

## INTISARI

### KARAKTERISASI SENSOR AMONIA BERBASIS *QUARTZ CRYSTAL MICROBALANCE* (QCM) DENGAN LAPISAN *POLYANILINE* (PANI) MENGGUNAKAN METODE *DROP CASTING*

Oleh

Zhafirah Nur Azizah

18/430230/PA/18743

Sistem pendeteksi adanya senyawa amonia ( $\text{NH}_3$ ) dalam setiap hembusan napas manusia sangat dibutuhkan sebagai alat deteksi dini kanker paru-paru. Amonia merupakan salah satu biomarker dari kanker paru-paru. Selain itu, tingginya jumlah amonia beracun dalam suatu lingkungan dapat memicu ledakan dan kerusakan pada organ tubuh seperti, mata, kulit hingga saluran pernapasan. Alat pendeteksi kanker paru-paru terdahulu seperti radiografi dada, sitologi dahak atau *computed tomography* dinilai tidak mendukung untuk diterapkan proses skrining pada populasi yang luas dan paparan radiasi yang dihasilkan memiliki efek samping bagi kesehatan. Selain itu, teknik seperti kromatografi gas-spektrometri massa terbilang cukup mahal, tidak portabel dan membutuhkan tenaga ahli. Oleh karena itu, pada penelitian kali ini bertujuan untuk menghasilkan sensor deteksi amonia dari hembusan napas dengan harga yang murah, praktis, serta dengan hasil yang cepat dan akurat. Sensor gas berbasis *quartz crystal microbalance* (QCM) dikembangkan pada penelitian kali ini dengan harapan dapat memberi performa yang lebih baik. Sensor QCM diberi *thin film* PANI menggunakan metode *Drop Casting* untuk meningkatkan sensitivitas serta selektivitas terhadap gas amonia. Pemberian *thin film* PANI menggunakan beberapa variasi konsentrasi yaitu 1%, 2% dan 3% (w/w). Hasil penelitian menunjukkan sensitivitas tertinggi dihasilkan oleh sensor QCM PANI 3% sebesar 4,47 Hz/ppm dengan waktu respons 77 detik untuk gas amonia 60 ppm. Sensor QCM PANI 3% juga memiliki selektivitas yang baik terhadap analit perbandingan seperti *acetone*, *ethanol*, *methanol* dan *toluene*. Namun sensor QCM PANI 3% mengalami penurunan performa sensor apabila disimpan terlalu lama. Dengan demikian, sensor QCM PANI 3% dapat menjadi sensor gas amonia dengan sensitivitas dan selektivitas yang baik.

Kata kunci : *Quartz Crystal Microbalance, Polyaniline, Ammonia, Drop Casting*

## ABSTRACT

### CHARACTERIZATION OF AMMONIA SENSOR BASED ON QUARTZ CRYSTAL MICROBALANCE (QCM) WITH POLYANILINE (PANI) COATING USING DROP CASTING METHOD

by

Zhafirah Nur Azizah

18/430230/PA/18743

The detection system for the presence of ammonia compounds ( $\text{NH}_3$ ) in every human breath is needed as an early detection tool for lung cancer. Ammonia is one of the biomarkers of lung cancer. In addition, the high amount of toxic ammonia in an environment can trigger explosions and damage to body organs such as the eyes, skin and respiratory tract. Previous lung cancer detection tools such as chest radiography, sputum cytology or computed tomography were considered unsupportive to applying the screening process to a large population and the resulting radiation exposure had side effects on health. In addition, techniques such as gas chromatography-mass spectrometry are quite expensive, not portable and require experts. Therefore, this study aims to produce an ammonia detection sensor from exhaled breath at a low price, practical, and with fast and accurate results. A gas sensor based on quartz crystal microbalance (QCM) was developed in this study with the hope of providing better performance. The QCM sensor was given a PANI thin film using the Drop Casting method to increase sensitivity and selectivity to ammonia gas. The administration of PANI thin film used several concentration variations, namely 1%, 2% and 3% (w/w). The results showed that the highest sensitivity was produced by the QCM PANI 3% sensor at 4.47 Hz/ppm with a response time of 77 seconds for 60 ppm ammonia gas. The 3% PANI QCM sensor also has good selectivity for comparison analytes such as acetone, ethanol, methanol and toluene. However, the 3% PANI QCM sensor experienced a decrease in sensor performance if it was stored for too long. Thus, the 3% PANI QCM sensor can be an ammonia gas sensor with good sensitivity and selectivity.

**Keywords :** *Quartz Crystal Microbalance, Polyaniline, Ammonia, Drop Casting*