Removal of Heavy Metal Ions from Industrial Wastewater Using Algal Polysaccharide Alginate

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Heavy metal contamination of both soil and water by industrial wastewater is currently an environmental and public health issue of great concern. These metals, unlike multiple others, which are vital for bodily function, have no essential roles and exert diverse and severe toxic effects on the body. Early exposure to these metals may lead to compromised development, with lifelong physical, intellectual, and behavioral impairments, as well as major chronic diseases in adulthood. Chelating agents are often used to more efficiently remove these metals from water. The agent and natural polymer alginate, which occurs naturally in brown algae and is both accessible and relatively easy to obtain, has been shown to possess great application potential for the removal of heavy metals from contaminated water. In this study, this potential (its chelating capacity) was investigated alongside its relationship with temperature. To do so, alginate was exposed to a heavy metal (lead (II) ions) solution at different temperatures (296, 313, and 333K) and had the percentage of removed (chelated) ions measured through the solution’s change in conductivity (n=5). Results showed an average 60.34, 59.42 and 58.07 (±0.05)% chelation at 296.0, 313.0, and 333.0 (±0.1)K, respectively, suggesting an approximate 0.06% reduction in chelating capacity for every 1K increase in temperature (R2=0.99148). Hence, the study demonstrates that as the temperature increases, the complex’s stability is reduced and, thus, so is the agent’s chelating capacity, also showing that alginate can be used as an effective chelating agent for lead (II) ions over a range of temperatures.

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