International Conference on Food
and Agriculture Applications
of Nanotechnologies

Kinetics of adsorption of Cd, Co, Cr, Cu, K, Ni and Zn in aqueous solutions using natural zeolite integrated to LTCC technology

F. S. C. Soares[(1)*], A. C. C. Bernardi[(2)**], R. Carapelli[(2)]; C. M. Bossu[(3)] Alonso[1] A. R. A. Nogueira[1]

(1) Universidade Federal de São Carlos, São Carlos SP, Brazil
(2) Embrapa Pecuária Sudeste, São Carlos, SP, Brazil, e-mail:
(3) Universidad Autonoma de Barcelona, Barcelona, Spain
**Corresponding author, CNPQ fellow

Abstract – This report describes the use of LTCC technology to construct miniaturized device composed with zeolite inside Owing the zeolite properties, it is possible to perform the construction under high temperature and pressure, without lose of physical ar chemical characteristics. The proposed device presented as an option to pre-concentration of minerals in diluted solutions.

The LTCC technology (Low Temperature Co-fired Ceramics) has become much more versatile than any technique applied so far in the field of miniaturization, since allowing the construction of three-dimensional devices quickly and easily. Due to the ease of handling, the green ceramic provide the multilayer arrangement of modules with different applications, such as, among others, in the field of microelectronics and manufacturing microvalves and microfluidic systems applied in flow injection systems. Natural materials, available in large quantities and that can be used as low cost adsorbents for wastewater treatment have been the target of numerous studies. As an example, chitosan, zeolites, natural sponges and activated carbon are used successfully for this purpose. Zeolites are natural or synthetic minerals, with a wide variety of technological applications. Its structure has channels and cavities in which it is possible to settle ions, water molecules or other adsorbates and salts. This study aimed to investigate the removal capacity of Cd, Cr, Cu, K, Ni and Zn by a sample of natural zeolite ceramic integrated devices through the LTCC technology. Ceramic systems with 2.6 cm long and 1.7 cm wide were constructed with natural zeolite integrated inside. The experimental parameters were optimized employing 10 mL of a 5 mg L^{-1} containing Cd, Co, Cr, Cu, K, Ni and Zn. The influence of pH and time on adsorption of metals by natural zeolite was evaluated. After the adsorption step solutions were analyzed by optical emission spectroscopy with inductively coupled plasma (ICP OES) for the analytes determination. The results showed that the determining factor in the adsorption capacity of natural zeolite is the pH of the solution. In the pH range of 6 up to 7 the competition adsorption of analytes was not observed. Values above 88% of adsorption were obtained for all metal ions studied. The kinetic study indicated that equilibrium was reached in approximately 2 hours of contact between the solution and natural zeolite. The results demonstrated the viability in the adsorption of Cd, Co, Cr, Cu, K, Ni and Zn in natural zeolite integrated ceramic systems, and the pH factor in optimizing the adsorption capacity of zeolite.

[1]Actual address: Universidade Federal de Viçosa - Campus Rio Paranaíba, Rio Paranaíba, MG,Brazil.