World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:11, No:07, 2017

Chromium (VI) Removal from Aqueous Solutions by Ion Exchange Processing Using Eichrom 1-X4, Lewatit Monoplus M800 and Lewatit A8071 Resins: Batch Ion Exchange Modeling

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Abstract : In recent years, environmental pollution by wastewater rises very critically. Effluents discharged from various industries cause this challenge. Different type of pollutants such as organic compounds, oxyanions, and heavy metal ions create this threat for human bodies and all other living things. However, heavy metals are considered one of the main pollutant groups of wastewater. Therefore, this case creates a great need to apply and enhance the water treatment technologies. Among adopted treatment technologies, adsorption process is one of the methods, which is gaining more and more attention because of its easy operations, the simplicity of design and versatility. Ion exchange process is one of the preferred methods for removal of heavy metal ions from aqueous solutions. It has found widespread application in water remediation technologies, during the past several decades. Therefore, the purpose of this study is to the removal of hexavalent chromium, Cr(VI), from aqueous solutions. Cr(VI) is considered as a well-known highly toxic metal which modifies the DNA transcription process and causes important chromosomic aberrations. The treatment and removal of this heavy metal have received great attention to maintaining its allowed legal standards. The purpose of the present paper is an attempt to investigate some aspects of the use of three anion exchange resins: Eichrom 1-X4, Lewatit Monoplus M800 and Lewatit A8071. Batch adsorption experiments were carried out to evaluate the adsorption capacity of these three commercial resins in the removal of Cr(VI) from aqueous solutions. The chromium solutions used in the experiments were synthetic solutions. The parameters that affect the adsorption, solution pH, adsorbent concentration, contact time, and initial Cr(VI) concentration, were performed at room temperature. High adsorption rates of metal ions for the three resins were reported at the onset, and then plateau values were gradually reached within 60 min. The optimum pH for Cr(VI) adsorption was found as 3.0 for these three resins. The adsorption decreases with the increase in pH for three anion exchangers. The suitability of Freundlich, Langmuir and Scatchard models were investigated for Cr(VI)-resin equilibrium. Results, obtained in this study, demonstrate excellent comparability between three anion exchange resins indicating that Eichrom 1-X4 is more effective and showing highest adsorption capacity for the removal of Cr(VI) ions. Investigated anion exchange resins in this study can be used for the efficient removal of chromium from water and wastewater.

Keywords : adsorption, anion exchange resin, chromium, kinetics
Conference Title : ICGCE 2017 : International Conference on Green Chemistry and Environment
Conference Location : Stockholm, Sweden
Conference Dates : July 13-14, 2017