

SINTESIS FILM SiO₂/α-FURIL DIOKSIM DENGAN METODE SOL-GEL UNTUK SENSOR KOLORIMETRI ION NIKEL(II)

Muhammad Bakhru Thohir
17/418577/PPA/05361

INTISARI

Sensor untuk mendeteksi ion nikel(II) telah berhasil dibuat dengan metode sol-gel menggunakan prekursor tetraetil ortosilikat dan reagen α-furil dioksim. Penelitian ini bertujuan untuk menentukan kondisi optimum sintesis, kondisi optimum penyensoran, derajat pelindian, selektivitas, linieritas, LOD, LOQ, presisi, dan akurasi.

Sintesis dilakukan dengan mencampurkan prekursor dengan pelarut alkohol. Berturut-turut setelahnya, H₂O, Triton X-100, reagen dan katalis ditambahkan pada campuran. Variasi yang dilakukan adalah waktu *aging*, rasio mol H₂O:prekursor, pH, konsentrasi, dan pelarut. Hasil penyensoran dinyatakan dalam nilai *Euclidean Distance* (ED) dari titik *Red-Green-Blue* (RGB) yang didapat. Karakterisasi film dilakukan dengan FTIR dan SEM. Kondisi optimum penyensoran dilakukan dengan variasi pH dan waktu kontak. Selektivitas diuji dengan mengukur larutan yang mengandung nikel dan logam lain.

Kondisi optimum pembuatan sensor terletak pada waktu *aging* selama 4 hari, rasio mol 4:1, pH 3, konsentrasi 0,1% dan pelarut etanol. Kondisi optimum penyensoran terletak pada pH 8 dan waktu kontak 120 detik. Dengan kondisi optimum penyensoran, didapatkan sensor yang bebas pelindian secara kasat mata dan persentase pelindian secara kurva standar sebesar 0,002%. Sensor memiliki selektivitas yang baik dan tahan terhadap logam lain kecuali ion Cr(III) yang dapat mengganggu proses deteksi. Validasi metode sensor didapatkan hasil berupa linieritas pada daerah 0,11 sampai 2,8 ppm dengan $y = 41,532x + 22,763$ dan $R^2 0,9962$. LOD dan LOQ berturut-turut sebesar 0,119 ppm dan 0,397 ppm. Sensor memiliki %RSD 1,42; 0,25 dan 0,29% untuk presisi keterulangan serta %RSD 0,91; 1,14 dan 0,37% untuk presisi antara. Akurasi untuk sampel air sungai 114,57; 119,54 dan 104,08% dan air kran 114,79; 102,67 dan 103,42%.

Kata kunci: ion Ni(II), sol-gel, α-furil dioksim, tetraetil ortosilikat, *Euclidean Distance*

SYNTHESIS OF FILM SiO₂/α-FURIL DIOXIME BY SOL-GEL METHOD FOR COLORIMETRIC SENSOR OF NICKEL(II) IONS

Muhammad Bakhru Thohir
17/418577/PPA/05361

ABSTRACT

A sensor for detecting nickel(II) ions has been successfully prepared by the sol-gel method using the tetraethyl orthosilicate precursor and the α-furil dioxime reagent. This study aims to determine the optimum conditions for synthesis, optimum condition for sensing, degree of leaching, selectivity, linearity, LOD, LOQ, precision, and accuracy.

Synthesis was carried out by dissolving the precursor in alcohol. Consecutively, H₂O, Triton X-100, a reagent, and a catalyst were subsequently added into the mixture. The variation of parameters such as aging time, ratio mol H₂O:Precursor, pH, concentration, and solvent was also conducted. The results of sensing are expressed in Euclidean Distance (ED) values from the obtained Red-Green-Blue (RGB) points. Characterization of the synthesized film was done by FTIR and SEM. The optimum condition for sensing was carried out with variations pH and contact time. Selectivity was tested by measuring solutions containing nickel and other metal ions.

The optimum conditions for sensor fabrication were at the aging time of 4 days, 4:1 mole ratio, pH value of 3, and 0.1% of the concentration in ethanol as the solvent. The optimum conditions of sensing were at a pH level of 8 and a contact time of 120 seconds. For color development, a sensor that was free of visible leaching was obtained and the percentage of leaching in a standard curve was 0.002%. The synthesized sensor had a good selectivity and was resistant to the other metal ions except Cr(III). The validation of the sensor method resulted in linearity in the range of 0.11 to 2.8 ppm with linear equation of $y = 41.532x + 22.763$ and R^2 value of 0.9962. The LOD and LOQ were 0.119 ppm and 0.397 ppm, respectively. The prepared sensor had a %RSD 1.42, 0.25 and 0.29% for repeatability precision and %RSD 0.91, 1.14 and 0.37% for intermediate precision. An accuracy for river water 114.57, 119.54 and 104,08% and tap water 114.79, 102.67 and 103,42%.

Keywords: Ni(II) ions, sol-gel, α-furil dioxime, tetraethyl orthosilicate, Euclidean Distance