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Ammonia-Nitrogen Recovery from Synthetic Solution using Agricultural Waste Fibers

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Abstract

Background/Objectives: In this study, modification of Empty Fruit Bunch (EFB) fibers as a means to recover ammonia nitrogen from a synthetic solution was investigated. **Methods:** The EFB fiber was modified using sodium hydroxide. Adsorption-desorption studies of ammonia nitrogen into the modified EFB fiber were investigated **Findings:** The increase in adsorption capacity was found to be proportional with the increase of pH up to 7, temperature and ammonia concentration. The maximum adsorption capacity is 0.53-10.89 mg/g. The attachment of ammonia nitrogen involves ion exchange-chemisorption. The maximum desorption capacity of 0.0999 mg/g. **Applications:** This study can be used as a baseline for designing a low cost adsorbent system for ammonia nitrogen recovery drainage and industrial wastewater as well as EFBs-palm oil mill effluent composting.

Keywords: Ammonia Nitrogen, Agricultural Waste, Desorption, Empty Fruit Bunch, Nutrient Recovery

1. Introduction

Industrial nitrogen can be discharged in large volume from pulp and paper, fertilizer, and mining industry[1]. Highest nitrogen discharges in pulp and paper industry is due to pulping and bleaching process[2]. Besides that, agricultural drainage and municipal waste are also among the main sources of polluter[1]. Ammonia nitrogen concentration greater than 10 mg/L causes intensifying of genotoxicity[3]. In addition, nitrogen pollution in waterways results in the eutrophication and fouling of rivers, lakes, water reservoirs and oceans. Recovering ammonia nitrogen from polluted water could be an option in treating the contaminated water and simultaneously recycle the nutrient back for agricultural purposes. Of numerous techniques investigated for ammonia nitrogen recovery[4], a considerable amount of approaches seem to concentrate on developing cheaper and effective agricultural waste adsorbents[5]. This method is considered eco-friendly, economical, and practically simple to operate[6].

In Malaysia, Empty Fruit Bunch (EFB) fibers are abundantly available waste with about 91.2 million tons were produced annually[7]. Previously, EFB fibers compost has shown potential in removing ammonia nitrogen from synthetic solution[8]. Degraded fibers could enhance the sorption of ammonia nitrogen due to increasing in negatively charge surface site. However, EFB biodegradation take a long time to biodegrade. To reduce the modification time, chemical modification is suggested in this study. Modification of pine cone powder using sodium hydroxide was found to increase the ammonia nitrogen sorption capacity to 6.15 mg/g[6]. In another study, adsorption capacity of banana peels treated with sodium hydroxide was found to increase from 8.6 to 20.0 mg/g[9]. However, the common purpose for EFB modification studies reported so far is mainly for the productions

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