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Easy one pot synthesis of NiO/Nitrogen doped carbon spheres for highly sensitive enzyme free amperometric glucose sensors

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Abstract

The NiO/Nitrogen doped carbon sphere (NiO/NCS) composites were successfully achieved via an easy one pot synthetic method with urea acting as both nitrogen source and Ni precipitator. The electrocatalytic performances of the obtained NiO/NCS modified glass carbon electrodes showed superior activity for direct electrocatalytic oxidation of glucose than that of nitrogen free NiO/carbon sphere (NiO/CS), which might be due to the synergistic effect of the properties of NCS and NiO nanoparticles. The introduce of nitrogen can improve the conductivity of the NiO/NCS and accordingly accelerate the electron transport within the composites, which was very beneficial to improve the sensitivity to glucose detection for NiO/NCS modified electrodes. The NiO/NCS electrodes exhibited two corresponding linear regions of 1-800 μM and 4-9 mM with the sensitivity of 398.57 $\mu\text{A mM}^{-1}\text{cm}^{-2}$ and 17.81 $\mu\text{A mM}^{-1}\text{cm}^{-2}$, and the detection limit of 0.25 μM and 0.05 mM respectively. Moreover, the NiO/NCS composites have also exhibited good selectivity by adding certain amount of urea, NaCl, L-proline, L-valine, L-Leucine and ascorbic acid into the 0.1M NaOH solution, respectively. The high sensitivity, wide glucose detection range and good selectivity of the electrodes may ensure its potential applications in the clinical diagnosis of diabetes.

Keywords: NiO nanoparticles; nitrogen doped carbon sphere; non-enzymatic; glucose sensor

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