DETEKSI METILAMINA MENGGUNAKAN *QUARTZ CRYSTAL MICROBALANCE* TERMODIFIKASI LAPISAN AKTIF NANOFIBER POLIVINIL ASETAT DENGAN DOPING Fe_3O_4

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INTISARI

Metilamina banyak digunakan dalam berbagai aplikasi, seperti pada industri pertanian, farmasi, teknik kimia, dan pertambangan. Meskipun demikian, metilamina sendiri merupakan senyawa beracun yang dapat menyebabkan kerusakan pada sistem pernapasan dan saraf tubuh manusia. Penelitian ini dilakukan untuk mengembangkan sensor metilamina berbasis *Quartz crystal microbalance* (QCM) yang dimodifikasi dengan nanofiber polivinil asetat (PVAc) dan doping Fe_3O_4.

Nanofiber PVAc dibuat menggunakan metode *electrospinning* dan Fe_3O_4 ditambahkan menggunakan metode *drop-casting*. Variasi sensor yang dibuat adalah PVAc, PVAc/Fe_3O_4 0,001%, dan PVAc/Fe_3O_4 0,01%. Komposisi kimia dan morfologi permukaan lapisan aktif sensor dianalisis menggunakan *Fourier-transform infrared* (FTIR) dan *Scanning electron microscopy* dengan *Energy dispersive X-ray spectroscopy* (SEM-EDX).

Hasil FTIR tidak menunjukkan perbedaan antara nanofiber PVAc dengan doping maupun tanpa doping Fe_3O_4. Gambar SEM menunjukkan bahwa penambahan doping Fe_3O_4 mempengaruhi diameter nanofiber. Hasil penelitian membuktikan bahwa peningkatan konsentrasi doping Fe_3O_4 pada nanofiber PVAc dapat meningkatkan respons sensor. Sensor QCM dengan lapisan aktif nanofiber PVAc/Fe_3O_4 0,01% memiliki sensitivitas tertinggi terhadap metilamina sebesar 0,681 Hz/ppm dengan waktu respons 14 s dan limit deteksi (LOD) sebesar 3,63 ppm. Sensor tersebut juga selektif untuk mendeteksi metilamina terhadap senyawa alkohol, aseton, formaldehida, benzena, toluena, dan xilena.

Kata kunci: Fe_3O_4, metilamina, PVAc, sensor QCM

DETECTION OF METHYLAMINE USING QUARTZ CRYSTAL MICROBALANCE MODIFIED WITH POLYVINYL ACETATE NANOFIBER ACTIVE LAYER DOPED WITH Fe_3O_4

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ABSTRACT

Methylamine is widely used in various applications, including agriculture, pharmaceuticals, chemical engineering, and mining industries. However, methylamine itself is a toxic compound that can cause damage to the respiratory and nervous systems of the human body. This research developed a methylamine sensor based on Quartz crystal microbalance (QCM) modified with polyvinyl acetate (PVAc) nanofiber and Fe_3O_4 doping.

The PVAc nanofiber was fabricated using the electrospinning method and then overlaid with Fe_3O_4 using the drop-casting process. The variation sensors used were PVAc, PVAc/Fe_3O_4 0.001%, and PVAc/Fe_3O_4 0.01%. The chemical composition and surface morphology of the active layer were analyzed using Fourier-transform infrared (FTIR) and Scanning electron microscopy with Energy dispersive X-ray spectroscopy (SEM-EDX).

The FTIR data showed no difference between PVAc nanofibers with or without Fe_3O_4 doping. The SEM images show that Fe_3O_4 doping impacts the nanofiber's diameter. The research results prove that increasing the concentration of Fe_3O_4 doping on PVAc nanofibers can improve the sensor response. The QCM sensor with a PVAc/Fe_3O_4 0.01% nanofiber layer showed the highest sensitivity to methylamine of 0.681 Hz/ppm with a response time of 14 s and a limit of detection (LOD) of 3.63 ppm. The sensor exhibited selectivity for methylamine detection, differentiating it from other gases or vapors, including alcohol, acetone, formaldehyde, benzene, toluene, and xylene compounds.

Keywords: Fe_3O_4, methylamine, PVAc, QCM sensor