Electrochemical detection of benzisothiazolinone on screen-printed electrodes

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Benzisothiazolinone (BIT) is a member of isothiazolinone derivatives, which are used as powerful antimicrobial and antifungal agents in a wide variety of everyday products, including detergents, cleaning products, water-based paints, varnishes, food packaging and more. The widespread use of BIT and other isothiazolinone-based biocides seriously threatens the integrity of waste and natural waters. BIT is released into aquatic ecosystems directly from consumer products, such as cosmetics and cleaning products or indirectly through wastewater treatment plants. It is harmful to aquatic life, including fish, algae, and other organisms. Additionally, contact with BIT-containing products may lead to skin sensitisation and contact dermatitis. Other harmful properties, such as cytotoxicity have also been observed. Due to these concerns, the use of BIT in cosmetics has already been restricted in the EU; however, it is still widespread in other consumer products. BIT is persistent in the environment, with a half-life of more than 30 days, and can be transported through soil and water pathways. For this reason, fast, reliable, in-situ detection of BIT is of utmost importance, with electrochemical sensors being good candidates for this purpose. [1,2]

According to a literature review, no electrochemical sensors for BIT have yet been developed, although electrochemistry of some other isothiazolinone-based compounds has been studied. We report on direct BIT detection in aqueous media on screen-printed electrodes (SPE) using cyclic voltammetry (CV) and square wave adsorptive stripping voltammetry (SWV). Different types of SPE with carbon and gold-based working electrodes were used. The various SPEs proved to have a good electrochemical response to BIT in wide concentration ranges and low limits of detection. The SPE-C with a carbon nanoparticle-based working electrode proved to be the most suitable for the direct analysis of BIT, with an LOD of 40 nmol/L. The sensor's performance was tested in environmental samples in the presence of several possible interferences, and good recovery values were obtained.

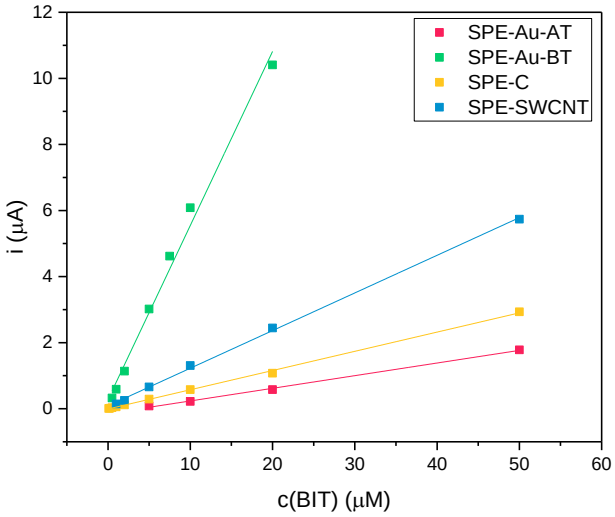

Figure 1. Current response to BIT on carbon-based (SPE-C and SPE-SWCNT) and gold-based (SPE-Au-AT and SPE-Au-BT) SPEs.

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References

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