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THE USE OF Zn^{2+}- CYCLEN LUMAZINE AS A MOLECULAR PROBE FOR DETECTION OF GLUTATHIONE (GSH) OR GLUTATHIONE DISULFIDE (GSSG)

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ABSTRACT

The significance of this study is to design a simple and selective molecular probe for detection of glutathione or glutathione disulfide. Zn^{2+}-cyclen coordinated lumazine has been chosen to act as the probe in this study. Zn^{2+}-cyclen complex which act as the receptor for lumazine will significantly enhanced the fluorescence intensity of lumazine. Glutathione which is a non-fluorescence compound will displace lumazine to coordinate with the Zn^{2+}-cyclen complex due to the sulphydril group in its moiety that has higher affinity towards Zn^{2+} as compared to lumazine. The ability of glutathione to coordinate with the Zn^{2+}-cyclen complex is indicated by the decrease in the fluorescence intensity of lumazine. There are only two major steps in order to synthesize the probe. The first step is the extraction of cyclen tetrahydrochloride salt into free cyclen. The second step is to do the complexation of free cyclen with Zn^{2+} by using $Zn(NO_3)_2.6H_2O$. The interaction of lumazine and glutathione with Zn^{2+}-cyclen complex was measured by using fluorospectrometer. However, the selectivity of the probe towards glutathione was not determined due to limitations in chemicals available and time constraint.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Glutathione (GSH) has been recognized as the master of antioxidant in human body as it continuously supplies hydrogen in the biological processes in order to combat free radicals (Freud & Freud, 2010; Kan, 2013). GSH is a tripeptide made up of amino acid glutamate, glycine and cysteine. Among these, cysteine is the most important building block of GSH as it contains sulphydril (-SH) group that plays the major role in keeping GSH in its reduced state. GSH will donate its proton in order to stabilize the free radicals that formed as a result of various biological and chemical processes in the body. Once it donated the hydrogen ion, it itself will be oxidized to glutathione disulphide (GSSG). Therefore, the ratio for the number of reduced GSH over its oxidized GSSG form can be used as an indicator for the health condition of the cells in our body (Townsend et al., 2003). The presence of high number of oxidized GSSG form in the body always associates with the presence of diseases such as Parkinson, HIV, lung diseases and so on (Bray & Taylor, 1994).

Meanwhile, the molecular probe for detection of GSH and GSSG has been studied widely with numerous thiol probes has been reported (Chen et al., 2010; Mohamed Ali et al., 2007; Peng et al., 2013; Sudeep et al., 2005). In fact, the development of fluorescent