

**CAPABILITY OF MICROALGAE (*Chlorococcum* sp.)
AND MACROALGAE (*Sargassum* spp.)
TO REMOVE HEAVY METAL (Cr or Cu)
FROM SYNTHETIC AND ACTUAL WASTEWATERS**

By

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ABSTRACT

CAPABILITY OF MICROALGAE (*Chlorococcum* sp.) AND MACROALGAE (*Sargassum* spp.) TO REMOVE HEAVY METAL (Cr or Cu) FROM SYNTHETIC AND ACTUAL WASTEWATERS

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The performance of a macroalgae (*Sargassum* sp.), a microalgae (*Chlorococcum* sp.) and a locally available commercial granulated activated carbon for the removal of copper (Cu) and chromium (Cr) from aqueous solutions was compared and evaluated in this study. *Sargassum* was collected from the coastal waters of Bolinao, Pangasinan, rinsed, air-dried, pulverized, sieved and oven-dried to constant weight. The *Chlorococcum* sp was laboratory-cultivated in three successive growth batches of 21-d each in BG-11 medium, with the final batch centrifuged, rinsed with deionized water and oven-dried to constant weight. The locally purchased 12X40 GAC for water treatment applications was oven-dried to constant weight. Batch experiments were conducted to examine the efficiency of the three different adsorbent on Cu and Cr removal. Kinetic and isotherm experiments were done at the optimal pH of 4.5 ± 0.1 for Cu (II) and 2.0 ± 0.1 for Cr (total). The equilibrium isotherms were determined and the results were analyzed using the Langmuir and Freundlich models. Both models could describe well the adsorption of Cu or Cr on the three adsorbents studied. The adsorbent were capable of sequestering significant amounts of Cu, although considerable difference in their performance was observed. Best Cu removal performance was observed on *Sargassum* at a maximum removal of 87.3% obtained for an initial concentration of 20 mg l^{-1} Cu. The maximum uptake capacities for Cu(II) were 71.4 mg g^{-1} , 19.3 mg g^{-1} and 11.4 mg g^{-1} of *Sargassum*, *Chlorococcum* and GAC respectively. The adsorbents were also able to remove Cr. However, its removal was not as high as copper removal. The maximum uptake capacities for Cr were 8.5 mg g^{-1} , 5.7 mg g^{-1} and 4.3 mg g^{-1} of *Sargassum*, GAC and *Chlorococcum* respectively. Kinetic studies reveal that removal rate of copper is much faster than of chromium. Experiments with copper showed that equilibrium was attained at around 1.5 h while it took about 6 h for equilibrium to occur in chromium solutions. The metal uptake by the three biosorbents was best described by pseudo-second-order rate model. The brown macroalgae *Sargassum*, was found to have the best potential as biosorbent for copper due to its maximum uptake capacities and affinities for this metal. Application of *Sargassum* on the treatment of a copper mine wastewater by column filtration showed an actual removal capacity of 12.48 g l^{-1} at a 3-minute empty bed contact time (EBCT).