SCO-Young Scientist Profile

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Details of research work carried out in S&T

The aim of my research work is to develop a passive microdevice for platelet-rich plasma (PRP) separation from blood. PRP finds wide applications from transfusion purposes for patients undergoing treatment of dengue, dental surgery, sports injury, and in the field of dermatology. The extraction of PRP therefore has a wide social impact. Globally, approximately 390 million people per year (World Health Organization 2017) get infected by dengue and need platelets transfusion for treatment. Clinical methods of PRP separation is centrifugation-based, which involves several drawbacks such as large setup, time and power consuming, need skilled personnel, involve manual steps, and have adverse effect on quality of sample (activation of ~50% of extracted platelets occurs during the separation process). The developed microdevice overcomes these drawbacks of conventional method and have the following unique features:

- The microdevice is simple, easy to fabricate, compact in size ($3\ cm \times 2\ cm\ \times 0.5\ cm$), low cost and easy to operate.
- The microdevice does not require external power supply, sheath fluid and additional pumping power for its operation.
- The microdevices utilises a unique principle for separation of PRP, which is the combined effect of hydrodynamics forces, biophysical laws, and geometrical effects for separation.
- The microdevice separates PRP with *~15-fold enrichment* from whole blood, which is better than all reported passive (and even active) microdevices ever built.
- The microdevice provides clog-free (and therefore) operation over a long duration.
- The microdevice can double-up as a platelets-poor plasma (PPP) separation device by altering the inlet blood samples and provide PPP with 94.7% purity.
- The biological characterization of the samples obtained from the microdevice have no adverse effect on the quality of the sample.
- Preparation of PRP and PPP on a single microdevice makes our device design unique.
- Potential of microdevice in detecting the severity of COVID-19 and cardiovascular diseases

Associated SCO-YSC Theme: Biotechnology and Bio-Engineering

Shanghai Cooperation Organization- 1st Young Scientists Conclave (SCO-YSC 2020)
A virtual event organsied in India at CSIR-IICT, Hyderabad
Theme: **Shaping SCO-STI Partnership: Young Scientists Perspectives**

Statement of Innovation

1. The microdevice have a potential to act as a point-of-care (POC) device at the site of patient for early detection, and in resource poor setting areas.

2. The microdevice have potential in enriching the platelets therefore this can be leveraged for counting the platelets in the case of thrombocytopenia or in the case of very low platelets count such as in critical cases of COVID-19. For that, microdevice needs to be calibrated so that the platelets measured at the outlet can be correlated with the platelets in the incoming sample. We can control flow rate and use a pre-programmed calibration curve for the best performance of the microdevice.

3. Developed microdevice integrated in series can extract 100% platelets from blood and can be used for transfusion purposes in the field of dermatology and for the treatment of dengue.

4. The platelet poor plasma separation can be a potential candidate for the coagulation study by integrating with the micro pump and target chemical assay.

Major awards/ Achievements

1. Recipient of **prestigious SITARE- Gandhian Young Technological Innovation (GYTI) Appreciation 2020.**
2. *Winner of* ***Post Graduate Research award*****-2020** at Department of Mechanical Engineering, Indian Institute of Technology Bombay
3. Highlights of the *doctoral research work on Platelet enrichment using microfluidics device published in newspaper Mumbai Mirror* at 12th September, 2019. https://mumbaimirror.indiatimes.com/mumbai/other/a-new-micro-device-to-battle-dengue/articleshow/71088613.cms

Possible collaboration with SCO countries

It will be a great opportunity to collaborate with SCO countries to develop microdevice as a point-of-care device and provide for clinical practice. The collaboration will further help in several aspects such as relevant application in cells and particles separation based on their size, deformability, for cells capturing, counting, and drug delivery.

Key words

Microfluidics, lab-on-a-chip, Platelet rich plasma, Blood, cell manipualation, point-of-care microdevice