THE DEVELOPMENT OF A FIELD-BASED PRESERVATION METHOD FOR TOTAL MERCURY IN WATER SAMPLES USING FUNCTIONALISED C18 SOLID-PHASE EXTRACTION

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Abstract
Mercury (Hg) is considered one of the most toxic elements to human health, due to its persistent and bioaccumulative properties, and is present in all spheres of the environment. Artisanal small-scale gold mining (ASGM) activities in countries, such as in Kenya, use Hg as a method to amalgamate gold from the geological matrix, with the potential to release Hg into the environment and subsequent public health exposure. In order to measure Hg in environmental samples improvements are required on existing recommended preservation methods for Hg in water samples that may not be fit for purpose e.g. acidification or use of glass bottles are potentially hazardous to operators in the field. Additionally, challenges are faced when samples are collected in remote locations far from laboratories with sufficient analytical sensitivity for Hg, requiring a preservation method that is safe to use during fieldwork, will preserve the analytical integrity of the sample and provide sufficient stability over a time period to allow for return to an appropriate laboratory. Therefore, a dithizone functionalised C18 solid phase extraction cartridge (SPE) was developed to preserve Hg in water samples, with the aim of presenting minimal risk to the operator when used in the field and to provide sufficient stability over a minimum of four weeks for subsequent elution and measurement in a laboratory environment – in this case, by ICP-MS. Performance characteristics were defined using a 0.8 µg L-1 Hg spike of a synthetic water matrix typical from an ASGM outflow – 30ml of this spike was passed through the functionalised cartridge and Hg eluted with 15ml of 2-mercaptoethanol (1% v/v with deionised water). The SPE cartridge retained 100% of Hg in the spike solution and provided stability for Hg preservation across a 57-day period, with recoveries of >75% Hg achieved following elution. Further work shows promising recovery rates of up to 90% with adjusted dithizone functionalisation of the SPE, without compromising retention of Hg on the SPE. Initial test data will be presented for ASGM sites in Kakamega County, Kenya