National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Investigation into the design of paper microfluidics for manipulating flow behaviour needed for developing point-of-care diagnostic devices
Speaker	: Dr. Prasoon Kumar
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Venue	: Seminar Room
Date and Time	: 17 Dec 2024 (11:00 AM)
Abstract	: The global paper strip based diagnostic device market size was valued at USD 5.2 billion in 2018 and is anticipated to exhibit a CAGR of 4.0% during the forecast period. However, one of the major challenges with these lateral flow assay devices for diagnostic application is processing the blood to obtain plasma for disease diagnosis. Hence, controlled and even spreading of complex fluids like native blood over microporous substrates in lateral flow devices is required for chemical and biological sensing applications. Owing to the non-Newtonian flow behavior, it poses a significant challenge to obtain uniform flow in a porous substrate. Further, blood coagulation process is another barrier to flow in a microporous substrate. Herein, we describe the strategies to overcome the challenges of fluid flow in paper devices. We have integrated a microporous paper with radially arranged bifurcating channels in PDMS to develop a leaf mimicking device. The device was able to pump water through trans-evaporation at the rate better than any other reported passive pumps. Further, a sandwich design was proposed wherein linear channel was integrated with microporous paper. The sandwich device could achieve rapid fluid pumping and even spreading of dye sample and blood overcoming the chromatography effect. We have also developed mathematical model to further assist in understanding and engineering of paper microfluidic devices proposed on above designs. In addition, curvature of the paper strip and backing layer also plays an important role in driving fluid through these lateral flow devices. This work will assist in developing diagnostic devices with using whole blood