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NUMERICAL PROTOTYPING OF USB POWERED MICROFLUIDIC PAPER-BASED ANALYTICAL DEVICES

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Abstract. Microfluidic paper-based analytical devices (MPADs) allow chemical determinations in a user-friendly and portable format, but their main disadvantage is their still limited applicability, mainly because the low sensitivity and the consequent lack of quantitative sensing. Several attempts to circumvent this problem have been presented requiring specific laboratory equipment, at the expense of usability. Simultaneously, universal serial bus (USB) are currently available everywhere, in electronic devices like smartphones, personal computers, and even TV sets. In this article, the concept of USB powered MPADs is presented as a fusion of both technologies, in order to address the low applicability of MPADs by enhancing the detection limits. Furthermore, two isotachophoretic (ITP) USB–MPADs were studied, both powered by the 5V electric potential provided by any standard USB port. The first device, based on the origami approach, was analysed by numerical simulations and experiments, achieving two-order-of-magnitude sample focusing in a 15 minute operation time. The second ITP USB–MPAD is a novel design (numerical prototype), in which the reservoirs were moved away from the ITP channel and capillary action was used to drive the sample and electrolytes to the separation zone. Numerical models were implemented using *electroMicroTransport*, an open source toolbox for the well known finite volume library OpenFOAM®.