental animals. Twelve each of Afar and Blackhead sheep aged between 5-6 months were assigned and each breed was divided by sex into two groups of 6 animals. All sheep was naturally exposed to infection with *Fasciola* spp. for 5 months from contaminated pasture near the Awash River path. The animals were regularly monitored for any evidence of disease. It was found that the overall prevalence of *Fasciola* spp. infection was 54%. Prevalence of infection by breeds was 37.5% for Blackhead and 33.3% for Afar breed. Prevalence of the infection by sex group was 61.5% for female and 38.5% for male group. There was no significant difference of the prevalence for different breeds and sex groups. The healthstatus of these sheep was reduced in body weight, red cell count (RBC), packed cell volume (PCV), total protein (TP) and hemoglobin (Hb) and this condition was obviously seen in severe infected sheep. Severe infection of *Fasciola* spp. started from fourteen weeks after the exposure to the end of the experiment. Breeds resistant potency occurred at sixteen weeks for infected breeds and the shedding rates were higher in the Blackhead sheep. On the basis of egg per gram and clinicalpathology parameters, the Blackhead breed was considered more susceptible to *Fasciola* spp. infection than the other. The Afar breed may be better adapted in the study area as shown in PCV and another blood parameters. However, there was no significant difference between the two breeds and sex groups.

Key words: sheep breeds, fascioliasis, Middle Awash River Basin, Ethiopia, infection

2. The Effect of Fertilizer and Irrigation onYield and Quality of Rubber (*Hevea brasiliensis*) Grown in Chanthaburi Province of Thailand

Sopheaveasna Mak1*, Sali Chinsathit2, Aphiphan Pookpakdi3 and Poonpipope Kasemsap4

ABSTRACT

The experiment on effects of fertilizer and irrigation on yield and quality of rubber (*Heveabrasiliensis*) grown at Chanthaburi province is an on-farm research conducted at the Rubber Plantation of Sindane Thai Rubber Co, Ltd. The objective of the experiment was to investigate the effect of irrigation and fertilizer on yield and quality of rubber. Experimental design used was a split plot with three replications, having irrigation and non irrigation as main plots and three formulas of NPK fertilizer of 15-7-18, 30-5-18 and 23-5-18 as subplots factorially arranged within each main plot. The trial was conducted on the clay loam soil of Klongluk series having the pH of 5.0 with 1.6% organic matter, 80.9 and 134 ppm of P and K respectively. The result of the experiment revealed that irrigation treatment increased the yield per tree per tapping, monthly production and also total rubber production per year. Latex yield also increased as the result of irrigation treatment. Under non-irrigation, the percentage of dry rubber content (DRC) was higher than those of irrigation treatment. Percentage of DRC was negatively correlated with both rubber yield and latex yield only under non-irrigation treatments. Result of latex diagnosis analysis showed that sucrose and total solid content (TSC) of samples were not affected by irrigation and fertilizer treatments. Inorganic phosphate (Pi) increased in the irrigated plot than those of non-irrigation but was not significantly differed ($P>0.05$) among others. Thiol content in latex samples showed the significant different ($P<0.05$) between irrigated and non-irrigated plots. Girth of rubber increased as the result of irrigation application while the percentage of tapping panel dryness (%TPD) was higher in non-irrigation treatment. The result of this study did not showed the effect of fertilizertreatments in any of the parameters measured. It may be possible that it would take a longer time than the experimental period before the effect of fertilizer will be pronounced.

Key words: *Hevea brasiliensis,* dry rubber content, latex diagnosis

3. Application of Remote Sensing Image and Mathematical Model for Dispersion of Suspended Solid in the Upper Gulf of Thailand Monton Anongponyoskun1*, Pramot Sojisuporn2, Shettapong Meksumpun1 and Saran Petpiroon1

ABSTRACT

The total suspended solid (TSS) dispersion model was based on the principle of conservation of mass. The model was used to study the TSS concentration fields in the immediate vicinity of the rivers mouth and in the Upper Gulf of Thailand. The verification had been done by comparing the predicted diffusion patterns with the satellite image. There was 10 cruises survey in the Upper Gulf of Thailand by Kasetsart 1. Total suspended solid were analyzed by the gravimetric method. The comparison of the TSS dispersion pattern between the observed TSS dispersion and the simulated result was quite similar. It appeared that it might be possible to obtain TSS information in the Upper Gulf of Thailand by using the TSS dispersion model.

Key words: Upper Gulf of Thailand, dispersion model

4. Seroprevalence of Bovine Leukemia Virus (BLV) Infection in Pregnant Replacement Dairy Heifers in Saraburi Province, ThailandTheera Rukkwamsuk1,* and Sunthorn Rungruang2

ABSTRACT

Seroprevalence of bovine leukemia virus (BLV) infection was studied in replacement dairy heifers. Blood samples were collected from 80 pregnant heifers raised in 8 dairy farms in Saraburi province, the central part of Thailand and serum samples were tested for antibodies against BLV infection using commercially available ELISA test kits. The results revealed that 26 (32.5%) pregnant heifers were positive reactors, which was higher than seroprevalence of BLV in lactating dairy cows previously reported in Thailand. This study provided an evidence of a high seroprevalence of BLV in replacement heifers raised in areas of Saraburi province. It

was crucial to the dairy farmers to be aware of this disease in replacement heifer rearing. Although serological test does not provide information of the infection at the early stage and is not sensitive enough to detect every infected animals, elimination of seropositive animals and prohibition of introduction of seropositive animals are sufficient to promote BLV-free herds in Thailand.

Key words: bovine leukemia virus, replacement dairy heifer, seroprevalence

5. Improvement of Propagation by Hardwood Cuttings with and without Using Plastic Pavilions in Fig (*Ficus carica* L.) Narongchai Pipattanawong1*, Sawitree Tiwong2, Benjarach Thongyean1, Rungtiwa Darak2, Pornprasert Thamin2 and Wet Techa1

ABSTRACT

Improvements of fig (*Ficus carica* L.) cutting propagation with and without using plastic pavilions were conducted at the Inthanon Royal Project Research Station (Khun Huai Hae area) as experiment 1 and at Pang Dah Royal Project Research Station as experiment 2, both in Chiang Mai province, at the elevation of 1,300 and 720 m above mean sea level, respectively. From experiment 1, larger cutting sizes in comparison with those of 0.6 – 0.8 and 1.0 – 1.2 cm was partially attributable to increased bud and root growth, as indicated by the number of emerged buds and roots in the "Brown Turkey" cultivar. In experiment 2, "Brown Turkey" was the most feasible cultivar for the region when using plastic pavilion, followed by "Dauphine" and "Lisa". Comparison between treatments with and without the pavilions among cultivars suggested that cuttings placed in pavilions increased the numberof emerged buds and roots earlier than those without pavilions. The results indicated that using plastic pavilion increased the temperature that promotes early callus formation of buds and roots in the propagation of fig cutting in cool area such as the Inthanon Royal Project Research Station.

Key words: fig, pavilion, hardwood cutting

6. Growth, Leaf Chlorophyll Concentration, and Morphological Adaptation of Selected Wax Apple Cultivars in Response to Flooding Phaisan Tanchai and Lop Phavaphutanon*

ABSTRACT

Growth, leaf chlorophyll concentration and morphological adaptation of young wax apple (*Syzygium samarangense* (Blume) Merrill & Perry) cvs. Plastic (PT), Thunklao (TK), Phetnamphueng (PP) and Thapthimchan (TC) and Malay apple (*Syzygium malaccense*) (MA) plants under flooding conditions were investigated. Potted wax apple and Malay apple plants were flooded to 5 cm above the soil surface for 70 days continuously. MA, TK, PP and TC plants survived under this flooding duration while PT plants had gradually died after flooding for 30 days. Vertical splitting of the outer bark was observed immediately above and below the flood level in all cultivars after flooding for 12 – 21 days followed by a development of adventitious roots at stem base below the flood level in most cultivars except for MA plants. Flooded PT plants formed adventitious roots faster than other cultivars while flooded TC plants had greatest mass of adventitious roots. Flooding significantly decreased shoot length, leaf number, leaf area, leaf chlorophyll concentration and dry weight of leaves and roots but increased shoot to root ratio. Severe growth restriction was observed in flooded MA and PT plants. Based on the ability to maintain growth under flooding conditions, PP was the most flood tolerance cultivar with profuse adventitious roots followed by TK and TC, respectively, while PT was the least flood tolerance in this study. MA plants restricted their growth and maintained leaf chlorophyll level to survive flooding without adventitious root formation. The results suggested that these selected wax apple cultivars and Malay apple tolerated to flooding differently and flooding tolerance was not generally associated with the ability to form adventitious roots under flooding conditions.

Key words: adventitious roots, flood tolerance, lenticel, *Syzygium malaccense, Syzgium samarangense* (Blume) Merrill & Perry

7. Process Optimization for the Production of *Philosamia ricini* (Eri Silk) Pupae Hydrolysate Pilanee Vaithanomsat* and Chidchai Punyasawon

ABSTRACT

The method for protein hydrolysate production from Eri silk pupae (*Philosamia ricini*), waste from silk reeling process, was investigated. The appropriate process started by blending fresh pupa into fine particles and water was added to adjust final protein concentration to 4.6%. The pH was adjusted to 7.5 to accommodate the enzyme activity. Commercial enzyme Alcalase was added to 0.5% and the process was carried out at 50C for 120 min with stirring. The protein hydrolysate from silk pupa was freeze-dried, ground into fine powder and analysed for compositions. The maximum degree of hydrolysis (DH) resulted from this condition was 73.27% with nitrogen recovery 62.82%. The hydrolysate product was water soluble and was rich in essential amino acids.

Key words: silk hydrolysate, Eri silk pupae, production, optimization

8. Effects of Smoking on Lipid Content, Macromolecular Structure and Rheological Properties of *Hevea brasiliensis* Sheet Rubber Satit Rodphukdeekul1, Siriluck Liengprayoon2-4, Vilai Santisopasri1, Klanarong Sriroth2, Frederic Bonfils3, Eric Dubreucq4 and Laurent Vaysse5*

ABSTRACT

Natural rubber ribbed smoked sheet (RSS) production process involves a drying step in a wood smoke dryer. The purpose of this work was to know whether this smoke drying step affected the lipid composition and the properties of sheet rubber. This study consisted of a comparative study between unsmoked sheets (USS) and ribbed smoked sheets (RSS) obtained from monoclonal latices from RRIM600, BPM24 and PB235 clones. The rubber was sampled in Chantaburi province, Thailand. It was found that the smoking process increased significantly the amount of

lipid extract but decreased significantly the free fatty acid content. No significant effect of smoking was detected on macromolecular parameters such as gel content or molar mass distribution and on rheological parameters such as initial plasticity (P0) and Mooney viscosity (ML(1+4)100). In terms of resistance to thermal oxydation estimated by Plasticity retention index (PRI), smoked sheets displayed a tendency to have lower PRI than unsmoked sheets. This difference was significant for PB235 clone. A clonal effect was detected for most of the measured parameters. Indeed, PB235 clone displayed a higher lipid extract, higher P0, higher ML(1+4)100,higher molar mass than those of the other studied clones while its PRI was lower.

Key words: *Hevea brasiliensis*, natural rubber, ribbed smoked sheets, smoking, rubber lipids

9. Enumeration and Identification of Microorganisms in Plantation White Sugar from Factories in Thailand Sirivatana Chittrepol1, Malai Boonyaratanakornkit2* and Klanarong Sriroth1

ABSTRACT

Enumeration of mesophilic bacteria and thermophilic bacterial spores from thirty-seven plantation white sugar factories were investigated. The total mesophilic count at 35□C and thermophilic flat sour spores count at 55□C were range from 0-670 CFU/10 g of sugar and 0-1,470 spores/10 g of sugar respectively. Thermophilic anaerobes were not observed where as yeast and mold count and pathogenic bacteria were undetectable in all samples. Eighty-four isolates of thermophilic bacteria were found in samples of twenty-seven factories. Based on physiological, biochemical and phenotypic characteristics, most of isolates were classified as *Bacillus coagulans* which were being the dominant species. *B.circulans* and *B.brevis* were found in the samples of two factories where as *B.macerans* was found in the only one factory.

Key words: plantation white sugar, thermophilic bacteria, *Bacillus* sp.

10. Efficacy of Calcium Hypochlorite on the Prevalence of Microsporidiosis (*Thelohania*) in Pond-Reared *Litopenaeus vannamei* Chalor Limsuwan, Niti Chuchird* and Kesinee Laisutisan

ABSTRACT

The efficacy of calcium hypochlorite for controlling microsporidian (*Thelohania* or *Agmasoma*) infection by treating the water before stocking Pacific white shrimp, *Litopenaeus vannamei*, postlarvae (PL) was studied in intensively cultured ponds. Five ponds (of 4 rai each) were used as the treatment group in which calcium hypochlorite at a concentration of 18 mg/l was added into the ponds while all the aerators were operating. In the control group, no calcium hypochlorite was used. PL10 were stocked at a density of 80 PL/m2 and shrimp were fed with commercial pelleted feed throughout the 120-day culture period. Results showed that the prevalence of microsporidian (*Thelohania, Agmasoma*) infection of shrimp in the treatment group was significantly lower than that of the control group ($P<0.05$). At day 50, the average highest percentage of microsporidian infection in the treatment ponds was 5.40% compared with 25.16% in the control ponds. The infected shrimp gradually died off or were eaten by the healthy shrimp so that after harvesting only a few infected shrimp were found. In conclusion, in shrimp culture areas where microsporidian outbreaks previously occurred, calcium hypochlorite at the concentration of 18 mg/l should be used for water treatment before stocking the PL.

Key words: microsporidian, *Thelohania, Agmasoma*, *Litopenaeus vannamei,* calcium hypochlorite

Journal 3

1. **Application of an Electrolytic Water Treatment Technique in a *Litopenaeus vannamei* (Boone, 1931) Closed-Hatchery System Wara Taparhudee1*, Saowarat Suksamran1, Prapansak Srisapoome1 and Niti Chuchird2**

ABSTRACT

The application of an electrolytic water treatment technique in a Pacific white shrimp (*Litopenaeus vannamei*) closed hatchery system was investigated in three experiments. The first experiment studied the chlorine concentrations produced from an electrolytic system with different electric current and water salinity levels in a static water system. The second experiment studied the optimal electric currents and water flow rates for water treatment. The last experiment compared the closed hatchery system with an electrolytic system to an open system using chlorine powder for water treatment. It was found that in the static closed-water system, chlorine concentration increased with an increase of the duration of flow electric current and water salinity. While in the lotic condition, the optimal flow rate of water into the electrolytic system was 2.5 l/min and produced 11.4 mg/l of chlorine with an applied amperage of 1.6 A. This level was suitable for water treatment and could be applied in the *Litopenaeus vannamei* closed hatchery system for at least three crops. Although the system could reduce the usage of chlorine powder, it had a lower survival rate and a greater nitrite-nitrogen level than the control.

Key words: electrolysis technique, water treatment, *Litopenaeus vannamei*, closed hatchery system

2. Extraction and Basic Testing for Antibacterial Activityof the Chemical Constituents in *Suregada multiflorum* Soontree Khuntong1* and Wanwisa Sudprasert2

ABSTRACT

Extractions of biologically active chemical constituents from the leaves, bark and stem of *Suregada multiflorum* with a polarity sequence of hexane, dichloromethane and methanol were conducted. Antibacterial activities of the crude extracts were examined by paper disc agar diffusion and spread plate methods with *Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Mycobacterium lacticola, Pseudomonas aeruginosa* and *Xanthomonas campestris*. The crude extracts of the greatest inhibition activities, i.e. dichloromethane extracts, were chromatographed over a silica gel column using a single solvent and solvent mixtures of increasing polarity as the eluents. The bacterial growth inhibitions of the pure fractions were also examined to find out the most active fractions. The chemical constituents extracted from various parts of *Suregada multiflorum* provided high yields of polar fractions. The crude and pure fractions, particularly the polar compounds, of each part of the plant inhibited several tested bacteria. The purified fractions exhibited stronger inhibition than the crude extracts. The inhibition of *Xanthomonas campestris* growth indicated the potential of chemical constituents from *Suregada multiflorum* to inhibit plant bacterial diseases such as citrus canker and that they would probably be useful for canker prevention in replacing chemical pesticides.

Key words: extraction, *Suregada multiflorum*, antibacterial activity, chemical constitutents, column Chromatography

3. Effects of Soil Amendment on Growth and Heavy Metals Content in Vetiver Grown on Iron Ore Tailings Nualchavee Roongtanakiat1*, Yongyuth Osotsapar2 and Charoen Yindiram 3

ABSTRACT

A greenhouse experiment was conducted to evaluate the effects of soil amendment on growth, performance and the accumulation of primary nutrients as well as Fe, Zn, Mn and Cu in vetiver. Ratchaburi vetiver ecotype plantlets were planted on iron ore tailings amended with compost and chelating agents (EDTA and DTPA). The results indicated that iron ore tailings contained high concentrations of heavy metals with total Fe, Zn, Mn and Cu concentrations of 63,920, 190, 3,220 and 190 mg kg-1, respectively and low contents of primary nutrients and organic matter. The combination of soil amendment materials, especially DTPA and compost, was more effective than sole chelating agents and sole compost in enhancing vetiver growth, nutrient and heavy metals uptake. The soil amendments used in this study did not affect Fe and Zn translocation from vetiver roots to shoots. However, chelating agent amendment could increase Cu translocation, especially in combination with compost, while it slightly decreased Mn translocation. The average mean translocation factors of Mn, Fe, Zn and Cu were 0.86, 0.71, 0.69 and 0.55, respectively. These results indicated that vetiver is a potential plant for phytostabilization and rehabilitation of iron ore mine areas.

Key words: phytoremediation, phytostabilization, vetiver, compost, soil amendment, EDTA

4. Relationship between the Sodium Nitroprusside Test for Ketone Bodies in Urine and Serum Hydroxybutyrate Concentrations in Dairy Cows Theera Rukkwamsuk1, *, Jenjira Suksiri1, Nonthasit Chutiyanawat1, Nathakorn Kaewsakhorn1 and Sunthorn Rungruang2

ABSTRACT

The relationship between the sodium nitroprusside (SNP) test for ketone bodies in urine and concentrations of serum ß-hydroxybutyrate (ß-HB) was studied in 50 Holstein Friesian cows on a commercial dairy farm, including 10 cows in the dry period, and 22, 8 and 10 cows and in week 2, 4 and 8 of lactation, respectively. Urine and blood samples were collected from all cows and were transported to the laboratory on the sampling date. Urine samples were analyzed for ketone bodies using the SNP test within 24 hours after collection. Serum samples were analyzed for the concentration of ß-HB. Results of the SNP test for ketone bodies were classified as either N (negative), +1 or + 2 based on the color reaction of SNP with a known amount of acetone in aqueous solution at 0 mmol (N), 1 to 5 mmol (+1) and 6 to 10 mmol (+2) respectively. Results of the SNP test for ketone bodies in urine were highly correlated with the concentrations of ß-HB in the serum (r = 0.82). Concentrations of serum ß-HB were 0.46 0.03, 0.98 0.10 and 2.63 0.34 mmol/L for cows with the SNP test results of N (n = 31), +1 (n = 10) and +2 (n = 9), respectively. Concentrations of serum ß-HB were 0.42 0.04, 0.97 0.21, 1.48 0.44 and 0.89 0.12 mmol/L for cows in the dry period and in week 2, 4 and 8 of lactation, respectively.The method was practical, simple and inexpensive and therefore, it would be very beneficial for the diagnosis of subclinical ketosis or the early detection of ketosis in dairy cows, particularly on smallholder farms.

Key words: ß-hydroxybutyrate, dairy cow, ketosis, sodium nitroprusside

5. Absorbency and Other Physical Properties of Three Different Rodent Beddings in Thailand Kanchana Kengkoom1, Sumate Ampawong 2*, Apisit Laosantisuk1 and Wasan Kaewmanee1

ABSTRACT

Absorbency and other physical properties of three different rodent bedding materials in Thailand corncob, woodchips, and para-rubber-were tested to find the most appropriate rodent bedding for the NLAC-MU colony. Corncob had the maximum volumetric absorbency after 48 to 72 h soaking in saline. The volumetric absorbency, mass, and density of corncob were significantly higher ($p<0.05$) than for woodchips and para-rubber (1.5 to 2.5 times). In contrast corncob had the lowest ($p<0.05$) mass absorbency when compared to woodchips and para-rubber, due to its mass. Autoclaving influenced some properties of corncob bedding due to a reduction in the mass, density, and absorbency. However similar change were not found in woodchips or para-rubber. Woodchips generated significantly more ($p<0.05$) dust particles than para-rubber and corncob respectively. Perimeter (mm) /area (mm2), and wood fiber space (m) were used to measure the altered shape after soaking in saline. The results showed that all the bedding used in this study did not significantly change ($p>0.05$) in shape and preserved its hardness after soaking. The study concluded that corncob and para-rubber were more appropriate for use as rodent bedding than woodchips. Further studies were needed to carry out toxicity, gas production and preference testing.

Key words: absorbency, physical properties, rodent beddings

6. Expression and Purification of NS1 Protein of Highly Pathogenic Avian Influenza Virus H5N1 in *Escherichia coli* Wudtichai Manasatienkij1, Porntippa Lekcharoensuk1* and Narin Upragarin2

ABSTRACT

The highly pathogenic avian influenza (HPAI) is a viral disease of poultry and is a zoonosis. The eighth segment of the viral genomic RNA encodes a nonstructural protein, NS1. NS1 is a viral regulatory protein responsible for virus virulence. This study, produced the 6xHis-tag fusion protein. The full length NS1 cDNA of A/Chicken/TH/KU14/04 (H5N1) was cloned into an expression vector, pQE80L. The recombinant NS1 was expressed in the *E. coli* strain DH5. The results showed that the polyhistidine-tagged NS1 fusion protein was successfully expressed in bacterial cells, but the fusion protein accumulated in the inclusion bodies. The fusion protein was isolated as either a native or denatured form and further purified by precipitation or immobilization on a nickel ion affinity column. Purification using affinity chromatography under denaturing conditions yielded greater amounts of purer NS1 protein. However, sufficient purity and concentration of the native NS1 protein was obtained after purification using a precipitation method. Both native and denatured, purified NS1 protein reacted specifically with the anti-NS1 chicken serum in a western blot assay. The results indicated that the NS1 protein may be useful for further applications.

Key words: highly pathogenic avian influenza, nonstructural protein, NS1 expression, NS1 purification, western blot

7. Analysis of Aquatic Ecosystem Response for Zone Management of Ban Pho Town, Chachoengsao Province, Thailand Kanyanat Soontornprasit and Charumas Meksumpun*

ABSTRACT

This research was carried out in the Ban Pho Town ship, Chachoengsao Province in the eastern part of Thailand, an important area for aquaculture. The objectives of the study were to assess the aquatic status and its potential carrying capacity for pollution and to understand the ecosystem response to human and natural impacts leading to a proposal for an appropriate zone management approach for sustainable utilization of the area. Information on community-based utilization patterns was obtained through surveys using questionnaires. Field conditions were monitored by 2-monthly surveys from August 2004 to August 2005. The survey areas covered 12 stations in the middle zone of the Bangpakong River, 12 stations at adjacent canal mouths that received pollution loads from a nearby community and 29 stations at pollution point sources. Results indicated that Bangpakong River was eutrophic all year round. High nutrient loads from Ban Pho community continuously flow into the aquatic environment. The highest concentration of NH4,Nutrients came from crocodile farms (5,408 mg/m3), whereas maximum total loads (299□109 mg) during the year were from domestic sources. Total nutrient loads varied temporally and were different among zones. Almost all nutrient levels were high during highloading periods while the remediation potential was generally low. Land remediation potential with respect to NH4 and PO43- was inexcess of 30 times more efficient in areas with comparatively high flow rates and more mangrove vegetation. In terms of river-water remediation potential, the efficiency of NH4 + elimination was less during the dry period. It was observed that the Na Lang, Nong Bua and Yai Loy canals were affected by some human and environmental impacts. These areas needed more attention with regard to monitoring and management. In addition, focus should also be given to the areas around the Pra Wet canal because of their low remediation potential during the dry period. Results of multivariate analysis on the ecosystem responses indicated that functions of NH4 + and total suspended solids in the

aquatic system significantly influenced chlorophyll *a* changes. Based on the overall results, area zonation of the Ban Pho Town was being proposed and problems were being prioritized. Moreover, the application of integrated models suggested the need for better water quality control and/or management.

Key words: remediation potential, ecosystem response, water quality, zone management, Bangpakong River

8. Composite–Sibbed Line Methods and Their Potential Use in Sweet Corn Hybrids Krisda Samphantharak*, Chadamas Jitlaka and Sukumarn Lertmongkol

ABSTRACT

The waxy, inbred line was crossed onto two inbred lines and one single cross of shrunken, super-sweet corn. They were then backcrossed onto the corresponding super-sweet parents. Following consecutive selfing up to BC1S4, 15 ears from each BC1S4 family were selected and then transformed into composite–sibbed lines by four different methods: consecutive selfing within family line (SFL), topcross within line (TCL), selective mass sibbing within line (MSL) and recurrent–sibbed line (RSL). Based on seed yield *per se* as the selection criterion, MSL and RSL were more effective than the other two methods. However, seed yield of the parent and the selection method did not imply the quality of fresh yield in the corresponding hybrid. Occasionally, some of the high seed yield lines from MSL and RSL not only gave high fresh-ear yield hybrids, but also an exceptional quality of fresh ears. The results reflected the possibility of using a composite–sibbed line method to improve the yield and quality of parent lines in sweet corn which could then be transmitted to the corresponding single cross hybrids.

Key words: sweet corn, composite line, hybrid

9. The Influence of NaCl Concentration on the Build-Up Properties and Aggregation of Reactive Dyes Jantip Suesat

ABSTRACT

This research investigated the influence of NaCl salt concentrations on the build-up properties of the selected warm- (Remazol Red RGB and Sumifix Supra Red 3BF) and hot- (Procion Red H-E3B and Drimarene Red X-6BN) dyeing reactive dyes on cotton. The results showed that an increment in the NaCl salt concentration in the dyebath influenced the visual color yields of the dyes on cotton. Too high a salt content led to a decline in the visual color yields. This may be explained by the formation of larger dye aggregates, being enhanced by the higher salt content. Too large aggregates were considered to lead to a lower number of dyes diffusing into the fiber and so they would mostly remain on the fiber surface, thereby reducing the visual color yield. A significant reduction in visual color yield of the dyes on cotton occurred at 300 g/l salt. Among the dyes studied, Drimarene Red X-6BN was less affected by the salt concentration changes. From the study of the aggregation of the dye molecules in solution, it was found that increasing the salt concentrations enhanced the aggregation of the dye molecules. In the presence of salt, less dye in monomeric form existed in the solutions. When salt concentrations increased, the absorbance peaks responsible for the dye aggregates increased compared with those of the dyes in monomeric form. In addition, a bathochromic shift was also observed. With increasing salt concentrations, Drimarene Red X-6BN exhibited less reduction in the absorbance peak of the dye aggregates compared with the other dyes. This was in agreement with the build-up results. From this research, it showed that almost all recommended salt concentrations used in the reactive dyeing were not the optimum concentrations delivering the ultimate build-up of the dyes on cotton.

Key words: NaCl salt, reactive dyes, build-up, color yield, cotton

10. Simulation of Heat and Mass Transfer in the Corrugated Packing of the Counter Flow Cooling Tower Montri Pirunkaset* and Santi Laksitanonta

ABSTRACT

This paper presents the simulation results of the heat and mass transfer characteristics of corrugated packing in a counter-flow cooling tower. The numerical analysis has been partially validated by comparing the experimental data from a testing apparatus of a cooling tower under the same conditions at inlet dry bulb temperature of 32.3C; inlet wet bulb temperature of 25.2C and inlet water temperature of 40C. Due to the complicated configuration of the packing surface and its installation, it was not able to measure the temperature of the air and water in the intermediate section, but only the exit air temperature and exit water temperature. It was found that the errors between the calculated and measured temperature of the exit air were less than 2.5% for the exit dry bulb temperature, less than 2.2% for the exit wet bulb temperature and for the exit water were less than 1.3% (by testing at L/G=1.800, 2.171 and 2.820). A comparison of the volumetric heat transfer coefficients derived from the experiment and the simulation using the Tchebycheff method found that all the errors were less than 4.8%. Consequently simulation can be used as a tool for studying the phenomenon of heat and mass transfer in corrugated packing.

Key words: simulation, corrugated packing, counter-flow cooling tower

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