# CHAPTER I

# INTRODUCTION

## 1.1 Statement of the problem

One of the most critical environmental pollutions experienced nowadays is metal contamination in water, especially those caused by arsenic. Arsenic (As) is a semi-metal element and a well known toxic chemical that is found in natural water and waste water from industries [1, 2]. The release of arsenic from industrial waste water would cause many health effects, such as dermal changes, skin cancer, lung, liver and renal cancers or may cause mutagenic effects so the determination of arsenic is very important [3-5].



The most popular techniques for arsenic detection in water are spectroscopy, chromatography and electrochemistry. For example, hydride generation atomic absorption spectrometry (HG-AAS) [6], graphite furnace atomic absorption spectrometry (GFAAS) [7], inductively coupled plasma optical emission spectrometry (ICP-OES) [8], inductively coupled plasma mass spectrometry (ICP-MS) [9], cathodic stripping voltammetry (CSV) [10] and anodic stripping voltammetry (ASV) [11] are sensitive and accurate techniques for the determination of low concentration of arsenic but those methods require costly instruments and skills to operate [12, 13].

Naked eye detection is an alternative and attractive method. This method has been recently proposed for the determination of arsenic in aqueous solution because it is relatively simple, economical, yet effective without the need of sophisticated instruments. Most of the colorimetric methods for the determination of arsenic require the formation of volatile arsine gas ($AsH_3$) prior to the measurement such as the Gutzeit's Test [14-16] and Marsh's Test [16] and the formation of silver diethyldithiocarbamate complex [17]. However, the major drawbacks of these methods are the toxicity of arsine gas and its complicated preparation.

Recently, Chaicham et al. [18, 19] have reported the synthesis and properties of difluoroboron-curcumin ($BF_2$-curcumin) by the addition of borondifluoride on the carbonyl group of curcumin from the extracts of turmeric. In the presence of cyanide, the color of this $BF_2$-curcumin solution changed from red to blue which can be described by the basicity of cyanide ions that can abstract protons from the hydroxyl groups in $BF_2$-curcumin molecule.

Based on this approach, As(III) and As(V) (inorganic arsenic) are also a conjugated base of arsenous acid and arsenic acid with low acid dissociation constant ($K_a$) and so they are believed to potentially behave like the hydrocyanic acid under similar condition. Therefore, this work aims to develop a new colorimetric method, which is simple, rapid, low cost and applicable for field analysis for the determination of inorganic arsenic in water samples by $BF_2$-curcumin solution and $BF_2$-curcumin coated resin.



## 1.2 Objectives and scopes of the research

- To develop a new colorimetric method for the determination of inorganic arsenic in aqueous sample by using $BF_2$-curcumin solution
- To develop a naked eye detection for inorganic arsenic by using $BF_2$-curcumin coated resin

## 1.3 Benefit of the research

The new methods for colorimetric detection and naked eye detection of inorganic arsenic using $BF_2$-curcumin solution and $BF_2$-curcumin coated resin were established.