INTISARI

KALIBRASI RESPON SENSOR PADA *ELECTRONIC NOSE* MENGGUNAKAN METODE *POLYNOMIAL* ORDE DUA DAN *ALLOMETRIC*

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Variabilitas yang melekat pada sensor berbasis MOS akibat proses manufaktur serta sensitif terhadap perubahan lingkungan, menyebabkan berkurangnya akurasi dan konsistensi dalam analisis sampel. Penelitian ini bertujuan untuk mengurangi variabilitas pada mesin dengan mengembangkan metode kalibrasi untuk masing-masing sensor. Kalibrasi dilakukan dengan gas ethanol 1-5 µL menggunakan 1 unit master dan 3 unit slave secara bersamaan. Nilai rata-rata *steady state* hasil ekstraksi data digunakan untuk membuat model kalibrasi dengan metode *polynomial* orde dua dan *allometric.* Metode *multi-criteria decision analysis* (MCDA) digunakan untuk menentukan metode terbaik pada masing-masing sensor. Hasil pengujian menunjukkan unit Enose 0123 dipilih sebagai mesin master karena termasuk dalam kategori batch awal dan memiliki kestabilan yang paling baik dibandingkan dengan mesin lainya. Sensor S1, S3 dan S6 pada semua mesin dikalibrasi menggunakan metode *polynomial* orde 2, sedangkan sensor S2, S4, S5 dan S7 dikalibrasi menggunakan metode *allometric*. Hasil kalibrasi diverifikasi menggunakan gas ethanol, ethyl butanoate dan napas untuk melihat performa kalibrasi dalam bentuk nilai *mean average error* (MAE) antara master dan slave. Pada gas ethanol kalibrasi dapat menurunkan variasi dengan persentase sebesar 84,14%, gas ethyl butanoate sebesar 76,87% dan napas sebesar 48,76%. Berdasarkan hasil penelitian yang telah diperoleh, disimpulkan bahwa setiap sensor pada slave dapat dikalibrasi ke master dengan sangat baik dan mampu mengurangi variasi sensor secara signifikan, walaupun performa kalibrasi masih memiliki kecenderungan terhadap gas yang dideteksi. Jika gas yang dideteksi sama seperti gas kalibrasi, hasil kalibrasi akan maksimal. Metode kalibrasi yang dikembangkan dapat mengurangi variasi antar Enose dengan cara yang lebih cepat, sederhana dan ekonomis.

Kata kunci: kalibrasi, *electronic nose, metal oxide semiconductor, steady state, allometric, polynomial* orde dua, *multi-criteria decision analysis, mean average error*

ABSTRACT

CALIBRATION OF SENSOR RESPONSE ON ELECTRONIC NOSE USING SECOND ORDER POLYNOMIAL AND ALLOMETRIC METHODS

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The variability inherent in MOS-based sensors due to the manufacturing process and sensitivity to environmental changes reduces the accuracy and consistency of sample analysis. This study aims to reduce the variability of the machine by developing a calibration method for each sensor. Calibration was carried out with 1–5 µL ethanol gas using 1 master unit and 3 slave units simultaneously. Steady state values resulting from data extraction on sensor response are used to create a calibration model using second order polynomial and allometric methods. The multi-criteria decision analysis (MCDA) method is used to determine the best method for each sensor. The results show that the Enose 0123 unit was chosen as the master machine because it is included in the initial batch category and has the best stability compared to the other machines. Sensors S1, S3, and S6 on all machines were calibrated using the second order polynomial method, while sensors S2, S4, S5, and S7 were calibrated using the allometric method. The calibration results are verified using ethanol gas, ethyl butanoate, and breath to see the calibration performance in the form of the mean average error (MAE) value between the master and the slave. For ethanol gas, calibration can reduce variations by a percentage of 84.14%, for ethyl butanoate gas by 76.87%, and for breath by 48.76%. Based on the research results that have been obtained, it is concluded that each sensor on the slave can be calibrated very well to the master and is able to reduce sensor variations significantly, although the calibration performance still has a tendency towards the detected gas. If the detected gas is the same as the calibration gas, the calibration result will be the maximum. The calibration method developed can reduce variations between Enose in a way that is faster, simpler, and more economical.

Keywords: calibration, electronic nose, metal oxide semiconductor, steady state, allometric, second order polynomial, multi-criteria decision analysis, mean average error.