CHAPTER I

INTRODUCTION

Chemicals used in agriculture have posed environmental problems in the present [1]. The chemicals can contaminate soil and underground water [2]. The most chemicals used in agriculture are pesticides and herbicides. Diuron is one of the most commonly used herbicides in Thailand. Diuron is also classified as a harmful chemical [1]. It has effect for human health and the equilibrium of ecosystems. Although diuron can be naturally degraded in the environment via biological or photochemical degradation [3], the degradation rate is slow. Diuron can also be degraded by photocatalytic degradation process [2]. The photodegradation of diuron has often been reported on oxide semiconductor photocatalysts. Among various oxide semiconductors, titanium dioxide (titania) and zinc oxide have been investigated and reported as one of the most suitable catalyst in widespread environmental applications. They are effective for the decomposition of environmental pollutant via photocatalysis reaction. They have good physical and chemical properties, such as strong oxidizing power [4, 5] and high photocatalytic activity [4, 6]. In addition, they are non-toxic and available at low price. Both zinc oxide and titania have similar electronic properties [7]. They have the same band gap energy of 3.2 eV. Yet, the effectiveness in photocatalytic degradation of zinc oxide and titania is different [6, 8].

Titania and zinc oxide can be prepared by several ways. One of the popular techniques is sol-gel method because of its low cost, reliability, reproducibility, simplicity and relative mild conditions of synthesis [9]. Sol-gel process is a route generally applied to prepare nanomaterial with notable advantages of high purity and good microstructure [5]. In this work, photocatalysts are synthesized via the sol-gel process.

The chemistry of the photodegradation processes is complex. Careful analytical monitoring using different techniques is essential in order to control all transformation steps, to identify harmful intermediates and to understand and interpret the reaction mechanism. The assessment of pollutant disappearance in the early steps is not sufficient to ensure the absence of residual products. The heterogeneous photocatalytic treatment may give rise to a variety of organic intermediates which can themselves be toxic, and in some cases, more persistent than the original substrate [10]. Therefore, it is an interest of this research to identify the formation of intermediates during the photodegradation of diuron.

The objective of this research is to investigate the photocatalytic degradation and the formation of intermediates during the photodegradation of diuron solution, using zinc oxide and titanium dioxide as catalyst.

The present thesis is arranged as follows:

Chapter I is the introduction of this work. Chapter II describes basic theory about diuron such as chemical and physical of diuron. Photocatalytic reaction, physical and chemical properties of zinc oxide and titanium dioxide, photocatalytic degradation of diuron are also described. Furthermore, literature reviews of the previous works related to this research are presented in this chapter as well. Chapter III shows experimental systems and procedures for the photocatalytic degradation and identifies the intermediates products. Chapter IV presents the experimental results and discussion. In the last chapter, the overall conclusions of this research.