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Removal Efficiency of Ammoniacal Nitrogen from Palm Oil Mill Effluent (POME) by Varying Soil Properties

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ABSTRACT

Palm Oil Mill Effluent (POME) contains large amounts of organic matters and nutrients. Instead of discharging into oxidation ponds, POME can be used as an alternative option to replace inorganic fertilizers which have been known to increase the hardness and acidity of the soil over time. This study investigated the effect of different soil properties on the ammoniacal nitrogen removal efficiencies in POME. The ammoniacal nitrogen removal efficiencies from three mediums over 7 days of retention times were studied. Medium I contained major amount of sand, whereas medium II contained major amounts of clay and lastly medium III contained large amounts of silt and clay. The results showed that medium II produced the highest removal efficiency of ammoniacal nitrogen in POME, with the average removal efficiency of 77±5.1%. The average values of removal efficiencies obtained from mediums I and III were 61±6.2 and 58±11.3%, respectively. In addition, the removal efficiency of ammoniacal nitrogen increased slowly with the retention time. Medium II recorded the highest removal rate ($k = 0.0897\ day^{-1}$) compared to mediums I ($k = 0.0435\ day^{-1}$) and III ($k = 0.0492\ day^{-1}$). The mechanism of removal ammoniacal nitrogen from the medium occurred *via* absorption by the soil particle.

Key words: Clay, sand, silt, removal of ammonical nitrogen, first order kinetic model

INTRODUCTION

Malaysia is one of the biggest palm oil exporters in the world. Based on the recent data published by the Malaysian Palm Oil Board (MPOB., 2014), the total amount of crude palm oil production in 2014 was about 19.67 million t, in which generated a total of 63.62 billion Ringgit Malaysia (~USD 17.74 billion) in export revenue in the same year. However, the rapid growth of palm oil related industries has also led to significant pollution of air, water and soil (Wu *et al*., 2007; Ahmad *et al*., 2009).

Palm Oil Mill Effluent (POME) is one of the major wastes discharged from the mill, which contains rich amount of organic matters and nutrients (Ahmad *et al*., 2009). Ahmad *et al*. (2005) reported that the production of 1 t crude palm oil (COD) generates about 2.5-3.5 m^3 of POME. Typically, POME consists of 60,000-40,000 mg L^{-1} of total suspended solids, 6000 mg L^{-1} of oil and grease, 50,000 mg L^{-1} of chemical oxygen demand (COD) 30,000-25,000 mg L^{-1} of biochemical oxygen demand (BOD), 750 mg L^{-1} of total nitrogen and 220-120 mg L^{-1} of ammoniacal nitrogen (DOE, 1999; Ahmad *et al*., 2005; Ujang *et al*., 2010; Chin, 2013). These water quality characteristics account to the elevated levels of organic substances in POME which necessitate efforts to treat