REMOVAL OF HEAVY METAL CHROMIUM ION BY REVERSE OSMOSIS PROCESS

by

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C E R T I F I C A T E

This is to certify that the thesis entitled 'Removal of heavy metal chromium ion by reverse osmosis', submitted by Bhanu Deb Thakur has been prepared under my supervision in conformity with rules and regulations of the Indian Institute of Technology, Delhi. The research report and results presented in the thesis have not been submitted for any degree in any other university.

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A C K N O W L E D G E M E N T

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A B S T R A C T

Heavy metals, particularly chromium in hexavalent form is one of the most common contaminant encountered in effluent stream from engineering and chemical industries. Separation of these components by reverse osmosis, which in itself is a relatively new process has been studied to determine various operating parameters including membrane characteristics.

Membranes were prepared in the laboratory under controlled condition to study the influence of process conditions during the making of membrane as the ultimate separation efficiency. Evaporation time and annealing temperature were the two major factors found to be most important for this purpose.

Separation characteristics of the membrane made at optimum condition was studied under different operating condition both physical and chemical. The physical parameters were pressure and circulation flow rate temperature, where as chemical factors were like pH, presence of other ions, mixture of hexavalent and trivalent chromium etc.

A model has been developed to predict both the permeable flux and rejection of chromium at varying pressure and temperature conditions. This model has been successfully applied to explain the experimental results. The flow rate affects separation of chromium because of the concentration polarisation.

A model based on mass transfer consideration has been developed to predict the membrane performance. True rejection capacity of the membrane was determined and found to be quite high similar to the data being published for commercial and other membranes.

The effects of pH, chloride and sulphate ions have been observed to significantly effect the separation of hexavalent chromium in most cases reducing the rejection by as much as 30%. This effects have been explained in terms of charge density of permeating ions.

Results of separation studies with mixture of hexavalent and trivalent chromium system shows that Cr^{+3} suppresses the rejection of Cr^{+6} whereas its own rejection is maintained at a very high level i.e. near 99% and is not affected by the presence of Cr^{+3}. The suppression has been satisfactorily explained by the particular ion formation, its size and charge.

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