

## **SENSOR FOR $\alpha$ -PINENE BY USING QUARTZ CRYSTAL MICROBALANCE COATED WITH MOLECULAR IMPRINTED POLYMER**

Sisilia Ayu Kezia Herwanto  
15/380928/PA/16736

### **ABSTRACT**

Preparation of  $\alpha$ -pinene sensor based on Quartz Crystal Microbalance (QCM) coated with Molecular Imprinted Polymer (MIP) was done. This research was done to know the effectiveness of QCM sensor that has been coated with MIP and rapidly provide an alternative method for analysis of  $\alpha$ -pinene.

The research began with the synthesis of MIP. The MIP was synthesized by reacting  $\alpha$ -pinene with acetonitrile, ethylene glycol dimethacrylate, and 2,2'-azobis-2-methylpropionitrile. After the MIP formed, it was extracted to remove the template. Next, the MIP solution was prepared by mixing polyacrylonitrile, dimethylformamide, and MIP. After the MIP solution ready, the QCM sensor was prepared. The QCM sensor was washed with piranha solution and distilled water respectively. Then, the MIP was used to coat QCM surface by spin coating technique. The QCM coated MIP was characterized by using AFM. Then, the QCM respond sensor was evaluated by using  $\alpha$ -pinene standard solution. After the calibration curve of resonance frequency shift vs concentration was obtained, the selectivity of QCM based MIP was observed by using  $\alpha$ -pinene,  $\beta$ -pinene, and  $\gamma$ -terpinene. Next, the test of qualitative analysis was done by using sample.

The QCM that had been coated by MIP could be used as an alternative method for qualitative analysis of  $\alpha$ -pinene. The straight line equation of QCM coated by MIP was  $y=24.1x + 24.7$  and  $R^2 = 0,9788$ . The sensitivity of this method was  $24.1 \text{ Hz}/\mu\text{L}$ . The LoB, LoD, and LoQ of this method were 1.546; 0.066;  $0.219 \mu\text{L}$ . The respond times of the  $\alpha$ -pinene,  $\beta$ -pinene, and  $\gamma$ -terpinene were different, they were 150, 108, and 97 seconds, and the humidity did not affect the analysis of the sensor. The QCM that had been coated by MIP showed that it was selective to  $\alpha$ -pinene.

**Keywords:**  $\alpha$ -pinene; chemical sensor; molecular imprinted polymer; quartz crystal microbalance

## SENSOR UNTUK $\alpha$ -PINENE MENGGUNAKAN QUARTZ CRYSTAL MICROBALANCE TERLAPIS MOLECULAR IMPRINTED POLYMER

Sisilia Ayu Kezia Herwanto  
15/380928/PA/16736

### INTISARI

Pembuatan sensor  $\alpha$ -pinene dilakukan dengan menggunakan *Quartz Crystal Microbalance* (QCM) yang dilapisi dengan *Molecular Imprinted Polymer* (MIP). Penelitian ini dilakukan untuk mengetahui efektivitas sensor QCM yang telah dilapisi dengan MIP dalam analisis  $\alpha$ -pinene dan dengan cepat memberikan metode alternatif untuk analisis  $\alpha$ -pinene.

Penelitian dimulai dengan preparasi MIP. MIP dibuat dengan mereaksikan  $\alpha$ -pinene dengan asetonitril, EGDMA, dan AIBN. Setelah MIP terbentuk, MIP diekstrak untuk menghapus template. Selanjutnya, larutan MIP disiapkan dengan mencampur PAN, DMF, dan MIP. Setelah solusi MIP siap, sensor QCM disiapkan. QCM sensor dicuci dengan larutan piranha dan air suling secara berurutan. Kemudian, MIP dilapisi menggunakan teknik *spin coating*. Setelah itu, MIP dilapisi QCM dikarakterisasi dengan menggunakan AFM. Kemudian, respon sensor QCM dievaluasi dengan menggunakan larutan standar  $\alpha$ -pinene. Setelah kurva kalibrasi perubahan frekuensi resonansi vs konsentrasi diperoleh, selektivitas dari QCM yang telah terlapis oleh MIP diamati dengan menggunakan  $\alpha$ -pinene,  $\beta$ -pinene, dan  $\gamma$ -terpinene. Selanjutnya, analisis kualitatif dilakukan dengan menggunakan minyak *eucalyptus*.

QCM yang telah dilapisi oleh MIP dapat digunakan sebagai metode alternatif untuk analisis kualitatif  $\alpha$ -pinene. Persamaan garis lurus dari QCM yang dilapisi oleh MIP adalah  $y = 24,1 x + 24,7$  dan  $R^2 = 0,9788$ . Sensitivitas dari metode ini adalah 24,1 Hz/ $\mu$ L. LoB, LoD, dan LoQ metode ini adalah 1,546; 0,066; 0,219  $\mu$ L. Waktu respon dari  $\alpha$ -pinene,  $\beta$ -pinene, dan  $\gamma$ -terpinene adalah 150, 108, dan 97 detik, dan humiditas tidak mempengaruhi hasil analisis pada sensor. QCM yang telah dilapisi oleh MIP menunjukkan hasil yang selektif untuk analisis  $\alpha$ -pinene.

Kata Kunci:  $\alpha$ -pinene; molekul tercetak polimer; sensor kimia; quartz crystal microbalance