KELANTAN BAMBOO ACTIVATED CARBON: AN ECONOMICAL AND SUSTAINABLE INNOVATION FOR WASTEWATER TREATMENT BY ADSORPTION TECHNIQUE

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Highlights: Wastewater, which causes negative upshots for the environment, is today's global concern. This research showcases the potential application of Kelantan bamboo activated carbon (KBAC), a low-cost and novel bio-adsorbent for wastewater treatment by the adsorption technique. AC is often made from wood; however, bamboo is an alternative to wood with excellent capacity as adsorbent due to its rich carbon content. The KBAC is produced through carbonization and pyrolysis and has received substantial attention from local industries. A letter of intent is in development to initiate a university-industry collaboration to consolidate the invention of KBAC from pilot-scale to a larger-scale systems.

Key words: *bamboo, activated carbon, pyrolysis, carbonization, bio-adsorbent, wastewatertreatment*

Introduction

Wastewater engendering elevates immeasurably with the betterment of living mode, where a colossus share of waste is inaugurated by manufacturing and chemical processes (Kocasoy & Sahin, 2007). Alleviating the menace of wastewater effluent that endangers life is essential. There are multiple techniques recognized for wastewater treatment. Among all other existing treatment of wastewater technologies, adsorption is tagged as a sustainable, cost-effective, and eco-friendly technique. The adsorption technique can eradicate organic pollutants with 99.9% efficacy (Ali, et al. 2012). In this perspective, the activated carbon (AC) is the most often used adsorbent since it owns the suitable porous inner surfaces for gas or liquid access. Sheng et al. (2012) reported that bamboo is feasibly used in heavy metal separation and wastewater purification. Due to the massive carbon content in bamboo, the bamboo AC has emerged as an escalating adsorbent to eliminate pollutants, heavy metal or dye removal (Norhusna et al., 2013). Notwithstanding the rapid growth rate of bamboo in Malaysia, scarce research has been done in converting bamboo into AC. The AC used in Malaysia is often made from wood materials. Inspired by the favourable properties in bamboo, this research was launched to produce the Kelantan bamboo AC (KBAC), an economical and novel bio-adsorbent for wastewater treatment by the adsorption technique. The KBAC offers a local, sustainable technology to Malaysia in battling the wastewater problem while leveraging the domestic bamboo commodity industry.

Content

Bamboo, a non-wood plant, is introduced as a good bio-adsorbent with high capability in adsorbing foreign materials in water (Ademiluyi & David, 2012). In today's market, AC is a type of bio-adsorbent typically made from wood products. Imported wood-based AC products in Malaysia are relatively high-priced. The novelty of this innovation lies in its initiative to develop a wastewater treatment technique with local, sustainable technology.

Specifically, this research converted a non-wood product, i.e., the Kelantan bamboo, into a bio-adsorbent named KBAC. The easy availability of Kelantan bamboo, credited to its high growth rate, has significantly put the amount of time it takes in creating the AC raw materials to minimal. The bamboo can be harvested quicker over the wood as the former matures in 3-5 years while the latter takes over 5 years to reach maturity before harvesting (Itoh & Shimanji, 1981).

The harvested Kelantan bamboo was 24 hours air and oven-dried respectively, which aim to reduce the moisture content below 15%. The dried bamboo was sliced, chipped, and blended into a fine powder. Four hours of carbonization and pyrolysis at 550oC through the steaming method took place to turn the powder into a readily used bio-adsorbent for wastewater treatment. Indisputably, the production process of KBAC is uncomplicated, and it has kept the production cost minimum.

The KBAC is an advantageous consumable domestic product. Besides eco-friendly, the KBAC exhibits excellent surface area characteristics and porosity properties. These superior traits granted the KBAC a high strength in adsorbing the foreign particles in the water. In practice, KBAC and wood-based AC products have virtually coincident performances for absorption capability, but the KBAC is shown to prevail from a cost perspective.

This innovative product has recently been shared with the public, where its findings will be published as a Scopus indexed article in the AIP proceeding. The KBAC's versatile merits have drawn considerable attention from the local community and industries, especially the SMEs. A university-industry collaboration certainly makes the KBAC remained a competitive advantage in the market share. Developing a letter of intent between UMK and the industry would be a step in the right direction.

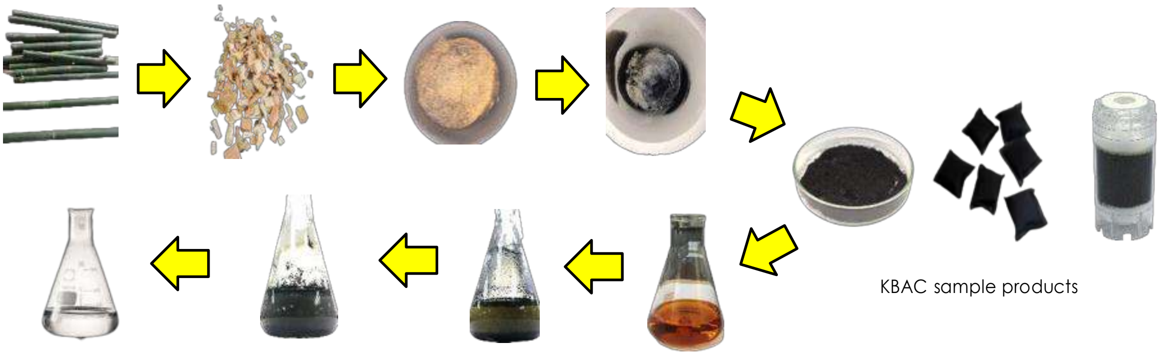

Figure 1. The production and implementation of KBAC for wastewater treatment

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