Applications of paper-based devices in (bio)analytical chemistry

Anastasios Economou
Department of Chemistry, National and Kapodistrian University of Athens, Athens, 157 71, Athens, Greece
e-mail: aeconomo@chem.uoa.gr

The birth of the modern field of paper-based analytical devices (PADs) is attributed to the pioneering work by the Whitesides' group which demonstrated that it was possible to perform complex manipulation of liquids within hydrophilic paper channels delimited by hydrophobic barriers [1]. The key features of paper and nitrocellulose as platforms of analytical devices are: flexibility; low thickness and lightness; absorbency; high surface-to-volume ratio; hydrophilicity and capillary action; chemical and biological inertness; disposability and biodegradability; low cost and wide availability he various detection modes. Combined with low-cost and portable instrumentation, PADs are well suited to on-site assays and point-of-care testing and relevant applications have been developed in various fields such as clinical diagnostics, environmental monitoring and food quality control [2-4].

In this work, we describe different types of paper-based and nitrocellulose-based devices and selected applications to (bio)chemical analysis using various detection modes (optical and electrochemical) and fabrication methodologies (such as pen-plotting, screen-printing and thermal printing). Representative applications will be demonstrated including: the determination of trace heavy metals in several matrices; the enzymatic assay of glucose in food; the multiplexed estimation of antioxidant activity of wines; the assay of carcinoembryonic antigen in serum; the quantification of thiocyanate in saliva, and; the detection of ochratoxin A in foodstuffs.

References

[1] A.W. Martinez, S.T. Phillips, M.J. Butte, G.M. Whitesides, Angew. Chem. Int. Ed. 46 (2007) 1318.
[2] E. Noviana, C.P. McCord, K.M. Clark, I. Jang, C.S. Henry, *Lab Chip* 20 (**2020)** 9.
[3] V.N. Ataide, L.F. Mendes, L.I.L.M. Gama, W.R. de Araujo, T.R.L.C Paixao, Anal. Methods 12 (2020) 1030.
[4] W. Mazurkiewicz, M. Podrażka, E. Jarosińska, K. Kappalakandy Valapil, M. Wiloch, M. Jönsson-Niedziółka, E. Witkowska Nery, ChemElectroChem 7 (2020) 2939.