Development of microfluidic paper-based analytical devices and its applications for pharmaceutical analysis

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Abstract: Low cost, disposable and easy to use microfluidic paper-based analytical devices (μPADs) were developed for rapid, simple and quantitation of acyclovir and paracetamol in tablets. The μPADs were fabricated by patterning hydrophilic-hydrophobic regions on cellulose paper using a wax printer. Colorimetric measurements of the two model drugs were carried out on μPADs using 2 N Folin–Ciocalteu reagent in 10% w/v sodium carbonate. An ImageJ was used to measure the intensity of the colored area in the detection zone. The method showed a dynamic range of 50-250 μg/mL ($r^2=0.9433$) for acyclovir and 10-80 μg/mL ($r^2=0.9896$) for paracetamol, good detection and quantitation limits (< 3.7 and < 44.1 μg/mL for acyclovir and paracetamol, respectively), recoveries (101.0-104.2% for acyclovir and 98.8-103.5% for paracetamol) and precision (RSDs < 2.8% for acyclovir and < 3.2% for paracetamol). Finally, the validated method was applied for the determination of acyclovir and paracetamol in tablets and results show the percents labeled amounts within the United States Pharmacopeia limit (90.0-110.0%). The developed μPADs provided short fabrication time, simple operation, portability and low cost. Additionally, the method illustrates a potential for the pharmaceutical analysis applications which, would be valuable for the developing countries or resources limited setting.

Keywords: Acyclovir; Folin–Ciocalteu reagent; Microfluidic paper-based analytical devices; Paracetamol; Tablets