Poster 46

Liquid Crystal–Templated Silver Electrodeposits for the Electrochemical Detection of Haloacetic Acids

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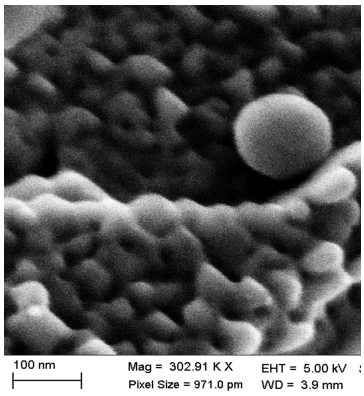
Haloacetic acids (HAAs) are ubiquitous disinfection by-products (DBPs) found in drinking and surface waters, and their routine monitoring is essential for public health protection. In recent years, electrochemical detection of HAAs has gained increasing attention as a low-cost, rapid, and potentially on-site alternative to conventional chromatographic methods [1,2].

Current research focuses on (i) the design of tailored electrode materials and nanocomposites that enhance electrocatalytic activity or adsorption toward halogenated acetic acids; (ii) biofilm- and bioreceptor-based platforms that assess HAA toxicity rather than direct concentration; and (iii) sensor arrays coupled with chemometric analysis that exploit electrochemical "fingerprints" to discriminate among HAA species in mixtures. These approaches have demonstrated excellent sensitivity and selectivity; however, key challenges persist, including matrix interferences (natural organic matter, halide background), electrode fouling, lack of standardized calibration against reference methods, and limited long-term stability and interlaboratory validation.

In this study, silver was electrodeposited on a gold electrode using liquid crystal phases composed of self-assembled non-ionic surfactant molecules [3]. The resulting Ag deposits exhibit a significantly larger electroactive surface area and enhanced catalytic activity compared with Ag nanoparticles. The modified electrodes were tested for monochloroacetic acid (MCAA), dichloroacetic acid (DCAA), and trichloroacetic acid (TCAA) detection via cyclic voltammetry. Five to six measurement sessions per electrode were conducted over the 10–1000 µM range, yielding reproducible and stable signals. In comparison with Ag nanoparticle-based systems reported in the literature, the electrodes produced consistent blank and sample responses. The figure below shows representative microstructures obtained using the electrodeposition strategy adopted in this study [3].



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