REMOVAL OF WATER HARDNESS FROM GROUNDWATER USING LEMON PEEL DERIVED BIOCHAR

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Abstract: Water hardness is the amount of dissolved calcium and magnesium ions in the water. Problems with hardwater include toughening of skin and hair, spots on sinks and clothes, scaling in boilers, washing machines, and pipes, and difficult soap lathering. Over time, prolonged excessive calcium intake can pose significant health risks, including osteoporosis, kidney stone formation (nephrolithiasis), colorectal cancer, high blood pressure (hypertension), stroke, coronary artery disease, insulin resistance, and obesity. The emergence of membrane technology has rectified the hardness problems of drinking water, however this technology is not often a suitable option for remote water scarce areas due to high energy consumption and high operational cost. This study explored the potential of using biochar made from lemon peels to reduce water hardness and enhance the quality of groundwater for drinking purposes. The adsorption method used here does not introduce any extra ions into the treated water, demonstrating its energy-efficient and cost-effective, demonstrating its cost effective in nature. Batch adsorption experiments were conducted for varying doses (2.5-30 g/L) and contact times (30-1440 minutes) under same experimental conditions to determine the optimum dosage and optimum contact time respectively at the shaking speed 200 rpm. The optimum dosage of lemon peel derived biochar was found to be 20 g/L to remove hardness from 600$\pm$20 mg/L to 345 mg/L (43%) at the optimum contact time of 300 minutes. The enhanced removal of hardness can be obtained when the biosorbent was tested with groundwater after boiling which removes temporary hardness.

Keywords: Batch experiments, Groundwater, Hardness, Lemon peel biochar