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ADSORPTION OF Pb(II) IONS FROM SYNTHETIC WASTEWATER (AQUEOUS SOLUTION) USING TREATED BANANA PEEL AS AN ADSORBENT

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ABSTRACT

Water pollution becomes one of the major concerns in Malaysia nowadays. One of the sources that contribute to the water pollution is industrial wastewater that contains heavy metals. Lead, nickel and copper are the heavy metals that commonly found in wastewater. There are some conventional methods to treat the wastewater such as chemical precipitation, reverse osmosis and ion exchange; however, they are less efficient and high in cost. The recent study indicates that adsorbent from agricultural waste materials has a potential in removing metals in the wastewater. Thus, the purpose of this study is to investigate the ability of treated banana peel as a good low-cost adsorbent to remove heavy metal which is lead from lead (II) nitrate solution. The effect of adsorbent dosage and contact time on the biosorption rate has been carried out. To prepare the adsorbent, the banana peel was cut into smaller pieces and dried in an oven first before it grounded into powder. Then, it has been soaked in citric acid solution and rinsed until it achieved pH 5.5. Dried treated banana adsorbent powder was mixed with lead (II) nitrate in two different situations which are different adsorbent dosage and contact time. The final concentration of lead in the solution was measured by using Atomic Absorption Spectrometer (AAS) and the percentage of lead removal was calculated. The results showed that the percentage of lead removal increases as the adsorbent dosage increases. The maximum percentages obtained in this study were 22.6%, which is at 3.0g of adsorbent dosage and 9.2% at 90 minutes of contact time. It also indicates that the longer the contact time of the biosorption, the higher the percentage of lead removal can be achieved. Therefore, treated banana peel does show some potential as low-cost adsorbent.

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INTRODUCTION

1.1 RESEARCH BACKGROUND

Of the total water on earth, only 0.0008% is available and renewable in rivers and lakes including water that falls as rain or snow or that has been accumulated and stored as groundwater (Ali et al., 2016). These "clean" water resources are used for human and agricultural uses. It is estimated that by the year 2025, there will be 4-5 billion people that will live in regions already insufficient clean water (Roger, 2006). In variety of industrial processes, there is a huge amount of heavy metals are used in their applications and operations such as metal plating facilities, mining operations and tanneries.

Heavy metals, for instance, chromium, copper, cadmium, lead and zinc are the most persistent wastewater pollutants as result of overpopulation and expansion of industrial activities. These heavy metals become a threat to human beings and other living species if their concentrations exceed certain limits (Renge et al., 2012). Most heavy metals are toxic and non-biodegradable substances. Thus, it have the tendency to bio-accumulate and it has been desired to reduce their concentration levels in the effluents before it deposited for storage in the ecosystem (Anwar et al., 2010).

There are many methods such as chemical precipitation, reverse osmosis and ion exchange that are used for the removal of heavy metals in the wastewater. However, all of these methods are expensive and non-environmental friendly. Recently, adsorption process becomes another choice in removal heavy metals as it is inexpensive compared to the others. Thus, it is essential to find agricultural by-products and to transform such materials to adsorbents.

Nowadays, agricultural wastes are getting more and more attention as adsorbents for the removal of heavy metals from wastewater. The adsorbents from agricultural origin have polymeric groups like cellulose, hemi-cellulose, pectin, lignin and proteins as active center for metal uptake (Anwar et al., 2009). Previous studies show that inexpensive agricultural waste from banana peels can be used as adsorbent