

ABSTRAK

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Program Studi : Fisika
Judul : Deteksi Boraks pada Pangan Berbasis Nanofiber
Fe₃O₄/PVA-GA/Kurkumin dengan Instrumentasi Sensor GMR

Boraks masih ditemukan sebagai bahan tambahan ilegal pada pangan sehingga diperlukan metode deteksi yang praktis dan mampu memberikan hasil pengukuran secara kuantitatif. Penelitian ini bertujuan menganalisis respons dan selektivitas sensor *Giant Magnetoresistance* (GMR) menggunakan nanofiber Fe₃O₄/PVA-GA 14% dengan kurkumin sebagai bioreseptor. Pengujian dilakukan terhadap larutan boraks, formalin, NaCl, dan MSG pada konsentrasi 0,5–45 mM. Pengujian juga dilakukan pada ekstrak bakso yang dikondisikan dengan boraks pada konsentrasi 0–35 mM. Setiap kondisi diukur sebanyak tiga kali dengan merekam medan magnet terhadap waktu. Respons sensor ditentukan berdasarkan perubahan medan magnet terhadap nilai *baseline*. Hasil pengujian menunjukkan sensitivitas terhadap boraks sebesar 0,00455 mT/mM, lebih tinggi dibandingkan formalin sebesar 0,00097 mT/mM, NaCl sebesar 0,00122 mT/mM, dan MSG sebesar 0,00081 mT/mM. Respons boraks cenderung tidak linear pada konsentrasi tinggi. Regresi polinomial orde dua memberikan kesesuaian yang lebih baik dengan nilai R^2 sebesar 0,9651 dibandingkan regresi linear sebesar 0,7482. Pada ekstrak bakso, respons sensor juga meningkat seiring penambahan boraks dengan nilai R^2 polinomial sebesar 0,9963. Hasil tersebut menunjukkan bahwa sensor GMR berbasis nanofiber Fe₃O₄/PVA-GA/kurkumin mampu memberikan respons yang lebih kuat terhadap boraks dibandingkan bahan pembanding dan berpotensi digunakan untuk pengujian boraks pada pangan.

Kata kunci: boraks, kurkumin, nanofiber Fe₃O₄/PVA-GA, sensor GMR, selektivitas.

ABSTRACT

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Study Program : Physics
Title : Detection of Borax in Food Based on Fe_3O_4 /PVA-GA
/Curcumin Nanofiber with GMR Sensor Instrumentation

Borax is still illegally used as a food additive; therefore, a practical detection method capable of providing quantitative measurement results is required. This study aims to analyze the response and selectivity of a Giant Magnetoresistance (GMR) sensor using 14% Fe_3O_4 /PVA-GA nanofibers with curcumin as the bioreceptor. The measurements were conducted using borax, formalin, NaCl, and monosodium glutamate (MSG) solutions at concentrations ranging from 0.5 to 45 mM. Measurements were also performed on meatball extracts spiked with borax at concentrations ranging from 0 to 35 mM. Each condition was measured three times by recording the magnetic field as a function of time. The sensor response was determined from the change in the magnetic field relative to the baseline value. The results showed that the sensor sensitivity to borax was 0.00455 mT/mM, which was higher than that to formalin, NaCl, and MSG, with sensitivities of 0.00097 mT/mM, 0.00122 mT/mM, and 0.00081 mT/mM, respectively. The sensor response to borax tended to become nonlinear at higher concentrations. A second-order polynomial regression provided a better fit, with an R^2 value of 0.9651, compared with the linear regression model, which produced an R^2 value of 0.7482. For the meatball extract samples, the sensor response also increased with increasing borax concentration, with a polynomial R^2 value of 0.9963. These results indicate that the GMR sensor based on Fe_3O_4 /PVA-GA/curcumin nanofibers produced a stronger response to borax than to the comparison substances and has the potential to be used for borax detection in food products.

Keywords: borax, curcumin, Fe_3O_4 /PVA-GA nanofibers, GMR sensor, selectivity.