

# CHAPTER I

## INTRODUCTION

### **Rationale for the study**

Natural rubber (NR) latex is a major agricultural product of Thailand due to the hot climate is conducive to the growth of the rubber tree. Thai rubber latex industries such as rubber manufacturing plants, gloves, condoms and tires require high quality of NR latex. One parameter pricing NR latex is the residual amount of magnesium. Magnesium is a chemical that effecting the stability of NR latex. Therefore, it is necessary to precipitate magnesium before manufacturing process. Diammonium hydrogen phosphate (DAHP) or diammonium phosphate (DAP) is used for the precipitating process. Then magnesium sediment (magnesium ammonium phosphate) was removed in the form of a bog or sludge by centrifugation. The excessive use of DAHP or DAP causes phosphate residues in NR latex. The phosphate residues will effect on the stability of NR latex such as mechanical stability time (MST), volatile fatty acid number (VFA) and chemical stability time (CST) and the physical properties of the products such as tensile strength and elongation [1, 2, 3]. Therefore, the detection of phosphate residues is very important. However, phosphate in NR latex has a various type such as phospholipids, free orthophosphate, sugar phosphate and phosphate from precipitation of magnesium [4]. As a consequence, total phosphate was interested and determined in the form of total phosphorus in this research. UV-Vis spectrophotometry is one of the technique that could be used to detect total phosphorus in various samples [5, 6]. Unfortunately, phosphorus residues in NR latex could not be directly determined by this technique because the NR latex has a colloidal characteristic which obstruct the penetration of light beam. In addition, the procedure for color developing by the molybdenum blue method requires certain acidic chemical condition [6]. When the NR latex is exposed to acid, it was agglomerated [1]. Thus, digestion of NR latex before the determination of phosphorus in NR latex by UV-Vis spectrophotometry is a crucial step. Digestion process is a procedure for destroying the rubber constituents until receiving clear solution which is ready for color developing

process. The digestion procedure normally involves the use of energy such as heat (UV light, microwave, thermoreactor) or uses chemical reagents such as acids or uses a combination of the two methods [7, 8]. Related previous reports, environmental and pharmaceutical samples containing phosphorus were determined by using ammonium peroxodisulphate or potassium peroxodisulphate as oxidizing agent or used in conjunction with acid such as perchloric acid or sulfuric acid and used UV light for providing energy [9, 10, 11, 12]. For NR latex sample, previous literatures used Kjeldahl technique to obtain a clear and appropriate solution. Concentrated sulfuric acid and nitric acid were used in the digestion procedure together with high pressure and temperature [4]. To the best of our knowledge, there is no report on sample preparation of NR latex by using UV-assisted digestion or microwave or thermoreactor before the detection of phosphorus with molybdenum blue method. Therefore, UV-assisted digestion and thermoreactor was selected in this work and various conditions of NR latex digestion will be studied.

### **Research objectives**

To study the possibility of the application of a UV-assisted digestion and a thermoreactor in NR latex digestion before the determination of total phosphorus residues by molybdenum blue spectrophotometric method and digital image-based colorimetry-artificial neural networks (DIC-ANNs).

### **Scope of the research**

1. Develop the digestion technique by UV-assisted digestion and thermoreactor for NR latex sample
2. Determine total phosphorus residues in NR latex samples by using molybdenum blue method coupled with UV-Vis spectrophotometry and DIC-ANNs

### **Benefits of the research**

A new, simple and rapid digestion technique before the determination of the total phosphorus residues in NR latex by UV-Vis spectrophotometry and DIC-ANNs will be obtained.