Using FTIR to Corroborate the Identity of Functional Groups Involved in the Binding of Cd and Cr to Saltbush (Atriplex Canescens) Biomass

Abstract

Fourier transform infrared (FTIR) studies were performed to confirm the chemical modification of saltbush (Atriplex canescens) biomass and to provide information about the identity and binding characteristics of the chemical groups responsible for the binding of Cd(II), Cr(III), and Cr(VI). In addition, studies were performed to determine the optimum time for the binding of the three ions by saltbush biomass, and to study the efficiency of HCl and sodium citrate as stripping agents. The metal quantification was performed using inductively coupled plasma optical emission spectroscopy (ICP-OES). The results showed that 10 min or less is enough to achieve the maximum metal binding, and that aqueous solutions of 0.1 mM HCl or sodium citrate were enough to strip more than 80% of the bound Cd. It was determined that more than 70% of the bound Cr(III) was stripped using 0.1 mM HCl. Chemical modification of carboxyl and ester groups on the biomass was performed. The FTIR results confirmed that the esterification of carboxyl groups and hydrolysis of ester groups in the native biomass had occurred. The direct effect of these modifications on the binding properties of the biomass provided strong evidence that the carboxyl functionality is the main group responsible for binding Cd and Cr(III). However, the IR data showed that for Cr(VI), a different type of functional group is involved.