Evaluation of a DGT approach to develop toxicity models of metal speciation in shallow seepage from a rehabilitated lead-zinc mine to an ephemeral tropical creek

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Monitoring of water quality in an ephemeral tropical creek lying within the lease of a rehabilitated lead-zinc mine has identified contributions from local seepage resulting in increased electrical conductivity (EC) and dissolved metal concentrations in the flowing creek water during and following cessation of the annual wet season. This study aims to evaluate the use of Diffusive Gradients in Thin-films (DGT) and ultra-filtration technique to determine discrete pathways of seepage from the former mine features and existing mineralisation that may induce metal toxicity to aquatic biota in the creek. The DGT technique provides measurement of soluble metal forms in water therefore estimating the toxicity response to aquatic biota. Following a preliminary trial of DGT deployment along the creek, a more precise delineation of seepage led to DGT placement during the early part of the dry season in 10 plastic tube lined holes to 0.5 m depth in the creek bed and tributaries from a former tailing dam. An increase in zinc concentration was accompanied by increases in EC and sulfate in water. For an observed hardness range of 800 -1500 mg/L $CaCO_3$ the zinc DGT concentrations, as an example, exceeded the adjusted ANZECC (2000) trigger value for 95% protection of aquatic species of 72 µg/L Zn indicating that further investigation of actual ecotoxicity is warranted. Thus the DGT technique enables accurate location to be made of seepage predicted to exhibit toxicity of metals.