

## Monitoring of Ammoniacal Nitrogen and Phosphate in the Leachates When Diluted Palm Oil Mill Effluent was Used as a Fertilizer

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### ABSTRACT

Palm oil mill effluent (POME) contains a high amount of nutrients and organic matter; therefore, it has been considered as an alternative liquid fertilizer (LF). However, the studies on the reuse of POME as fertilizer have been mostly limited to nutrients absorption but the leachates were neglected. Such approach caused potential impacts on ground water pollution. Thus, this research aimed to compare the leachabilities of ammoniacal nitrogen ( $\text{NH}_3\text{-N}$ ) and phosphate ( $\text{PO}_4^{3-}$ ), as well as the growth rates of oil palm seedlings in three different watering conditions. Six oil palm seedlings were watered with either POME, LF or tap water. The leachates from each seedling pot were collected weekly and analyzed for their  $\text{NH}_3\text{-N}$  and  $\text{PO}_4^{3-}$  concentrations. The pots which were watered with tap water showed the highest leaching rate of  $0.0251 \text{ mg.L}^{-1}.\text{week}^{-1}$  for  $\text{NH}_3\text{-N}$  and  $0.0392 \text{ mg.L}^{-1}.\text{week}^{-1}$  for  $\text{PO}_4^{3-}$ . The average concentrations of  $\text{NH}_3\text{-N}$  in the leachates from the POME, LF and tap water pots were 0.45, 0.38 and 0.36 mg/L, respectively, whereas for  $\text{PO}_4^{3-}$ , the average concentrations were 1.09 (POME), 0.96 (LF) and 0.66 (tap water) mg/L. The quickest plant growth rates were recorded in tap water (0.56 cm/day), followed by LF (0.51 cm/day) and POME (0.42 cm/day).

**Keywords:** Fertilizer, leachate, nutrient absorption, plant growth, POME

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### INTRODUCTION

Palm oil mill effluent (POME) is a brownish liquid waste, produced from palm oil mills particularly in the sterilizer condensate and the oil-sludge clarification processes (Patel, 2015; Liew *et al.*, 2015). This type of wastewater contains a high amount of nutrient (ammoniacal nitrogen = 220 mg/L) and organic matter (COD value = ~50,000 mg/L), which can cause significant negative impact to the environment (DOE, 1999; Madaki and Lau, 2013; Loh *et al.*, 2013). In addition to the high amount of pollutants, POME is also generated in extremely large volume per day. According to previous reports, an ordinary mill with a daily production of 360 tons of crude palm oil can generate up to 1,260 ton of POME (Ahmad *et al.*, 2005a).

Researchers have published numerous articles on the treatment of POME, including membrane filtration (Ahmad *et al.*, 2005b), oxidation pond (Rupani *et al.*, 2010), coagulation (Norulaini *et al.*, 2001) and advance oxidation processes (Lim *et al.*, 2017). Alternatively, instead of degrading the pollutants in POME, the reuse of POME as a fertilizer has also attracted substantial researches (Onyia *et al.*, 2001; Wu *et al.*, 2009; Ogboi & Izeke, 2010; Nwoko & Ogunyemi, 2010; Iwara *et al.*, 2011; Afandi *et al.*, 2016). Despite the positive findings that POME has good fertilizer value, it has not been adopted by oil palm planters. The fear that the applied POME may pollute ground water may have prohibited its application in the field. We reported a leaching study of ammoniacal nitrogen ( $\text{NH}_3\text{-N}$ ) from different soil mediums that have been watered with POME over seven-days of retention time.