

**PERANCANGAN SISTEM DETEKSI PUPUK *OFF-SPEC* BERBASIS  
SENSOR MAKRO NUTRIEN PADA PERKEBUNAN KELAPA SAWIT**

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**INTISARI**

Saat ini luas perkebunan kelapa sawit di Indonesia telah mencapai 14,72 juta hektar dimana perkebunan kelapa sawit swasta memiliki porsi luas kelapa sawit terbesar yaitu 55% diikuti oleh perkebunan negara dan rakyat yaitu masing-masing sebesar 41% dan 4%. Manajemen pupuk terdapat beberapa kendala seperti selama ini solusi yang telah dilakukan untuk identifikasi pupuk *off-spec* dilakukan secara manual (ciri fisik, bau, warna, bentuk, dilarutkan dalam air) dan analisis kandungan hara di laboratorium kimia. Analisis kandungan hara di laboratorium kimia memiliki akurasi yang tinggi, namun beberapa pelaku usaha tidak melakukan analisis tersebut dengan pertimbangan ketidaktahuan bahwa pupuk harus dilakukan analisis, biaya analisis mahal sedangkan jumlah pupuk sedikit, dan inkonsistensi kinerja karyawan melakukan sampling pupuk. Identifikasi secara manual dapat lebih cepat mendapatkan hasil, namun akurasi ketepatan rendah karena saat ini pupuk *off-spec* juga diproses mirip seperti pupuk asli dari pabrik pupuk. Oleh karena itu, penelitian ini dilakukan untuk mengembangkan *Perancangan Sistem Deteksi Pupuk Off-spec Berbasis Sensor Makronutrien Pada Perkebunan Kelapa Sawit*. Tujuan dari penelitian ini adalah merancang dan mengevaluasi kinerja system deteksi pupuk *off-spec* berbasis sensor makronutrien pada perkebunan kelapa sawit untuk mengamati kadar N, P, dan K pada pupuk organik. Didapatkan system deteksi pupuk *off-spec* yang dapat mendeteksi kadar NPK dalam satuan mg/L dengan pengenceran optimum 100.000 ppm. Kinerja system deteksi pupuk *off-spec* berbasis sensor makro nutrient memiliki konsistensi pembacaan yang stabil dengan nilai validasi sebesar 84,6%.

**Kata kunci:** kadar hara, pupuk, kelapa sawit

## **DESIGN OF A SPEC-OFF FERTILIZER DETECTION SYSTEM BASED ON MACRO NUTRIENT SENSORS IN PALM OIL PLANTATIONS**

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### **ABSTRACT**

Currently, the area of oil palm plantations in Indonesia has reached 14.72 million hectares, where private oil palm plantations have the largest portion of palm oil area, namely 55%, followed by state and community plantations, namely 41% and 4% respectively. Fertilizer management has several obstacles, such as so far the solution that has been used to identify off-spec fertilizers is done manually (physical characteristics, odor, color, shape, dissolved in water) and analysis of nutrient content in a chemical laboratory. Nutrient content analysis in chemical laboratories has high accuracy, but some business actors do not carry out this analysis due to ignorance that fertilizer must be analyzed, the cost of analysis is expensive while the amount of fertilizer is small, and inconsistencies in the performance of employees carrying out fertilizer sampling. Manual identification can get results more quickly, but the accuracy is low because currently off-spec fertilizer is also processed in the same way as real fertilizer from fertilizer factories. Therefore, this research was conducted to develop a design for an off-spec fertilizer detection system based on macronutrient sensors in palm oil plantations. The aim of this research is to design and evaluate the performance of an off-spec fertilizer detection system based on macronutrient sensors in oil palm plantations to observe N, P and K levels in organic fertilizer. An off-spec fertilizer detection system was obtained that can detect NPK levels in mg/L units with an optimum dilution of 100,000 ppm. The performance of the off-spec fertilizer detection system based on macro nutrient sensors has stable reading consistency with a validation value of 84.6%.

**Keywords:** nutrient levels, fertilizer, palm oil