

CHAPTER I

INTRODUCTION

1.1 The Background of Study

Indonesia has 127 active volcanoes, 35 of them are Sumateran volcanoes and 7 of them are West Sumatera volcanoes (www.pikiran_rakyat.com, 2012). About 22.2% of Indonesian landform is formed by volcano activities (PPT, 2004). Additionally, Indonesia also has a lot of sources of pumice rock. There are more than 10 billion tonnes of pumice which are believed to have economic value. In West Sumatera, the pumice rock materials approximately cover 23.25% (130.486 Ha) of its area (PPT, 1990).

Volcanic ash and pumice are solid volcanic materials. Both of them are mostly consist of glasses and crystalline minerals with composition of SiO_2 , various oxides elements (Al_2O_3 , K_2O , Fe_2O_3 , TiO_2) and amorphous minerals (Manville et al., 2009). On the other hand, there are several differences between them, such as percentage, forming process, morphological and chemical properties. Pumice is defined as pyroclasts material which is an accumulation of rock fragments (Ross and Smith 1961).

Deamer et al. (2002) and Bada (2004) noted that pumice as a fine medium powder is able to reduce water pollutant. Pumice have a great capacity to adsorb biological compounds due to very large surface area that directly increase their adsorbance capacity toward pollutant. The low specific gravity and high porosity of pumice makes it important for a number of applications in the water treatment process and wastewater (Farizoglu et al., 2003). Pumice is able to form chemical bond with organic and inorganic compounds due to the presence of surface OH^- groups plus monovalent and polyvalent ions in their chemical structure (Moraci and Paolo, 2010), then, it is also able to adsorb phosphorous (Njau et al., 2003), and to reduce fluoride in water (Malakootian et al., 2011). Application of pumice can decrease metals activities in soil and wastewater (Sephehr et al., 2013). Meanwhile, the volcanic ash has not fully used to remove of water pollutant yet.

Metal accumulation in soils is of concern in agriculture production due to the negative effects on food safety, crop growth causing phytotoxicity, and

environmental health of soil organisms (Nagajyoti et al., 2010). The such metal in particular iron (Fe) and aluminum (Al) which will be accumulated. It has known that iron (Fe) and aluminum (Al) content in the tropical regions are relatively higher than those in other region due to weathered soil condition of the tropics (Shamshuddin and Fauziah, 2010). Indonesia is one of tropical countries having more than 60% of the lands is acidic and mainly consist of Ultisols and Oxisols (Hakim, 2006). High Fe saturation is known to be toxic to crop growth (Anda et al., 2014). Moreover, solubilization of Al is enhanced by low pH and Al toxicity is a major factor limiting plant production on acid soils (Delhaize and Peter, 1995). The application of pumice and volcanic ash as soil amendment has good potential to reduce iron and aluminum activity in soils.

In addition, the worldwide consumption of pesticides is about two million tonnes per year and 47.5% herbicides (De et al., 2014). Indonesia is one of countries that consume highly herbicide. FAO data (1998) considering as Indonesia herbicide utilization was 26,570 tonnes in 1996. An average increase of pesticide consumption total per year was 6,33% (Djunaedy, 2009). That means that there is 120.27% of increasing of herbicide utilization from 1996 until 2015. The figure showed that there was 58,525.74 tonnes of herbicide utilization in 2015.

When a herbicide is applied directly onto a target pest, the whole site is affected including crop plants, soil organisms and, potentially, humans and wildlife. Part of it goes to the air or to surface waters, due to emission. Once on the target site, the herbicide may drain into surface waters or volatilize into the air. From the air it may deposit on humans, wildlife or plants or on the soil surfaces. From the animals or plants where it was applied the pesticide may leak into groundwater (Health Canada, 1998). That is a very worried condition. Hence, author conducted a research about “Characteristic of Pumice and Volcanic Ash of Sumatera Volcano and Their Potential to Remove Water Pollutant”.

1.2 Objectives of Study

- 1.2.1 To Identify the morphological, mineralogical, and chemical properties of pumice and volcanic ash
- 1.2.2 To determine the optimum adsorption capacity of pumice and volcanic ash on removing water pollutant materials (Fe^{3+} , Al^{3+} , and herbicide)
- 1.2.3 To determine the best form (direct and indirect) of pumice and volcanic ash on removing water pollutant materials (Fe^{3+} , Al^{3+} , and herbicide).

