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DEVELOPMENT OF SIMPLE AND LOW-COST PAPER FLUIDIC DEVICES COUPLED WITH AMPEROMETRY FOR SEPARATION AND DETECTION OF PHARMACEUTICAL COMPOUNDS

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The advancement and characterisation of cellulose chromatography paper-based microfluidic devices mark a significant step forward in analytical chemistry, particularly for point-of-care diagnostics and environmental monitoring. Hydrophobic patterning on chromatography paper was used to define hydrophilic flow channels, directing the sample from an inlet to a defined location for subsequent analysis. This simple yet elegant development led many to recognise paper as a substrate material for applications where low-cost and portability are critically important. Carbon ink was used to fabricate the working electrode on the paper-based microfluidic device, and silver paste was used as the pseudo-reference electrode to keep the device simple and low-cost. A 350 V difference was applied along the paper channel to create the fluidic flow. As the electrolyte 10.00 mmol L^{-1} borate buffer solution at pH 9 was used. Amperometric analysis was carried out using a homemade instrumental setup. When subjected to amperometric analysis, the developed paper-based microfluidic device produced distinct peaks for ascorbic acid and acetaminophen. Migration times of 120 s and 85 s and peak currents of 0.28 µA and 0.31 µA for acetaminophen and ascorbic acid, respectively, were obtained for a separation distance of 1.5 cm. The R^2 value for the calibration curve of ascorbic acid was 0.94. Future efforts may focus on constructing calibration curves for acetaminophen based on the peak areas of amperograms and reducing the peak width for more accuracy. This study successfully demonstrated the detection and separation of two key electrochemically active analytes, ascorbic acid and acetaminophen. Further, instead of power-free fluid transport via capillary action, paper electrophoresis was used to obtain narrow peaks by increasing the fluid flow rate.

Keywords: Acetaminophen, Amperometry, Ascorbic Acid, Paper based microfluidic device