

# Design and Construction of Equipment to Make Adsorption at Pilot Plant Scale of Heavy Metals

Juan C. Moreno-Piraján<sup>a</sup>, David Rangel<sup>b</sup>, Bibiana Amaya<sup>b</sup>, Edgar M. Vargas<sup>b</sup>, and Liliana Giraldo<sup>c</sup>

<sup>a</sup> Departamento de Química, Facultad de Ciencias, Universidad de Los Andes, Grupo de Investigación en Sólidos Porosos y Calorimetría, Carrera 1 No. 18A-10/70, Bogotá, Colombia

<sup>b</sup> Departamento de Ingeniería Química, Facultad de Ingeniería, Universidad de Los Andes, Carrera 1 No. 18A-10/70, Bogotá, Colombia

<sup>c</sup> Departamento de Química, Universidad Nacional de Colombia, Carrera 30 calle 45, Bogotá, Colombia

Reprint requests to Prof. J. C. M.-P.; E-mail: jumoreno@uniandes.edu.co

Z. Naturforsch. **63a**, 453 – 461 (2008); received November 29, 2006

The purpose of this paper was to illustrate the procedure to obtain activated carbon from lignocellulosic residues through chemical and physical paths. A general surface characterization was made and aqueous solution isotherms were obtained in order to evaluate the behaviour of each carbon atom in solutions contaminated with selective ions. The other purpose was to show a simple way to perform a scale-up process of an absorber from the laboratory level to an industrial level, using the breaking curves in fixed beds developed through the continuous pursuit of the Pb(II) and Cr(VI) ions concentration in the effluent of the bed. Activated carbon was used to study the adsorption of Pb(II) and Cr(VI). Isotherms of aqueous adsorption were determined. This model was developed in order to examine its efficiency and to compare it with an experimental model made in the laboratory, which rendered very similar results. The main characteristic of the feasibility of the application of this design is the fact that neither tedious calculations nor mass transfer coefficients are required in order to construct the above-mentioned curves. The model was developed by applying concepts such as mass transfer zone (MTZ) and length of unused bed (LUB), which are the dynamical basis understanding for the adsorption process in fixed beds.

As a complementary item of the experiment, within a pilot plant scale, a filter was developed in order to achieve flexibility when manipulating the most important adsorption parameters and to enable the control of the variables involved in the process that change the operating conditions.

*Key words:* Activated Carbon; Mass Transfer Zone; Length of Unused Bed; Curve of Breakthrough.