NCON-PGR_2022_207

Efficiency of Mixed Activated Carbon Layer from Sugarcane Bagasse and Coconut Shell in a Biological Sand Filter for Peat Swamp Groundwater Treatment

Zaiton Ibrahim, Nurul Farah Anisa Hairolnizam, Chan Jing Jing, Suryati Sulaiman *and* ***Abdul Syukor Abd Razak****

Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, 26300 Gambang, Pahang, Malaysia.

**Corresponding author*: syukor@ump.edu.my

Abstract

Globally, 998 million tonnes of agricultural waste are produced per year. In Malaysia, 1.2 million tonnes of agricultural waste are disposed into landfills annually. The production of activated carbon from local agricultural waste is one of the environment-friendly ways to transform the waste to value. The focus of this study is to investigate the effectiveness of mixed activated carbon layer from sugarcane bagasse and coconut shell in a biological sand filter for peat swamp groundwater treatment. Twelve parameters that will be analysed are pH, colour and turbidity, total suspended solid (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), lead, iron, zinc, manganese, E.coli and total coliform (TC) of groundwater. In this study, the sugarcane bagasse and coconut shell are first dried at 105°C for 24 hour and undergo carbonization process by burning in furnace at 500°C and 400°C after impregnation by phosphoric acid to activate a pore surface for the carbon. Two models of biological sand filter will be built with one conventional biosand filter and one integrated biosand filter by additional mixed activated carbon layer to carry out water parameter quality test. The material for biosand filters are wash sand (0.30mm - 0.60mm), support gravel (6.30mm-10mm), underdrain gravel (>10.00mm) and mixed activated carbon (0.63mm-2.00mm). The data obtained were used to determine the performance efficiency of conventional and integrated biosand filter. All the analytical measurements performed in this study were conducted according to the Standard Methods for the examination of water and wastewater by APHA (2007). The Drinking Water Quality Standard and National Water Quality Standards for Malaysia are used to establish the quality of treated water while the analysis of variance (ANOVA) is used in this study to determine whether each water parameter is significant differences between the means of three or more independent (unrelated) groups. The peat swamp groundwater was in the pH range of 3.81-3.90, colour range of (1080 - 1098) TCU, turbidity range of (60.4 - 64.8) NTU, BOD range of (12.4 – 12.85) mg/l, COD range of (110 – 125) mg/l, TSS range of (14 – 21) mg/l, total coliform more than 2419.6 MPN, iron range of (8.284 – 8.312) mg/l and zinc range of (0.185 – 0.204) mg/l. The peat swamp groundwater was absent of E.coli, lead and zinc. The performance efficiency of conventional biosand filter in pH was 71.00%, 80.88% for color, 70.08% for turbidity, 49.09% for BOD, 55.16% for COD, 59.06% for TSS, 95.59% for total coliform, 77.86% for iron and 64.69% for zinc. However, the performance efficiency of integrated biosand filter was 81.34%, 90.60% for color, 69.58% for turbidity, 63.32% for BOD, 69.47% for COD, 81.29% for TSS, 87.11% for total coliform, 81.51% for iron and 70.3% for zinc. In overall, all two objectives in this study were achieved. The physical, chemical, biological characteristics of peat swamp groundwater were determined. The integrated biosand filter was more effective than conventional biosand filter in increasing pH value, reduction of colour, BOD, COD, TSS, iron and zinc. However, conventional biosand filter was more effective than integrated biosand filter in reducing turbidity and total coliform.

Keywords: Agricultural waste; Biosand filter; Coconut shell activated carbon; Groundwater; Sugarcane activated carbon.