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NUMERICAL PROTOTYPING OF PAPER-BASED ISOTACHOPHORESIS

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Abstract. Microfluidic paper-based analytical devices are nowadays a well-established technology, although aspects related to the transport of chemical species need to be improved to reach higher levels of analytical precision, efficiency, and portability. This work focuses the experimental validation of numerical prototypes for paper-based isotachophoresis. The model includes advective, diffusive, dispersive and electrodispersive mechanisms, as well as the effects of porosity, tortuosity, and permeability of paper substrates, and the solvent velocity profile due to the electroosmotic flow. The porous medium created by the cellulose fibers is considered as a network of tortuous capillaries and represented by macroscopic parameters following an effective medium approach.The model has been tested both numerically and experimentally, with analytes related to Lithiasis pathology. Numerical prototypes were implemented in OpenFOAM®software, using the `electroMicroTransport` toolbox. Promising results can be used in the near future to build a Lab-on-a-chip (LOC) device to measure renal nephrolithiasis biomarkers.