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Comparative Study of Hexavalent Chromium [Cr(VI)] Removal Efficiency of Natural Adsorbent, Planktonic *Bacillus subtilis* KCB07C10, and their Biofilm

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Chromium is a widely used raw material in textile, tanning, electroplating, and wood preservative industries, which releases significant amounts of hexavalent chromium contaminated wastes into inland waters and aquatic environments, causing hazardous effects on biota, i.e., cancers, organ disorders, morphological changes, functional alterations, etc. Therefore, many pollutant removal strategies including chemical, physical and biological remediation methods are used in the chromium-based industry to prevent such adverse effects. This study mainly compared the effectiveness of physical and biological methods for hexavalent chromium removal. The physical remediation was done using agricultural waste; straws as a natural adsorbent, which is abundant in Sri Lanka. Bioremediation was investigated using previously isolated hexavalent chromium tolerant bacterial strain *Bacillus subtilis* KCB07C10. Bacterial biofilms of *B. subtilis* KCB07C10 were formed on straw and visualized by scanning electron microscopy. Straw, bacterial isolate, and biofilm were exposed to 16.0 mg/L of hexavalent chromium in Tris minimal medium (modified), and hexavalent removal was measured spectrophotometrically by 1,5-diphenylcarbazide analysis during 24 hours of time intervals up to 96 hours. The study describes that the complete removal of hexavalent chromium can be achieved by both *B. subtilis* KCB07C10 immobilized straw and planktonic cell suspension within 48 and 96 hours, respectively, while the adsorbing straw indicated 51.47 % removal during the study period. It can be concluded that the efficiency of hexavalent chromium removal differs significantly among the adsorbents, planktonic bacteria, and biofilms in question ($p=0.022$) and that hexavalent chromium removal can be efficiently performed by B. subtilis KCB07C10 biofilm on straw.

Keywords: *hexavalent chromium, removal, adsorbent, bacillus subtilis, biofilm*