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Design a sensitive optical thin film sensor based on incorporation of isonicotinohydrazide derivative in sol–gel matrix for determination of trace amounts of copper (II) in fruit juice: Effect of sonication time on immobilization approach

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Abstract

A new selective and sensitive optical sensor based on the incorporation of new synthesized N'-(2-hydroxy-5- iodobenzylidene) isonicotinohydrazide (HIBIN) as an effective reagent into the nanoporous of a transparent glass like material through the sol–gel process was developed which was suitable for the determination of copper (II) ions in aqueous solutions. The thin film sensors were constructed by spin-coating of prepared sol onto glass plate and their surface morphology were studied by field emission scanning electron microscopy (FE-SEM) and atomic force microscope (AFM) technique. Influence of sonication time on immobilization of HIBIN into silica matrix was investigated through calculation of leaching percentage. The Results shown that sonication time of 35 min is suitable to give more stable thin films without fluctuation in sensitivity and response time of presented sensor for a long period of time. The proposed optical sensor can be used for determination of copper (II) ions in the range of 9.1×10^{-8} to 1.12×10^{-5} mol $L^{-1}$with a detection limit of 1.8×10^{-8} mol L^{-1}. It also showed relative standard deviation 3.4 and 0.72 % for reproducibility and repeatability respectively, along with a fast response time about of 2 min. The constructed optode is stable in wet conditions and could be stored for at least 6 weeks without observing any change in its sensitivity. The developed sensor was successfully applied to the determination of copper (II) in fruit juice and water samples which results were confirmed by atomic absorption spectrometry method.

Keyword: Sol-gel technique; Optical sensor; Sonication time; Copper (II) ion;