

CHAPTER I

INTRODUCTION

1.1 Introduction

The release of heavy metals in the environmental system is a critical worldwide issue due to numerous number of toxic side effects associated with these metals. Nickel, a silver-white and hard metal is a widely used element that has many desirable properties for combination with other metals to form mixtures called alloys. These alloys are generally used to cast coins, jewelry and medical prosthesis. Nickel compounds are also used in electroplating, electroforming and electronic equipment [1]. Nickel may be released to the environmental area such as ambient air, water, and soil. Moreover, it can contaminate in fruits, vegetables, food and drinking water. Lastly, human may expose to nickel via breathing, drinking, or direct contact. An exposure to higher levels of nickel can cause skin allergies, lung fibrosis, and cancer of the respiratory tract [2]. The analytical methods for the determination of nickel ions (Ni(II)) have been extensively investigated such as atomic absorption spectrometry (AAS), inductively coupled plasma atomic emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS) and electrochemical methods. However, these techniques require complicated sample preparation, advanced expensive instrument, and skilled operation. Therefore, the development of a less demanding method to monitor nickel level in environment is equally necessary. For these reasons, sensitive, rapid, and simple-to-use methods for Ni(II) are highly desired.



in different morphologies including prisms, cubes, bars, rods, wires, nanoflowers, particles and plates, corresponding to the different optical properties. For example, silver nanoplates (AgNPLs) provides high molar extinction coefficient and broader range of visible wavelength, compared with other type of AgNPs [3].

For this work, the first use of glutathione (GSH) and L-cysteine (Cys) modified AgNPLs for simple, rapid, sensitive and selective determination of Ni(II) was demonstrated and successfully applied to detect the level of Ni(II) in gold plating solution from jewelry factory.

1.2 Objective of the research

The two main goals of this work are as follows:

1. To develop a colorimetric method for determination of Ni(II) using GSH and Cys modified AgNPLs.
2. To apply the modified AgNPLs-based colorimetric method for the determination of Ni(II) in real samples.

1.3 Scope of the research

To achieve the research objective in this work, the information of ligand, modification of AgNPLs and optical detection were investigated. AgNPLs obtained from the Sensor Research Unit at the Department of Chemistry, Faculty of Science, Chulalongkorn University were characterized by UV-visible spectrophotometry and transmission electron microscopy. The influences of the ratio of modifier, pH of the



solution and reaction time were examined to obtain the optimal conditions of this experiment. To demonstrate the analytical efficiency of this developed method, AgNPLs-based colorimetric method were applied to measure the levels of Ni(II) in gold plating solution from jewelry factory. The determination of Ni(II) in real sample was carried out using the optimal conditions and validated by ICP-OES method.

