

## Modification of Ion Exchange Resin for Enhanced Removal of Nickel (II) Ions From Aqueous Environment

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### Abstract

In this study, the removal of nickel (II) ions using a strong acid cation resin was investigated through a fixed bed column technique. The aim of this study was to enhance the performance of the resin through modification. The resin was modified employing the impregnation method. A characterization analysis was conducted to investigate the resin after the modification with comparison to the original one. The equilibrium behavior of the modified resin was investigated at different pH values (3-7) and different initial concentrations of nickel (1.8, 2.8 and 3.8 g/L). The effect of regeneration on the modified resin was determined to show that the regeneration did not affect on the equilibrium performance. The removal efficiency and rate of removal were represented on breakthrough curves. The kinetics of the process was determined; Thomas model was used to express and evaluate the experimental data which showed a high correlation. The results suggest a better performance of the modified resin compared to the original one which can significantly enhance the actual application of ion exchange process.

*Keywords:* Ion exchange; Resin; Nickel; Fixed bed; Wastewater.

### 1. INTRODUCTION

Ion exchange, adsorption and membrane filtration are the most used techniques for the removal of heavy metals in wastewater effluents (Chandra and Pillay, 2005; Elshazly and Konsowa, 2003; Fu and Wang, 2011; Reynolds and Richards, 1996). High rate of removal of Ni(ii) ions from effluent have been achieved by ion exchange process. Limited number of studies focuses on THE performance of ion exchange fixed bed column for metal removal (Arsalani et al., 2009; Gode and Pehlivan, 2003; Shaidan et al., 2012; Yavuzet al., 2008). In this study the performance of modified Lewatit S1467 cation exchange resin was investigated. Lewatit S1467 is a strong acid cation resin; the resin was subjected to modification using Tetrabutylammonium iodide (TBAI) as a modifier. The aim of this study is to analyze and investigate the equilibrium performance of the modified resin in a fixed bed column technique. The optimum operating conditions of the modified resin at different pH values and initial concentration of the contaminant were investigated. The kinetic study of the ion exchange modified resin to determine the rate of removal of nickel ions was conducted. Juang et al. (2006) investigated the column removal of Ni(II) from synthetic electroplating waste water using a strong-acid resin (Purolite NRW-100). Modification of ion exchange resin by impregnation of TBAI showed a better results in relation to the hydrophobic and hydrophilic properties of resin. Sata, et al. (2010) stated that the number of water molecules surrounding two monovalent cation is larger than those of one divalent ion. Since the ions are more hydrated, they are less fixed on the resin. Amara et al. (2002) proved that the introduction of TBAI inside the resin phase increases hydrophobicity due to the increasing aliphatic chains bonded to the ammonium groups.