Electrochemical response of senecionine at carbon-based electrodes using carboxyl graphene as a surface modifier

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Senecionine, one of the many identified toxic pyrrolizidine alkaloids, is dangerous for humans due to its hepatotoxic, carcinogenic, and genotoxic effects. Chromatographic methods are widely used to detect and quantify these toxins in herbal preparations. The referent method, described in European pharmacopeia, is based on HPLC MS-MS. Based on the literature research, up to date, there are no studies on the electrochemical behavior of senecionine. In this work, we have studied the electrochemical behavior of senecionine using carbon-based electrodes such as solid glassy carbon electrodes, screen-printed carbon electrodes and boron-doped diamond electrodes. Carboxylic graphene and its nanocomposite were applied as a surface modifier. Cyclic voltammetry (CV) and differential pulse voltammetry (DPV) techniques were applied to observe the electrochemical behavior of senecionine on each electrode. Experimental parameters (supporting electrolyte, scan rate, potential range, and modifier concentration) were optimized to enhance sensor performance. Phosphate buffer (pH 7.4) and KCl/NaOH (pH 10) were used as a supporting electrolyte. The best results for the sensitivity and repeatability of the response to senecionine were obtained using carbon screen-printed electrodes, modified with carboxyl graphene (GCOO). The type of the electrode and modifier has a high impact on the sensor's function, sensitivity and selectivity. Further work is necessary to investigate the other factors that affect the interaction of the analyte with the electrode and validate the method's application in complex sample matrices with herbal ingredients.

References:

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