Contribution ID: **804** Type: **Poster (+) Presentation**

Rapid spreading of complex fluids in porous substrates

Wednesday, 2 June 2021 09:00 (1 hour)

With the advent of paper microfluidics and the concept of Point-of-care healthcare diagnostics, study of imbibition of complex fluids in porous media has become significantly important. In these applications, a rapid and even spread of complex fluids on absorbent paper is essential to ensure a uniform component spread for accurate chemical and bio-sensing. Especially in the case of blood analysis techniques like Dried Blood Spot (DBS) analysis, an even and rapid spread of blood is crucial to avoid coagulation and even distribution of analytes for consistent sample spotting. While cellulose-based filter papers, commonly used in these applications, are good for absorption, the nanoporous matrix provides a significant hindrance to the flow of a liquid. Thereby, it inhibits the spread of a liquid. The porous network can also clog if the fluid contains large particulate matter.

In this work we present a filter paper based device where we overcome the resistance to fluid flow which allows a rapid and even spread of complex liquids. In our design, we sandwich a filter paper between a nanofibrous matrix supported on a polyethylene terephthalate (PET) sheet. With this sandwich design, we decrease the net resistance to the flow while maintaining the high suction pressure provided by the filter paper. As a result, a large quantity of liquid can be imbibed into the device quickly and evenly. We demonstrate the working of this device for linear imbibition using three types of liquids: dyed water. milk solutions and whole blood. We support these experimental observations using a 1D Darcy's law for flow in porous media. We also employ a simple equivalent resistance model to demonstrate how the sandwich design reduces resistance to flow compared to jus the filter paper.
The concepts and designs presented in this work can be expanded to radial imbibition for use in microfluidic devices. As the design relies on additive manufacturing, without any modifications to the source paper, the concepts can also be used for improving the reliability of Dried Blood Spotting techniques.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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