

## **DETEKSI KONTAMINASI *Saccharomyces cerevisiae* PADA FERMENTASI NATA DE COCO BERDASARKAN POLA RESPONS SENSOR *ELECTRONIC NOSE***

### **INTISARI**

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Nata de coco merupakan produk hasil fermentasi air kelapa oleh *Acetobacter xylinum* yang menghasilkan *bacterial cellulose* (BC). Selama proses fermentasi, terbentuk senyawa volatil yang memengaruhi aroma khas nata de coco. Kontaminasi oleh mikroorganisme seperti *Saccharomyces cerevisiae* dapat mengganggu proses tersebut dan menghasilkan pola senyawa volatil berbeda. Penelitian ini bertujuan untuk menganalisis perubahan pola respons sensor selama proses fermentasi nata de coco dalam kondisi normal dan terkontaminasi, serta mengidentifikasi waktu awal terjadinya perbedaan pola tersebut sebagai indikasi kontaminasi.

Pengujian dilakukan selama tujuh hari menggunakan *e-nose* dengan 10 sensor gas tipe *metal oxide semiconductor* (MOS). Data sensor diproses melalui tahap pra-pemrosesan sinyal dan ekstraksi ciri (mean, gradien, median, maksimum, dan standar deviasi), kemudian dianalisis menggunakan metode *Principal Component Analysis* (PCA).

Hasil penelitian menunjukkan bahwa pola respons sensor pada fermentasi normal didominasi oleh sensor S8, sedangkan pada kondisi terkontaminasi *S. cerevisiae*, sensor S2 menjadi lebih dominan. PCA berhasil memisahkan karakteristik pola antara kondisi normal dan kontaminasi, dengan proporsi varians tertinggi pada parameter mean (83,67%). Perbedaan pola signifikan terdeteksi sejak hari ke-4, ditunjukkan oleh pemisahan kluster pada score plot. Kombinasi *e-nose* dan PCA terbukti efektif sebagai metode deteksi dini yang cepat, non-destruktif, dan efisien untuk memantau kualitas fermentasi nata de coco serta mendeteksi kontaminasi.

Kata kunci: *electronic nose (e-nose)*, nata de coco, *principal component analysis* (PCA), *Saccharomyces cerevisiae*, *volatile compounds*

## **DETECTION OF *Saccharomyces cerevisiae* CONTAMINATION IN NATA DE COCO FERMENTATION BASED ON ELECTRONIC NOSE SENSOR RESPONSE PATTERN**

### **ABSTRACT**

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Nata de coco is a product of coconut water fermentation by *Acetobacter xylinum*, which produces bacterial cellulose (BC). During the fermentation process, volatile compounds are generated that contribute to the distinctive aroma of nata de coco. Contamination by microorganisms such as *Saccharomyces cerevisiae* can interfere with the fermentation and result in different volatile compound profiles. This study aims to analyze changes in sensor response patterns during the fermentation of nata de coco under normal and contaminated conditions and to identify the earliest point at which these differences appear as an indication of contamination.

The experiment was conducted over seven days using an electronic nose (e-nose) equipped with 10 metal oxide semiconductor (MOS) gas sensors. The sensor data were processed through signal pre-processing and feature extraction stages (mean, gradient, median, maximum, and standard deviation), followed by analysis using the Principal Component Analysis (PCA) method.

The results showed that the sensor response pattern in normal fermentation was dominated by sensor S8, while in contaminated conditions, sensor S2 became more dominant. PCA successfully differentiated the response patterns between normal and contaminated samples, with the highest variance proportion observed in the mean parameter (83.67%). Significant pattern differences were detected starting on day 4, indicated by the clear separation of clusters in the PCA score plot. The integration of e-nose and PCA proved to be an effective, rapid, non-destructive, and efficient method for early detection of microbial contamination and quality monitoring during nata de coco fermentation.

*Keywords: electronic nose (e-nose), nata de coco, principal component analysis (PCA), Saccharomyces cerevisiae, volatile compounds*