Environmental contamination due to heavy metals is caused by several industries, metal plating, mining, painting, and car radiator manufacturing, and also by agricultural sources such as fertilizers and fungicidal sprays. The presence of the above metals in the environment is a major concern because of their toxicity and threat for human life and for the environment, especially when tolerance levels are exceeded.

In this context, the recovery of heavy metals from wastewater has become a major topic of research in water treatment. Several methods are commonly used (chemical precipitation, membrane filtration, and ion exchange), but adsorption has been shown to be an economical alternative for removing trace metals from water. Previous research has demonstrated the ability of granular activated carbon (GAC) for metal ion adsorption. Recently, a new form of activated carbon has appeared: activated carbon cloth (ACC). We have reported its faster adsorption kinetics than GAC and its high adsorption capacities for organic micropollutants, but its use for the removal of inorganics (and especially metal ions) has not yet been studied. The aim of this work is to evaluate the feasibility of using ACC for the removal of toxic heavy metals from aqueous solution. The influence of experimental conditions such as contact time, metal ion concentration, or pH will be studied. Experimental results will be analyzed to provide an understanding of the adsorption mechanism. The activated carbon cloths used in this study are commercial products from the Chemviron C-1300. They were compared with a granular activated carbon prepared by chemical activation ($H_2SO_4 + NH_4S_2O_8$) of coirpith. The porosity parameters were used to confirm microscopic observations carried out with a scanning electron microscope SEM and FTIR. Acidic and basic surface groups were determined by titration using the Boehm method. The pH of the point of zero charge $pH_{pzc}$, i.e., the pH above which the total surface of the carbon is negatively charged, was measured by the so-called pH drift method. ACC suspension tests were performed, to study the amphoteric behavior of ACC in water. Five hundred milligrams of ACC were stirred for 6 h in 250 mL of distilled water, whose initial pH was adjusted to between 3 and 10 with NaOH and HCl 0.1 M. Metal ions were analyzed on a Perkin-Elmer 2280 atomic absorption spectrophotometer.

Optimum conditions were found as concentration of 10 mg l$^{-1}$, pH: 5, contact time:25 min, and activated carbon amount:750 mg. Optimum condition were applied to drinking water for removal of Al(III). Furthermore, adsorption isotherm data were fitted to both Langmuir and Freundlich models for finding the optimum conditions.

References