

## RANCANG BANGUN SISTEM PENGUKUR KELAYAKAN DAN KELEZATAN MAKANAN POKOK INDONESIA BERDASARKAN PENGUJIAN FISIK MENGGUNAKAN E-NOSE

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### INTISARI

Program Makan Bergizi Gratis (MBG) menuntut penyediaan makanan pokok dalam jumlah besar sehingga diperlukan metode penilaian kelayakan yang cepat, objektif kuantitatif, dan non-destruktif. Perubahan kualitas makanan pokok, seperti nasi, lauk, dan sayuran, berkaitan dengan dinamika senyawa volatil yang memengaruhi aroma, sementara metode konvensional seperti uji sensorik dan analisis kimia memiliki keterbatasan dalam waktu dan objektivitas. Penelitian ini merancang sistem *Electronic Nose* berbasis sensor MOS untuk mendeteksi etanol, amonia, dan formaldehida sebagai parameter volatil yang relevan.

Sistem dikembangkan menggunakan sensor MQ-3, MQ-135, dan MS1100 dengan akuisisi data melalui PSoC 5LP dan kalibrasi logaritmik. Pengujian dilakukan secara non-destruktif selama 5 menit pada sampel makanan pokok berupa nasi putih, ayam goreng, sayur, dan telur. Sistem memiliki rentang ukur etanol 0,00–0,17 mg/L, amonia 0,00–20.370 ppm, dan formaldehida 0,00–76,56 ppm.

Hasil implementasi menunjukkan seluruh sampel berada dalam kategori layak berdasarkan batas etanol  $\leq 0,10$  mg/L, perubahan amonia  $\leq 5$  ppm, dan formaldehida  $\leq 3$  ppm sehingga amonia dan formaldehida menjadi indikator yang paling efektif. Analisis korelasi Pearson menghasilkan nilai yang tidak signifikan ( $p > 0,05$ ) menunjukkan bahwa persepsi aroma tidak dapat direpresentasikan oleh pengukuran volatil utama. Dengan demikian, sistem E-Nose efektif untuk menilai kelayakan makanan pokok namun belum dapat digunakan untuk menilai kelezatan.

**Kata kunci:** E-Nose, Sensor MOS, Senyawa Volatil, Kelayakan Makanan, MBG

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## DESIGN AND DEVELOPMENT OF AN E-NOSE SYSTEM FOR MEASURING THE QUALITY AND TASTE OF INDONESIAN STAPLE FOODS

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### ABSTRACT

The Free Nutritious Meal Program (MBG) requires the large-scale provision of staple foods, thereby necessitating a rapid, quantitative, objective, and non-destructive method for food quality assessment. Quality degradation in staple foods such as rice, protein-based dishes, and vegetables is strongly associated with the dynamics of volatile compounds influencing aroma, while conventional approaches such as sensory evaluation and chemical analysis exhibit limitations regarding time efficiency, objectivity, and laboratory dependence. This research develops an Electronic Nose (E-Nose) system based on MOS gas sensors to detect ethanol, ammonia, and formaldehyde as relevant volatile indicators.

The system employs MQ-3, MQ-135, and MS1100 sensors, with data acquisition performed using a PSoC 5LP microcontroller and logarithmic calibration. Measurements were conducted non-destructively for 5 minutes on staple food samples, namely white rice, fried chicken, vegetables, and eggs. The system achieved measurable ranges of 0.00–0.17 mg/L for ethanol, 0.00–20.370 ppm for ammonia, and 0.00–76.56 ppm for formaldehyde.

The implementation results show that all food samples were classified as suitable, evidenced by ethanol  $\leq 0.10$  mg/L, ammonia variation  $\leq 5$  ppm, and formaldehyde  $\leq 3$  ppm, establishing ammonia and formaldehyde as the most effective indicators. Pearson correlation analysis produced statistically insignificant results ( $p > 0.05$ ), indicating that aroma perception cannot be directly represented through major volatile measurements. Therefore, the developed E-Nose system is effective for assessing food quality but has not yet demonstrated capability in evaluating palatability.

**Keywords:** E-Nose, MOS Sensors, Volatile Compounds, Food Quality, MBG

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