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Applications of chitin- and chitosan-derivatives for the detoxification of water and Wastewater

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Abstract:

Water is one of the basic necessities required for the sustenance and continuation of life. It is therefore important that supply of good quality water should be available for various activities. However, this is becoming increasingly difficult in view of large scale pollution
caused by industrial, and domestic activities. These pollutants are often toxic and cause adverse affects on human and animal life if present above certain concentration levels. In order to avoid pollution of natural water bodies, it is essential to treat wastewater for the removal of pollutants before being discharged into them. Biosorbents gain wide attention as these are available in large quantities worldwide and are eco-friendly. The use of adsorbents containing natural polymers has received reorganization, in particular polysaccharides such as chitin and its derivate chitosan.

Chitosan is a natural, not toxic and biodegradable polycationic; it is obtained by deacetylation of chitin. It's a polymer which possesses valuable properties as a metal recovering and water purifying agent. Interactions of metals with chitosan are complex, probably simultaneously dominated by adsorption, ion-exchange and chelation. To study this, it is of utmost importance to work with well-characterized chitosans. Chitosan properties depend on several parameters, such as its origin (shrimp, squid, fungi etc), characteristics (mole fraction of N-acetylation; molecular weight) and the treatments used to condition it (dissolving, precipitation, drying). These parameters can influence the material's sorption properties for metal ions and dyes.

In this work, we studied the one hand, the removal of metals cations such as copper, zinc and cadmium by biosorption of the bentonite chitosan system and secondly, the removal of dyes by biosrption on the chitosan-bentonite-beads system. This is done with respect to various parameters.

The results showed that the elimination of metal cations depends on several factors such as pH, temperature and chitosan /bentonite ratio. Moreover, cation concentration of chitosan and the process employed have an effect on the elimination of cations.

The elimination method used proved that there is a synergy between chitosan and bentonite. Bentonite and chitosan showed a different affinity for each of the three cations. This affinity increases in the order Cu >Cd>Zn.

The adsorption of Red Teflon dye onto chitosan-bentonite-beads in aqueous solutions was investigated . Experiments were carried out as a function of contact time, initial dye concentration (10–200 mg/L), pH (2–9.0), and temperature (25–45 °C). The maximum adsorption capacity (qe) was found to be 650 mg/g.

Keywords: chitine, chitosane, bentonite, retention, heavy metals, dyes