# CHAPTER 1

# INTRODUCTION

## 1.1 Statement and significant of the problems

Every new invented drug with originality by brand name company is always marketed with patent protection. They are usually sold at expensive price that recoups the cost of development. Without patent protection, the drug can be reformulated freely into a generic version by other drug companies, and it can be marketed in relatively lower price. The principal reason for the low price of generic drugs is that the generic production does not involve in an investment of a drug discovery and they can maintain profitability at a lower cost to consumers. Additionally, generic manufacturers do not bear the full cost of proving the safety and efficacy of the drugs through clinical trials since these trials have already been conducted by the brand name company. In Thailand, trend of domestic drug companies pays particular attention on generic drug development since the effort of inventing new drug costs expensively due to necessary technologies are needed to import from aboard. From annual survey, the statistic states that original drugs are more expensive than the generic ones over 110% in Thailand (Sirisinsuk and Katechroen, 2009).

In universal agreement, generic drugs can be legally produced for drugs where: 1) the patent has expired; 2) the generic company certifies the brand company's patents are either invalid, unenforceable or will not be infringed; 3) for drugs which have never held patents; or 4) in countries where a patent(s) is/are not in

force. In Thailand, a patent right is legally in force and it lasts based on the country where the patent belongs to.

To reformulate an original drug, details given in its patent are the most fundamental source. However, a drug patent generally contains some implicit details for protecting the inventions to be completely imitated. These include an amount of excipients, a type of excipients, a crystal form of excipients and so forth. Such implicit details are a challenge to pharmacists who attempt to reformulate the original drug since they specifically require pharmaceutical expertise, case-based experience and time consuming to totally figure the missing information. Moreover, an approved generic drug in the market must be qualified in term of a pharmaceutical equivalence between it and its original drug. Therefore, the generic drug formulation and production is practically not a simple task for inexperienced pharmacists.

In the world of information technology, computer applications have been developed to deal with such complicate tasks. Even so a pharmaceutical field, application called expert system is employed to suggest a formulation and production of drug. Despite the lack of human experts, an expert system in pharmaceutical domain is a computer program which emulates pharmaceutical expertise to resolve significant problems in a particular drug production and formulation. Basically, an expert system deploys inference engine to infer implicit details regarding to given explicit facts. To effectively infer a result, the facts entrusted in an expert system are usually provided as domain knowledge.

In pharmaceutical domain, domain knowledge in expert system was firstly representing within the rule itself to execute an action once a condition is met, namely a production rule. Later, domain knowledge was extracted aside the rule to purely

store relevant facts. For a decade, ontology has been brought to represent knowledge in many scientific domains. The advantages of an ontology in knowledge representation are obviously the capability of the knowledge sharing, the re-use of knowledge and the better engineering of knowledge based system with respect to acquisition, verification and maintenance. Lately, an ontology was involved in representing a domain knowledge for an expert system and it effectively reflects a sharing common understanding of the structure of information among software agents.

Previous implemented expert systems in pharmaceutical field; unfortunately, are all developed for recommending an original drug. All of them cannot be applied to generic drug production. Moreover, every expert systems are focused for only one or two relevant dosage form. Since tablet is certainly the most preferred dosage form covering 70-80% of all medicines (Augsbuger and Hoag, 2008), it deserves the primary intention. In Thailand, tablet dosage form does not only stand for a drug. But also herbal tablet has been famous for century. Nevertheless, there is no existing expert system that concerns an herbal tablet.

## 1.2 Objectives of the study

1. This study aims to develop an ontology based expert system for a production of generic drug tablet and herbal tablet.
2. The developed system can recommend a formulation and manufacturing instructions rationally.

3. The developed system continues to recommend a formulation and manufacturing instructions until the tablet produced based on the recommendation contains pharmaceutical equivalence to its original drug.
4. Pharmaceutical domain knowledge using in the system is represented in ontology for reusability and knowledge sharing.

## 1.3 Scope of the study

1. In this work, a generic drug tablet only refers to immediate release tablet.
2. A coating aspect is excluded in this study.
3. An only herbal tablet made from herbal powder is included.
4. A produced tablet based on recommendation is evaluated only in laboratory scale.
5. Only drugs informed in ontology are limited.