CHAPTER 1

INTRODUCTION

1.1. Background

Cancer defines as a lethal disease with the highest mortality rates in the world. The induction of cancer occurs due to the morbid proliferation of some cells in the body, which subsequently metastasize to other organs (Bertram, 2000). Among several types of cancer, breast cancer becomes the leading cause of death among women, which accounts for 2,099,849 cases and 626,679 deaths worldwide in 2018 (IARC, 2018). Meanwhile, in Indonesia, the incidents of breast cancer account for 61,682 cases in 2013 and 49,998 cases in 2014 (Kementerian Kesehatan RI, 2015; World Health Organization, 2014). Unfortunately, the data only available from 2013 to 2014 due to the lack of documentation. Late tumor detection and treatment become the leading causes of high breast cancer prevalence worldwide and Indonesia. Hence the cancer cells already metastasize and dampen the drug efficacy (Caplan, 2014).

Several breast cancer treatments such as breast cancer surgery, chemotherapy, radiation therapy, and targeted therapy remain as the gold standard (PDQ Adult Treatment Editorial Board, 2002). These modern treatments can eliminate breast cancer cells and prevent disease progression. However, despite the propitious outcome, these treatments can generate adverse effects such as hair loss, ecchymosis, anemia, and hinder the proliferation of highly proliferated cells due to the lack of cell sensitivity (Ramirez et al., 2009). Moreover, breast cancer surgery requires high cost and reduce patients' life quality. Hence, an alternative medication with minimum side effects and inexpensive are needed.

The research to discover the alternative medication for breast cancer has broadened to the sphere of plants and spices. Many studies have made attempts to discover

an alternative medication with high efficacy and minimal deleterious effects (Desai et al., 2008). The ideal alternative medication is a drug that can selectively induce apoptosis on cancer cells, since it can selectively kill cancer cells. It targets protein that uniquely expressed in the cancer cells by the activation of death cascades, for example resveratrol extracted from grapes and cyanidin-3-glucosidase from blackberry (Singh et al., 2013; Ding et al., 2006).

Aside from plant-based medication, spices also have the potential as alternative anticancer agents. One of the prospective spices is cardamom (Winarti & Nurdjanah, 2005). Cardamom belongs to the *Zingiberaceae* family and mostly found in tropical countries such as Indonesia. This herb generally used as a food condiment and traditional medication. There are two genera of cardamoms, which are *Elettaria cardamom* (L.) Maton which called as *kapulaga seberan*g and *Amomum compactum* Sol. Ex Maton, which called as *kapulaga Jawa* (Vutakuri & Somara, 2018). *Elettaria cardamomum* (L.) Maton has a small light green pod, whereas *Amomum compactum* Sol. Ex Maton or *Amomum compactum* has a large dark brown pod and round shape. Both types of cardamoms are believed to possess antiproliferative and antioxidant properties, and have been used in Ayurvedic medicine for arrhythmia, asthma, gastritis, and indigestion treatments (Sharma & Sharma, 2018). Study by Qiblawi et al., shows that cardamoms can impede the invasion of forestomach papilloma genesis induced by benzo(α)pyrene [B(α)P] in Swiss Albino mice, implies that cardamoms have anti-inflammation properties (Qiblawi et al., 2015).

On another hand, *Amomum compactum* shows promising antimicrobial activity against gram-positive and gram-negative bacteria (Sukandar et al., 2016). This spice is also believed to possess anticancer effects due to its bioactive compounds; 1,8- cineole, α-pinene, β-pinene, α-terpineol, tannins, and α-humulene (Das et al., 2018; Euphorbiaceae, 2012). Unfortunately, there are no extensive studies regarding the anticancer activity of *A. compactum* extract towards cancer cells. Hence, this study aims to investigate the effect of *A.*

compactum seed extracts toward human T47D cell line, a wild-type mutant p53 breast cancer derived from human ductal carcinoma (Lim et al., 2009). Furthermore, this study will serve as the first analysis and expected to provide initial data regarding the anticancer effect of *A. compactum.*

1.2. Research Objectives

Based on the problem formulation, this study has two objectives that will be achieved which are:

1. Examine the cytotoxicity of *Amomum compactum* seed extracts against T47D and Vero cell lines
2. Investigate the cell cycle distribution and cell death of T47D after being treated with *Amomum compactum* seed extract

1.3. Scope of Project

This project will cover five main scope of projects, which are:

1. Phytochemical analysis of *A. compactum* seed powder
2. Multistage maceration of *A. compactum* seeds by using both polar and non-polar solvent: hexane and methanol
3. T47D (tumorigenic cell line) and Vero (non-tumorigenic cell line) cells culture
4. Treatment with *A. compactum* seed extracts
5. Cytotoxic evaluation by using MTT assay
6. Cell cycle distribution and cell death analysis by using flow-cytometry
7. Thin Layer Chromatography (TLC) of both *A. compactum* extracts