

# CHAPTER I

## INTRODUCTION

### 1.1 Research Background

*Cendol* is a traditional Indonesian beverage made from mung bean flour as the main ingredient mixed with pandan leaf and/or suji leaf juice as additional ingredients. This popular Indonesian drink is commonly served as a cold snack or dessert added with coconut milk and palm sugar syrup. *Cendol* particulates are formed through the process of starch gelatinization which results in a chewy texture. They can be naturally flavored and colored green using pandan and/or suji leaf juice or artificially flavored using pandan paste (Rahman and Mardesci, 2015). Studies have shown that pandan leaves possess high antioxidant activity while suji leaves possess very weak antioxidant activity. Thus, *cendol* particulates containing pandan leaf juice was expected to have higher antioxidant activity compared to that containing suji leaf juice (Chalid and TS, 2009; Jokopriambodo *et al.*, 2014).

*Vernonia amygdalina* Delile, commonly known as African bitter leaf or bitter leaf, is a common shrub that is indigenous to sub-saharan Africa. The plant is well-distributed in Asia and typically found in natural forests or commercial plantations as well as along drainage lines. *V. amygdalina* is a medicinal plant that has been traditionally used in phytomedicine to treat fever, gastrointestinal problems, malaria, infertility, diabetes, sexually transmitted diseases and kidney disease. Additionally, this plant has been reported to possess antitumor, antihelminthic, hypoglycemic and hypolipidemic properties. The leaves are dark-

green in color and have bitter taste and a characteristic odor (Adebayo *et al.*, 2014; Kadiri and Olawoye, 2016).

*Cyclea barbata* Miers, commonly known as *cincau hijau* or green grass jelly, is a vine that grows in West Java. The leaves are commonly used to make grass jelly drinks. The plant has also been traditionally used in Indonesia to treat several health problems such as flatulence, fever, peptic ulcer and cancer. Studies have shown that antioxidant activity of *C. barbata* leaves is able to kill cancer cells such as leukemia, cervical, lung and breast cancer cells (Farida *et al.*, 2015).

*V. amygdalina* contains phytochemicals which are naturally occurring bioactive compounds known for their health benefits. Studies have shown that phytochemicals in *V. amygdalina* possesses bioactive compounds that have anti-viral activity as well as protective and therapeutic effect against cancer cells. In addition, the plant has been reported to contain antioxidant properties that are linked to its medicinal properties. *C. barbata* leaves also have been shown to possess antioxidant and anti-cancer properties. Antioxidants are compounds that inhibit the action of free radicals and their reactive oxygen species (ROS) which may cause diseases originating from oxidative stress. Studies on extracts of bitter leaf showed potent antioxidant properties which were correlated to the flavonoid and phenolic content of the plant, while antioxidant properties of *C. barbata* leaf extracts were attributed to its alkaloid and flavonoid content. Ethanolic extracts of both plants exhibited antioxidant activity in DPPH radical scavenging test. The plants also have been known to play dietary and functional roles in disease prevention (Farida *et al.*, 2015; Kadiri and Olawoye, 2016).

Adding the extracts of African bitter and green grass jelly leaves to *cendol* can be done to improve the functionality of the popular beverage. Therefore, this study was intended to find the best formulation of *cendol* containing pandan and/or suji leaf juice or artificial pandan flavoring with the addition of bitter and/or green grass jelly leaf extract based on antioxidant, sensory and physicochemical analysis.

## 1.2 Research Problem

*Cendol* is a popular Indonesian beverage that may have low antioxidant activity. *Cendol* can be processed to become a functional drink by adding source of antioxidants. Functional food can be defined as foods or beverages that are expected to have a specific health effect due to relevant constituents (Saarela, 2011). There are numerous sources of antioxidants, such as African bitter and green grass jelly leaves. The addition of extracts of African bitter and green grass jelly leaves in *cendol* has never been done before. Hence, the study of antioxidant and physicochemical characteristics of *cendol* particulates mixed with crude extracts of African bitter and green grass jelly leaves was expected to overcome this problem. As new ingredients in *cendol*, the best concentrations of crude extracts of bitter and green grass jelly leaves that result in *cendol* with the best antioxidant profile needed to be determined.

## 1.3 Objectives

### 1.3.1 General Objectives

The general objective of this research was to study the antioxidant and physicochemical characteristics of *cendol* particulates mixed with crude extracts of African bitter and green grass jelly leaves.

### 1.3.2 Specific Objectives

The specific objectives of this research were:

1. To determine effect of different types of flavoring agent (pandan leaf, suji leaf, combination of pandan and suji leaves or artificial pandan flavoring) on antioxidant and sensory characteristics of *cendol* particulates; and then to select formulation having most acceptable sensory characteristics.
2. To determine effect of selected formulation and concentration of crude extracts of African bitter and green grass jelly leaves mixed in the selected formulation on antioxidant, physicochemical and sensory characteristics of selected *cendol*; and to select *cendol* displaying best antioxidant profile and acceptable sensory characteristics.