

PERFORMANCE OF ELECTRONIC NOSE MULTI-CHAMBER FOR CLASSIFICATION OF HERBAL POWDER USING PRINCIPAL COMPONENT ANALYSIS (PCA) AND ARTIFICIAL NEURAL NETWORK (ANN) METHODS

ABSTRACT

Commodities of biopharmaceutical plants (herbs) can be processed into powders and are intended to reduce size while extending shelf life. Herbal powders can be identified by their color, shape, and size. However, it is not easy to differentiate one herbal powder from another due to the similar color or size. The human olfactory system is subjective and susceptible to physical and psychological conditions. The sensory analysis will also be challenging to do, so it will impact the difficulty of conducting consistent quality assessments. Electronic nose technology (e-nose) is a technology capable of detecting aromas. Its working principle mimics the human nose by digesting information from odor stimuli. The E-Nose used in this study has six sample chambers (chambers). The electronic nose will catch the smell of the material directly or the steam generated from heating the material. Material characteristics can be seen from the variety of sensor response values to the material. A database of these values was collected, and a pattern recognition analysis was performed for each sample tested. The samples of agricultural products tested were garlic powder, moringa leaves, the Creat plant, black pepper, white ginger and lemongrass. The one-time testing process includes three stages, namely 120 seconds of flushing, 180 seconds of collecting, and 180 seconds of purging. The number of data collection carried out was 50 repetitions for each sample. The data was then analyzed using two pre-treatment data processing methods unlimited data for PCA analysis and normalized absolute data for analysis using an Artificial Neural Network. The pre-treatment results were used to analyze the Principal Component Analysis (PCA) and Artificial Neural Network (ANN) methods. Artificial Neural Network (ANN) can classify samples with an accuracy rate of up to 100.00%, only the Moringa sample has an accuracy below 100%, which is 70%, and the Sambiloto sample is 90%. The two moringa sample data are more similar to the 81% white ginger sample. Meanwhile, PCA analysis could only separate 1 sample, namely black pepper. Meanwhile, the Creat plant sample failed to classify one sample, which was 48%.

Key Words: *Electronic Nose, Herbal Powder, Principal Componen Analysis, Artificial Neural Networks*

**UNJUK KERJA *ELECTRONIC NOSE MULTI CHAMBER* UNTUK
KLASIFIKASI BUBUK HERBAL DENGAN METODE *PRINCIPAL
COMPONENT ANALYSIS (PCA)* DAN *ARTIFICIAL NEURAL NETWORK
(ANN)***

INTISARI

Oleh:
ANDI SETIAWAN
20/467651/PTP/01783

Komoditas tanaman biofarmaka (herbal) dapat diolah menjadi bubuk dan dimaksudkan untuk memperkecil ukuran sekaligus memperpanjang umur simpan. Bubuk herbal dapat diidentifikasi dengan warna, bentuk dan ukuran, namun sulit membedakan antara bubuk herbal yang satu dengan yang lainnya, karena warna dan ukuran yang sama. Sistem penciuman manusia umumnya bersifat subjektif dan rentan terhadap keadaan fisik dan psikologis. Teknologi *electronic nose (e-nose)* merupakan teknologi yang mampu mendeteksi aroma. Prinsip kerjanya meniru hidung manusia dengan mencerna informasi dari rangsangan bau. Dalam penelitian ini, *E-Nose* yang digunakan dalam penelitian ini memiliki enam ruang sampel (*Multi Chamber*). *Electronic nose* akan menangkap bau dari bahan secara langsung atau uap yang dihasilkan dari pemanasan bahan. Karakteristik bahan dapat dilihat dari ragamnya nilai respon sensor terhadap bahan. Database nilai-nilai tersebut dikumpulkan dan dilakukan analisis pengenalan pola untuk setiap sampel yang diuji. Sampel produk pertanian yang diuji yaitu bubuk bawang putih, daun kelor, sambiloto, lada hitam, jahe putih, dan serai. Satu kali proses pengujian meliputi tiga tahap yaitu flushing 120 detik, collecting 180 detik, dan purging 180 detik. Jumlah pengambilan data dilakukan sebanyak 50 kali ulangan untuk setiap sampel. Data tersebut kemudian dianalisis menggunakan metode dua pre-treatment pengolahan data yaitu *absolute data* untuk analisis PCA, *normalize absolute data* untuk analisis menggunakan Jaringan Saraf Tiruan. Hasil pre-treatment tersebut digunakan untuk menganalisis dengan metode *Principal Component Analysis (PCA)*, dan *Artificial Neural Network (ANN)*. *Artificial Neural Network (ANN)* mampu mengklasifikasikan sampel dengan tingkat akurasi hingga 100.00%, yaitu lada hitam, bawang putih, jahe putih dan serai. Sedangkan sampel kelor yang memiliki akurasi dibawah 100% yaitu sebesar 70% dan sampel sambiloto 90%. Dua data sampel kelor lebih mirip ke sampel jahe putih 81%. Sedangkan analisis PCA hanya bisa memisahkan 1 sampel yaitu lada hitam. Sedangkan sampel sambiloto gagal dalam mengklasifikasi satu sampel yakni sebesar 48%.

Kata kunci: *Electronic Nose*, Bubuk Herbal, *Principal Componen Analysis*, *Jaringan Saraf Tiruan*