

Digital image determination of copper in food and water after preconcentration and magnetic tip separation for in-cavity desorption/ color development

ABSTRACT

A new analytical method for measuring copper in food and water was developed and validated, employing a solid-phase extraction (SPE) technique combined with digital-image-based (DIB) detection. A novel magnetic adsorbent of zinc ferrite/*Citrullus colocynthis* biochar (ZF@C.BC) was used to preconcentrate copper. A magnetic tip was used to separate the copper-loaded adsorbent from the extraction medium and to dispense it to the DIB plate. In-situ desorption and development of the spot color with iodide-starch reagent were carried out, and a digital image of the developed spots was captured using a smartphone and processed using ImageJ software. The copper adsorption capacity was 91.3 mg g^{-1} . Desorption was effected using a 0.3 mol L^{-1} hydrochloric acid. The preconcentration factor was 300, the limit of detection was $4.8 \text{ } \mu\text{g L}^{-1}$, the linearity was $16\text{--}600 \text{ } \mu\text{g L}^{-1}$ and the sample throughput was 12 h^{-1} . The developed approach was validated by analyzing food and water samples, confirming recoveries $\geq 91 \%$ and 88% , respectively, with $\text{RSD} \leq 8.4 \%$, $n = 3$.