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Production and Characterization of Rice Husk Biochar and Kenaf Biochar for Value-Added Biochar Replacement for Potential Materials Adsorption

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ABSTRACT

Two raw biomass materials from different sources were investigated: aluminosilicate obtained from rice husk and agricultural lignocellulosic waste from kenaf fiber. The properties of the optimal mixing ratio of biochar were investigated by using proximate analysis, ultimate analysis, thermogravimetric analysis, surface area and pore volume determination, Fourier Transform Infrared Spectroscopy analysis, X-ray diffraction, and Scanning Electron Microscopy. According to the proximate analysis, the ash content is increasing while the moisture content fixed carbon and volatile matter decrease. On the basis of the BET characterization finding, the surface area is increased proportionally to the increasing mixing ratio RHB: KFB (0.8:0.2, 0.5:0.5, 0.2:0.8). The SEM images showed that both biochars are suitable sources of blending because of the differences and the availability of good adsorbents. This study indicated that RHB and KFB as pure biochar have a great potential to be applied as adsorbents. However, blending is not giving the desired result to be used as an adsorbent.

Keywords: biochar, biomass, adsorption, blending, kenaf fiber, rice husk, pyrolysis

INTRODUCTION

Most industrial wastewater is highly persistent; otherwise, it will turn into a recalcitrant form. Water pollution posed different hazards to humans, animals, and plants on Earth. The water pollution is included in many classifications like organic pollution such as phenol, ammonia, dyes, and other aromatics substances found in industries. Furthermore, heavy metals such as copper, cadmium, arsenic, chromium, mercury, zinc, and other metals from the metal finishing industries are released during electroplating and coating to wastewater. Due to the chronic consequences of heavy metals to a human being, the removal treatment for those dangerous heavy metals must be performed before discharging. Many advanced technologies are applied for heavy metal removal such as chemical precipitation, flotation, ion exchange, coagulation, flocculation, membrane filtration, and adsorption (Renu, Agarwal, and Singh 2017; Saeed 2020).

Among all the methods mentioned above, the adsorption method is considered as an additive, efficient technology that can be used to remove heavy metals from wastewater and provide a quantitative amount of treated wastewater (Ardejani et al. 2007). Various adsorbents, like activated carbon, activated biochar, are the most employed method. Malaysia is one of those countries which are rich in agricultural waste such as rice husk, empty fruits bunch, coconut shell, and kenaf fiber. Malaysia generates more than 2 million tons of agricultural waste annually which is disposed