

CHAPTER I

INTRODUCTION

1.1 Background

Lawsone (2-hydroxy-1,4-naphthaquinone) is a natural coloring component contained in Henna leaves (*Lawsonia inermis* Linn.) that has been used as a pigment agent to stain skin and hair (Chaudhary, 2010; Zumrutdal and Ozaslan, 2012). Lawsone is a part of naphthoquinone group, which is a group of natural pigments that known for its biological activities. Lawsone has a hydroxy function at C-2 attached at 1,4-naphthoquinone ring (Lopez *et al.*, 2014).

Lately, naphthoquinone and its derivatives have become the center of multiple areas of research such as in organic synthesis, and for natural products, pharmacology, toxicology and pharmaceuticals (Lopez *et al.*, 2014). Researchers have found that naphthoquinone and its derivatives, especially those that containing nitrogen, have promising biological activities and enhanced therapeutic properties (Lopez *et al.*, 2014). In this research, lawsone extracted from Henna leaves will be used to be modified using ethanolamine in a certain concentration. Ethanolamine was chosen to act as a source of primary amine in this reaction. Two types of solvents will be used, which are water and ethanol. Water and ethanol were chosen to assess whether this reaction can be categorized as the green chemistry. According to U.S. Environmental Protection Agency (2017), green chemistry is the promotion of chemical technologies that reduce or eliminate the use or generation of hazardous

substances, applied across its design, manufacture, use, and ultimate disposal (Lancaster, 2010). It is expected that modified lawsone might contribute to the enhanced antioxidant activity of the crude extract (Lopez *et al.*, 2014; Ramos-Peralta *et al.*, 2015; Elavarasan *et al.*, 2013).

1.2 Research Problem

The modification of lawsone is known to increase biological activity of this class compound, one of which is the antioxidant activity (Lopez *et al.*, 2014). However, there is a lack of information regarding the modification of lawsone obtained from Henna leaves (*Lawsonia inermis* L.) towards the antioxidant activity of the crude extract, thus need a further investigation (Elavarasan *et al.*, 2013). The formation of this lawsone derivative will be also assessed, whether it can be synthesized under the green media such as water, because the usage of organic solvents is often associated as “auxiliary waste” in most chemical productions that can be toxic or harmful to environments (Li and Trost, 2008). Therefore, this study was conducted to identify lawsone component, the potential modification of lawsone obtained from Henna leaves extract and determine whether the reaction of lawsone derivative may occur by using the green media such as water.

1.2.2 General Objectives

The general objective of this research was to determine the presence of lawsone in Henna leaves and to study the effect of modified lawsone towards the antioxidant activity of the crude extract.

1.2.3 Specific Objectives

1. To determine the best solvent in extracting lawsone from Henna leaves.

2. To determine the effect of modified lawsone on the yield and antioxidant activity of crude extract.
3. To determine the best solvent and reaction time to synthesize the expected compound.
4. To determine whether the reaction can be categorized as Green Synthesis.

