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BIOSORPTION OF HEAVY METALS BY CLOSTRIDIUM SP BACTERIA

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ABSTRACT

The present study is focused on the removal of heavy metals from ground water using on eco friendly adsorbent clostridium sp. Bio sorption is one of the economic methods that used for removal of heavy metals. The results revealed that the use of clostridium sp. is very effective for the treatment of heavy metals in the ground water.

KEYWORDS: Bio sorption, Clostridium sp, Heavy metal, AAS.

INTRODUCTION

Ground water is an important source of drinking water and its quality is currently threatened by the contamination of chemical pollution and microbiological contamination, especially microbes of sewage origin.[3] High incidence of diarrhoea, trachoma and the overall high mortality salts are associated with poor environmental sanitation.[4] Drinking water may be contaminated by the harmful bacteria resulting health problem.[1] The WHO reported that nearly half of the population in developing countries suffers from health problems associated with lack of drinking water of with microbiologically contaminated water.[2] However some of the bacterias are mainly used for removal of heavy metals in water.

The presence of heavy metals in aquatic environments is known to cause severe damage to aquatic life, beside the fact that these metals kill microorganisms during biological treatment of wastewater with a consequent delay of the process of water purification. Most of the

heavy metal salts are soluble in water and form aqueous solutions and consequently cannot be separated by ordinary physical means of separation.

Bacteria are generally the first organisms to be affected by discharges of heavy metals into the environment, resulting in an increase of metal resistant bacteria in this environment.[5] Resistant of toxic metals in bacteria probably reflects the degree of environmental contamination with these substances and may be directly related to exposure of bacteria to them.[6]

Microorganisms have developed several mechanisms to tolerate high concentrations of heavy metals. Biomass of algae, fungi and bacteria has been known to readily adsorb or accumulate metal ions. The ability of metal uptake by those microorganisms (known as bio sorption or bioaccumulation) has caught great attention due to its potential to provide an effective and economic means for heavy-metal remediation.

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MATERIALS AND METHODS

1000 ppm solutions of lead, chromium, copper, iron and manganese were prepared. It was then suitably diluted to 10 ppm solution. Each 100 ml of mineral media for the growth of micro organism was taken in five conical flasks. 10 ppm of different metal ion solution was added incorporated in the mineral media separately and then centrifuged. The supernatant was separated.

The separated supernatant of mineral media was taken with 10 ppm solutions of Pb, Cr, Cu, Fe and Mn respectively and centrifuged at 10000 rpm, at 4 ^{o}C for 15 minutes and supernatant was separated. This culture supernatant was checked with turbidity. Five conical flask of 100 ml were taken for each heavy metal containing the supernatant and one ml of culture supernatant was added which contain the isolated organism of clostridium sp and *pseudomonas sp separately*. These flasks were then *separately* incubated in the rotary shaker at 120 rpm for 15 days. The growth rate of organism in each flask was studied on the

7th and 15th day using Atomic absorption spectrophotometer for the determination of heavy metals.

RESULT AND DISCUSSION

The major advantages of Biodegradation, over conventional treatment methods include low cost, high efficiency, minimization of chemical and biological sludge and regeneration of biosorbent and possibility of metal recovery.[7] The disadvantages of Biosorptions are (i) early saturation i.e., when metal interactive sites are occupied (ii) the potential for biological process improvement (e.g., through genetic engineering of cells) is limited because cells are not metabolizing and (iii) there is no potential for biologically altering the metal valency state.[8]

The bacterial cell growth and cell division in aquatic systems is highly dependent on the availability of phosphate, substrate and mineral nutrients. The mechanisms by which metal ions bind to cell surface include electrostatic interactions, Van der waals forces, covalent bonding, redox interactions and extracellular precipitation or combination of their processes. The ability of Clostridium to decrease various metals concentration was examined in both media within 7 days. Maximum degradation of metals was observed in 15th day of incubation.

The study of Clostridium sp. ability in degrading of Pb, Cr, Cu, Fe and Mn showed that this bacterium could degrade average of 42% in 7 days and average of 70% in 15 days. The metal sorption tends to reverse the negative charges on bacterial cells and numerous studies have reported that the phosphoryl residues on the outer membrane of bacterial cells are the most likely binding sites for metals for most Gram-negative bacteria.

The minimum inhibitory concentration (MIC) of metals (Pb, Cr, Cu, Fe and Mn) in the growth cycle of Clostridium sp was observed to be highly dependent on the composition of culture media and incubation temperature. It was found from the results of this study that metal toxicity and cell growth rate depends on the combination of media composition, substrate concentration and incubation temperature.

The cells might compete with the components in the medium for metals binding sites. In 15th day, Pb, Cr, Cu, Fe and Mn can form more metal complexes and help the cells to grow in higher concentrations compared to that in 7th day. The cells then provide more metal binding

sites for and thus show less toxic to metals in 15th day. It was concluded that Clostridium sp biosorbed almost 70% of heavy metals in 15 days.

CONCLUSION

The present study showed the effect of clostridium sp for the removal of heavy metals in ground water. Clostridium sp showed that it could degrade average of 76% of heavy metals in 15 days and the process results to be of low cost a removal of heavy metals in and it does not involve any kind of chemicals thus this study shows that the biological treatment helps in full reduction or removal of heavy metals in the environment.

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