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Rational design of ruddlesden–popper phase Mn_2SnO_4 for ultra-sensitive and highly selective detection of chloramphenicol in real-life samples

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Abstract

A novel metal stannate (Mn_2SnO_4) nanocube electrocatalyst with an outstanding sensing capability and electrochemical properties is established by an ultrasonic assisted technique. A variety of physicochemical and electrochemical methods were used to characterize the structural, surface morphological and electrochemical properties of Mn_2SnO_4. We then observed the analytical behaviour and applications of Mn_2SnO_4/GCE for the determination of chloramphenicol (CAP) by using various voltammetric techniques. The effects of the experimental conditions, such as the amount of modifier, sample concentration, scan rate and pH, on the peak current of CAP were studied. The proposed Mn_2SnO_4/GCE sensor shows a higher cathodic current in response to a wide dynamic linear range of 0.04–437.18 μM and superior electrocatalytic activity with an appreciably lower detection limit (0.0194 μM) and good sensitivity (0.1648μA μM^{-1} cm^{-2}), which were determined from differential pulse voltammetry (DPV). The practical applicability, such as repeatability, stability and reproducibility towards CAP, exhibits acceptable results. Consequently, the as synthesized Mn_2SnO_4 modified sensor might be a potential candidate for the determination of CAP in milk powder and eye drop analyses and the results are noticeable.