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Applying immobilised phycobiliproteins onto chitosan for efficient mercury removal

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This study aimed to improve chitosan polymer's capabilities to absorb mercury by immobilising phycobiliproteins (PBPs) onto the surface of chitosan beads (chitosan–PBPs). Phycobiliproteins, light-harvesting proteins from algae and cyanobacteria, have several industrially essential applications. These proteins can bind heavy metals with high affinities. Protein extracts obtained from both *Arthrospira platensis*, with C-phycocyanin as the dominant phycobiliprotein and *Neoporphyra haitanensis*, with R-phycocyanin and R-phycoerythrin as the dominant PBPs, were covalently immobilised onto chitosan beads. Binding analysis showed that, on average, 54 µg of PBPs were immobilised per bead. Immobilised proteins were still in their native state, with no visible colour change after immobilisation. Chitosan–PBPs and chitosan alone were tested for mercury adsorption at pH 4 and pH 7 by atomic absorption spectroscopy. The tested concentration range of mercury was from 1 to 70 ppm. Affinity, calculated using Henry's binding isotherm, of chitosan–PBPs for mercury was higher at both pH values than chitosan alone. Furthermore, chitosan–PBPs beads were able to absorb significantly more mercury than chitosan alone. These results show that the covalent immobilisation of PBPs onto chitosan improves its mercury adsorption characteristics and creates a more efficient eco-friendly adsorbent for removing mercury ions in the tested concentration range.

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