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## Shock electro dialysis phenomenon for sustainable separation devices through a fluidic system

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Paula Montes<sup>1</sup>, Jose Trejo Gonzalez<sup>1</sup>, Emilse Aráoz<sup>1</sup>, Sofia Pérez<sup>1</sup>, R. Matias Trujillo<sup>2</sup>, Rossana Madrid<sup>2</sup>, and Adolfo Avila<sup>1</sup>

<sup>1</sup>INQUINOA, Universidad Nacional de Tucumán, CONICET, San Miguel de Tucumán, Argentina

<sup>2</sup>LAMEIN, Departamento de Bioingeniería, INSIBIO - Universidad Nacional de Tucuman, CONICET

[rmadrid@herrera.unt.edu.ar](mailto:rmadrid@herrera.unt.edu.ar)

*The availability of biomass associated with agroindustry residues provides enormous opportunities for new bioproducts applications for sustainable processes. Biochar is a cost-effective carbonaceous material which can serve as raw material to create new separation agents and microdevices for gas purification, water treatment, biomolecule separation, controlled drug delivery, electrochemical reactors, microseparators and many other advanced applications. In this work, we used biochar disks derived from biomass harvest residues as a porous media to study the shock electro dialysis phenomenon in a home-made cell for continuous electrolyte flow of 2 mL in volume. The cell includes two stainless steel electrodes to study this phenomenon (Fig.1). Comparative cyclic voltammetry measurements were performed using the cell in batch mode with 0.1 mM KCl solution either including or not including the biochar porous media. The difference between both voltammetry profiles showed the additional diffusion limitation of the current density provided by the porous material. A set of continuous flow runs considering 0.1 mM KCl solution ( $\approx 17 \mu\text{S}/\text{cm}$ ) were performed under an applied electric potential ranging from 0.2 to 5.0 V and different flow rates between 0.1 to 10.0 mL/min. The continuous monitoring of the solution ion conductivity in the cell outlet throughout each run provided important insights. The decrease of the outlet ion conductivity when the electric potential was applied to the cell indicated the presence of ion concentration polarization through the biochar porous material. The polarization effect increased when flow rates and electrolyte concentrations were lower. Much sharper conductivity drops were observed for flows in the order of 100  $\mu\text{L}/\text{min}$  (Fig. 2). Miniaturized systems could be applied in tissue or organ engineering for fluids treatment. With a proper engineering design and scale (geometry, thickness and morphology) and considering optimized operating conditions (flow rate, applied voltage and ion concentration), this cost-effective carbonaceous material may play an important role in the development of new separation technologies for water treatment.*