IIT Bombay blood plasma separator: A hand-operated point-of-care device for integration with diagnostics for pediatric sepsis

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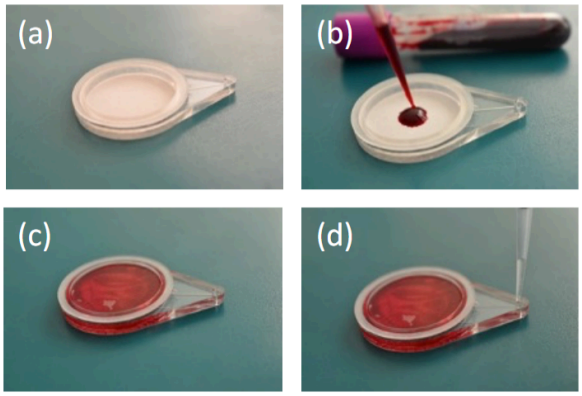
Specific problem being addressed: The accuracy of diagnostic tests is crucial for detection of diseases. To achieve this, a component separation of blood is required that separates plasma from blood cells. This project proposes an efficient plasma separation from capillary blood. The device will be integrated into a point-of-care (POC) device currently being developed by our industry partner Achira Labs Pvt. Ltd., a pioneering microfluidics company, for the detection of pediatric sepsis. Contrary to the existing sophisticated diagnostic methods, which require skilled personnel and large amounts of blood samples, our device is a POC device and requires only ~ a few microliters (30 microlitres or less) of blood. Though other miniature diagnostics are available, they are very costly.

Project Summary: The novelty of the proposed device is that we can achieve clogging-free filtering of plasma without the need for dilution, along with a significant increase in plasma yield. The proposed separation device has the potential to overcome challenges such as red blood cell damage and long operation times. It is robust, easy to fabricate, and simple to operate. It will further undergo performance tests and clinical trials. Once proven, the proposed method has the potential to be of use in several similar diagnostic applications. The figure shows plasma separation achieved by the device through various steps. The plasma separator device transfers the separated plasma to the test cartridge of Achira Labs for obtaining the final results. The Achira Labs can also assist in translating the final product into a commercial prototype. The device has multiple applications moving forward such as plasma separation before molecular assays (E.g. blood bank screening assays for HIV, HBV, HCV etc.) The technology can be taken forward as a platform technology in two ways:



(a) integration with point-of-care platforms to enable plasma separation and
(b) stand-alone devices for plasma collection.

Impact of this innovation: Sepsis is the body's immune response to an infection by damaging its tissues. It can occur suddenly and deteriorate rapidly to a life-threatening condition. Sepsis may progress to septic shock, affecting major organs and increasing the risk of death. Since a timely diagnosis is crucial, this is a potential problem in developing countries such as India, where there are deficiencies in healthcare resources, including infrastructure, instruments, and professionals. Sepsis-induced morbidity and mortality could inflate in the future due to more immunocompromised patients in the post-pandemic period, more resistant microorganisms, and wider use of surgical procedures. Sepsis could be determined by the presence of some naturally occurring proteins such as procalcitonin (PCT) and C-reactive protein (CRP) which are found in blood plasma. A novel, portable, hand-operable blood plasma separation device, proposed in this project can work with a single-drop volume of undiluted blood at point-of-care.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