

Development of a 3D paper-based device for qualitative analysis of lead in Water

M. B. P. Wickramaratne and Migelhewa N. Kaumal

Department of Chemistry, University of Colombo, Colombo 03

The addition of lead to drinking water has been a major problem as it has been used extensively in the past in plumbing, paints and as an anti-knocking agent in the petroleum industry. As a result of such activities, large amounts of lead have been released to the environment. Heavier lead particles deposit on soil and gradually leach into groundwater while airborne lead particles can precipitate with rain and snow. Exposure to lead can cause severe damage to the developing central nervous system of children rather than that of adults. The current methods for detecting lead are expensive and time consuming. This paper reports a portable, onsite and simple 3D paper-based device that can be used for the qualitative detection of lead in water. Four layers of Whatman 1 filter paper were stacked together to develop the device and each layer was fabricated with polyurethane varnish to drive the sample on a designated path. This portable tool is based on a rapid colourimetric reaction which occurs between lead (II) ions and rhodizonic acid. In this device, strontium chloride is used to stabilize sodium rhodizonate. The minimum detection limit of this device is $50 \mu\text{mol dm}^{-3}$. This device can be used to test the amount of lead in water samples by directly introducing few drops of sample on to the device. The development of the characteristic colour is used to determine the presence of lead in water.

Keywords: Detection of lead, portable, 3D paper-based devices, portable onsite method