South African Journal of Science

Paper-based smart microfluidics for education and low-cost diagnostics

AUTHORS: Suzanne Smith[1]
Klariska Moodley[1]
Ureshnie Govender[1]
Hao Chen[1]
Louis Fourie[1]
Sibusiso Ngwenya[1]
Shavon Kumar[1]
Phumlani Mjwana[1]
Hastings Cele[1]
Mesuli B. Mbanjwa[1]
Suretha Potgieter[1]
Trudi-Heleen Joubert[1]
Kevin Land[1]
AFFILIATION:
[1]Materials Science and Manufacturing, Council for Scientific and Industrial Research, Pretoria, South Africa
CORRESPONDENCE TO:
Suzanne Smith
EMAIL:
ssmith@csir.co.za

Abstract

Current centralised healthcare models pose many challenges, particularly for developing countries such as South Africa, where travel and time costs make it difficult for patients to seek healthcare, even when urgently needed. To address this issue, point-of-care (PoC) tests, which are performed at or near the site of clinical care, have gained popularity and are actively being developed. Microfluidic systems, in which small volumes of fluids can be processed, provide an ideal platform on which to develop PoC diagnostic solutions. Specifically, the emerging field of paper-based microfluidics, with advantages such as low-cost, disposability and minimal external equipment requirements, provides unique opportunities for addressing healthcare issues in developing countries. This work explores the field of paper-based microfluidics, with step-by-step instructions on the design, manufacture and testing processes to realise paper-based devices towards diagnostic applications. Paper-based microfluidic and electronic components are presented, as well as the integration of these components to provide smart paper-based devices. This serves as an educational tool, enabling both beginners and experts in the field to fast-track development of unique paper-based solutions towards PoC diagnostics, with emphasis on the South African context, where both the need for and impact of these solutions are great.