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MODELING AND SIMULATION OF PAPER-BASED GRADIENT GENERATORS

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Abstract. Paper-based analytical devices are nowadays a well-established technology in the academia, the industry and domestic applications. Within the scope of this technology, the concentration gradient generators constitute a family of devices with applications of great importance in cell biology, pharmacology and biotechnology, among others. However, there are still fundamental aspects regarding transport mechanisms that still need to be studied in order to increase the performance and applicability of the devices. Particularly, the transverse dispersion of the advectively transported solutes is a phenomenon that requires an exhaustive study in order to correctly design the gradient generators. Although this phenomenon has been investigated for decades in areas of science studying transport dynamics in phreatic layers, it has not yet been addressed in micro- and nanoestuctured media, as is the case of paper. The present work deals with the design of paper based concentration gradient generators, through the modeling of the transport of solutes on paper (using a novel model accounting for mechanical dispersion), and the experimental validation of said model. In addition, different concentration gradient generator designs are presented in the format of numerical prototypes, evaluating the validity of the design concepts, its range of operation and its overall performance.