REMOVAL OF COPPER IONS FROM AQUEOUS SOLUTIONS USING CATION- AND ANION-EXCHANGE MEMBRANES BY ELECTRODIALYSIS PROCESS

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Electrodialysis is an electrochemical separation process where under the influence of an applied electrical field and with the help of semi-permeable membranes ionic species from an aqueous solution are diverted through the membrane obtaining two or more effluent streams, one depleted in ionic species and the other enriched in the very same ionic species. Taking into account the versatility of this process, electrodialysis is a promising technique for the treatment of effluents to recover valuable substances for further re-use or to treat polluted effluents [1]. Electrodialysis is applied nowadays as a recovery method for a large number of metals (Au, Pt, Ni, Cu, Ag, Pd, Cd, Zn, Sn, Pb) from plating baths [2, 3].
A category of heavily used membranes in electrodialysis is that of the ion-exchange membranes. These are placed alternately, (i.e. a cation-exchange membrane and an anion-exchange membrane and so on between an anode and a cathode), constituting an electrodialysis stack reactor [1].

In this paper we investigated the effects of operating parameters, such as the initial concentration of solution, the flow rate and the applied voltage, on removal rate of Cu^{2+} employing a three chamber electrodialysis cell stack, using semi-permeable membranes and ion exchange membranes such as: PPOBr, PS , Purolite C104, Purolite A400. The contaminated solution is pumped into the electrodialysis unit, each stack being separated by a spacer, allowing the solution either to be stagnant or to flow at a controlled flow rate depending on the chosen operating conditions. Under the influence of the applied electrical potential across the stack membranes the cations in solution migrate toward the cathode, and anions toward the anode. When a cation encounters a semi-permeable cation membrane, it passes through. As it continues to migrate, it will subsequently encounter a semi-permeable anion membrane through which it cannot pass and will remain in that compartment. Similarly anions migrate toward the anode, pass through a semi-permeable anion membranes; their travel is halted when they encounter a semi-permeable cation membrane. In the case of ion-exchange membranes, the process is some how similar, however here the main process of passing through the membranes is replaced with that of an ionic exchange (cationic or anionic depending on the membrane type) process.
Each cell stack is equipped with an individual pump and two valves which enable the adjustment of the flow rate to have the same pressure in all circuits.

References:

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