Heavy metals ions (HMI) are micropollutants that represent a growing environmental problem, as they have influenced various components of the environment, such as terrestrial and aquatic biota. Among HMI, lead and cadmium are highly toxic, and even small doses can lead to harmful effects on human health. Thus, rapid methods to detect these metals in multi-matrices are urgently required. Here, an electrochemical sensor screen-printed onto a flexible substrate has been coupled with a paper-based platform for the determination of HMI in clinical, environmental and food matrices have been developed. The bismuth film-based flexible device has been optimized and it has been able to detect cadmium and lead, respectively, down to the detection limit of 1.3 and 2 ppb. The use of chromatographic paper has allowed to improve the sensitivity towards the detection of HMI, because of the porosity that allowed to pre-concentrate species. The combination of this platform with a paper-based one has allowed to enhance the sensitivity of the whole device, with a detection limit of 0.3 and 0.5 ppb, respectively, to cadmium and lead, and offers the possibility to tune the sensitivity according to needs, e.g., improving the number of pre-concentration steps. The electrochemical sensor was evaluated in drinking water, mussel and blood serum, demonstrating how these hybrid polyester-paper electrochemical strips can significantly lower the time and costs for on-site measurements, through analytical methods of simple use. The accuracy has been evaluated by comparison with ICP-MS measurements, giving satisfactory results.

DOI 10.1149/1945-7111/ac5c98