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Glucose Sensing Characterization of Non-Enzymetic Nickel plate and Nickel Foam Electrodes in Sodium Hydroxide Solutions

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Sugar is one of the most common ingredients in most of the food processing. Recently, the social healthy trend raises awareness on the sugar control in foods, leading to a demand on a fast and simple sugar sensor. Recently, a non-enzymatic glucose sensor has gained a lot attention, because it is re-useable, fast and simple, as opposed to traditional enzymatic glucose sensor. In this work, two types of electrodes, including Electroplated Ni film and Ni foam, were used as sensing electrodes for a non-enzymatic glucose sensor. The Ni film and Ni foam sensing electrodes were investigated for their quantitative and qualitative sensing properties for glucose. The studied sensing properties of the Ni film and Ni foam included sensing sensitivity, selectivity, and detection limit. For the sensitivity and selectivity analysis, the sensing electrodes, with geometrical working area of 1 and 2 cm^2 for Ni foam and Ni film respectively, were submerged in a 1M NaOH solution, connected as a working electrode. Ag/AgCl and Pt were used as a reference and counter electrodes, respectively. Amperometric scanning measurement was used for the sensitivity and selectivity analysis. Sensitivity measurement was tested by dropping glucose solutions into 1M NaOH solution and recording the amperometric response of the sensor under varying sugar contents.

The results showed that Ni foam electrode exhibits higher sensitivity, which average sensitivities are 1.1048 and 6.4228 $mAmM^{-1}cm^{-2}$ for Ni plate and Ni foam respectively. Limit of detection (LOD) was calculated by the equation LOD = $3S_a/b$ (S_a is standard deviation of current density when glucose concentration equal to 0; b is sensitivity of electrodes). LOD of Ni film and Ni foam are 0.0143 and 0.0144 mM, respectively. The selectivity of electrodes were tested by dropping 3 types of disturbing agents: Quinine, Acetic acid and NaCl. The disturbing agents showed no effect on the current density signal during the amperometric measurement for both of the Ni plate and Ni foam electrodes.

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