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Biosorption process: Comparison of heavy metals Pb (II), Cu (II) and Mn (II) removal using *Limonia acidissima* shell powder

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The presence of heavy metals in the environment at concentrations above critical values stipulated by national and international regulatory bodies is considered unacceptable. Protection of 'essential elements of life' as well as preservation of our rich and diverse natural resources are the essential pre–requisites for a benign and compassionate environment. Therefore, one should strive to achieve the dual goal of human well being consequences of healthy environment. In almost all modern technologies water is used as the principal industrial commodity both as a utility service and also a raw material. Rapid strides in industrial sector coupled with oft–updated manufacturing processes lead to enormous increase in the volume and complexity of effluent discharge. Regardless of their produce, all industries depend upon the most valuable natural resources of our planet, namely, air, land and water. Among the three, water being an omnipotent substance is the 'lifeline' of a vast majority of industries. Because of its unique nature and unparalleled properties, water is used in various manufacturing processes. But during the course of production, the precious resource is contaminated and this may prove catastrophic in the long run. Recognizing the potential danger in the offing, almost all Governments have been framing stringent environmental laws, insisting on effective eco–friendly control measures to abate pollution and safeguard tremendously valuable natural resources to posterity. Heavy metals in the various water bodies are of major concern because of extensive industrialization and increasing population density. The heavy metals such as lead, cadmium, copper, nickel and zinc are among the most common pollutants found in industrial effluents. Solid and or liquid wastes containing toxic heavy metals may be generated in various industrial processes such as chemical manufacturing, electric power generating, coal and ore mining, smelting and metal refining, metal plating, and others. The presence of heavy metals in the effluent streams from chemical, electroplating, paper and pulp, petroleum refining and wood preserving industries and the mining/extraction have been the major sources of concern to communities and environments. Among the heavy metals that are commonly generated by industrial process chromium is one which elicits a variety of serious toxic responses upon prolonged exposure to elevated concentrations either orally or by inhalation. Tanneries are mainly responsible for the release of huge amounts of Lead, Manganese and Copper into the environment. They accumulation causes severe environmental problems due to its extreme toxicity to living organisms. They on 'acute' exposure or chronic exposure effects different body organs. Over exposure of workers to heavy metals dust causes irritation and corrosion of skin, irritation in respiratory system and lung carcinoma. Ingestion of heavy metals many cause epigastria pain, nausea, vomiting, severe diarrhea and hemorrhage. Effect of heavy metals on aquatic life is due to disruption of metabolic processes during developments. In aquatic plants it is observed that concentration needed to inhibit growth and metabolic processes such as photosynthesis vary widely and depend on factors such as concentration of cells and nutrients, physiological state of cells, salinity and temperature. There are several techniques for the removal of heavy metals from aqueous medium such as chemical precipitation, ion exchange, reverse osmosis, lime coagulation, adsorption, solvent extraction, evaporation and electrolytic recovery. Selection of a treatment technology is based on the concentration of waste and the cost of the treatment process. In comparison with the conventional methods for removing toxic metals from industrial effluents the biosorption process has several advantages, such as low operating cost minimization of the volume of biological sludge to be dispersed off, high efficiency in detoxifying very dilute effluents and least nutrient requirements. Though several researchers have reported studies on the removal of heavy metals from aqueous solutions by adsorption, little work has been undertaken using biomass. Among the most promising types of biosorbents studied is the algal biomass. These algae possess a high metal-binding capacity. This is due to the presence of various functional groups such as carboxyl amino, sulphate and hydroxyl groups, which can act as binding sites for metals. The objective of the present work is to explore the feasibility of biosorption technique for the removal of heavy metals from aqueous solution using new biosorbent material Limonia acidissima Shell Powder, used as an adsorbent for removal of heavy metals. The equilibrium studies on adsorption of heavy metals are carried out in a batch process systematically, covering various parameters –Equilibrium time, weight of the biosorbent, initial metal concentration, pH of the aqueous solution, temperature and kinetics were studied. The results indicate that the amount of Lead, Copper and Manganese adsorbed increased with increase in metal concentration, dosage of biomass and pH of the aqueous phase up to certain level and then decreases giving raise to optimum concentration, pH, and dosage. We compared the three metals in which the maximum % of removal of metal is done using the same biosorbent Limonia acidissima shell powder with same parameters. In this investigation we found that removal of heavy metals are in the order lead (Pb^{+2}) >copper (Cu^{+2}) > manganese (Mn^{+2}) under same parameters and biosorbent. This study shows that Limonia acidissima is an effective biosorbent for the removal of Lead (II) from aqueous solutions.

Biography

Ch. V. Naga Sowjanya has completed his work at the age of 21 years from Andhra University. I'm a student presented almost 10 papers in International level and national level organized conferences. I published 2 papers in reputed journals which are under the process.

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