

Points of view in bioengineering: molecular diagnostic, transdermal drug delivery and nanomedicine

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Abstract:

The presentation consists of two parts. The *first part* will be dedicated to a new approach in paper-based microfluidics: heat-driven evaporation. Paper-based microfluidic devices are attractive diagnostic platforms for nucleic acids testing (NAT) due to their low-cost and ease-of-use. However, paper-based microfluidic platforms are relatively less sensitive and require a substantial amount of nucleic acids (NA) for detection. Therefore, sensitive and specific detection of the (NA) using paper-based microfluidics requires filtration, NA concentration, and amplification to be incorporated and developed on the same device. The current work proposes a paper-based microfluidic platform that uses thermophoresis and driven-evaporation for nucleic acids concentration. The sample concentration was achieved by overlapping a “hot spot” (required to generate thermal gradients) with the “spot” designed as evaporative concentrator. The proposed paper-based microfluidic platform presents a sandwich structure with four components: a rigid plastic support to hold a filtration paper, a nitrocellulose paper to drive the NAs through the collection point and a plastic tape, with a small opening defining the evaporation area, to seal the structure, and a Vivid filtre paper. Through vertical flow the sample is collected into a nitrocellulose paper, while a lateral flow is used to concentrate the sample. Simulation results showed that, once the device comes in contact with a hot surface, the structure assures a “hot spot” around the evaporation area. The focalization process using evaporative concentrator and thermophoresis was visualized first with colour die. The positive Soret coefficient of the DNA allowed its concentration on the hot area, while the evaporative concentrator enhance it. The method was tested also using spiking salmon DNA in blood. The *second part* will be focused on the current research spotlights in the eBio-hub Centre: the molecular diagnostic, transdermal drug delivery and nanomedicine.