

ABSTRAK

MUHAMMAD ABIYYU ALHARITS. Studi Komparatif *Machine Learning* Prediksi Kadar Air Rumput Laut *Kappaphycus alvarezii* Berbasis Spektral Sensor AS7265x. Dibimbing oleh HOLLANDA ARIEF KUSUMA dan AIDIL FADLI ILHAMDY.

Kadar air merupakan parameter penting kualitas pascapanen rumput laut *Kappaphycus alvarezii* karena berpengaruh terhadap stabilitas, umur simpan, dan mutu produk akhir. Penelitian ini bertujuan memprediksi kadar air rumput laut *Kappaphycus alvarezii* menggunakan data spektral sensor AS7265x melalui pendekatan *machine learning*. Pengujian dilakukan dengan mengeringkan sampel pada suhu 50 °C untuk memperoleh variasi kadar air, kemudian data reflektansi 18 kanal spektral diakuisisi sebagai fitur. Data dipraproses menggunakan *Z-score Standardization*, direduksi dengan *Principal Component Analysis* (PCA), dibagi menjadi data latih dan data uji dengan rasio 80:20, lalu dimodelkan menggunakan *Random Forest*, *K-Nearest Neighbor* (KNN), dan *Artificial Neural Network* (ANN). Hasil PCA menunjukkan enam komponen utama merepresentasikan 93,7% variansi data. Dari total 3353 data yang dibagi dengan rasio 80:20, evaluasi pada data uji menunjukkan bahwa KNN menghasilkan kesalahan terendah dengan *Mean Absolute Error* (MAE) 0,0293, *Mean Squared Error* (MSE) 0,0895, *Root Mean Squared Error* (RMSE) 0,2991, dan koefisien determinasi (R^2) 0,9998. Namun, pada inferensi langsung menggunakan ESP32, *Random Forest* menunjukkan kinerja paling stabil dengan MAE 9,187%. Temuan ini menunjukkan bahwa data spektral AS7265x layak digunakan sebagai masukan model prediktif, serta model terbaik pada pengujian dataset belum tentu paling sesuai untuk implementasi perangkat tertanam. Implikasinya, sistem ini dapat menjadi dasar pengembangan alat prediksi kadar air rumput laut secara portabel dan non-destruktif.

Kata kunci: AS7265x, kadar air, *Kappaphycus alvarezii*, *machine learning*, spektral

ABSTRACT

MUHAMMAD ABIYYU ALHARITS. Comparative Study of Machine Learning for Moisture Content Prediction of *Kappaphycus alvarezii* Seaweed Based on AS7265x Sensor Spectral Data. Supervised by HOLLANDA ARIEF KUSUMA and AIDIL FADLI ILHAMDY.

Moisture content is important in determining the quality of *Kappaphycus alvarezii* seaweed because it affects stability, shelf life, and product quality. This study predicted moisture content using AS7265x spectral sensor data with machine learning. Samples were dried at 50 °C to obtain moisture variations, and reflectance data from 18 spectral channels were acquired as features. The data were preprocessed using Z-score Standardization, reduced using Principal Component Analysis (PCA), divided into training and testing sets with an 80:20 ratio, and modeled using Random Forest, K-Nearest Neighbor (KNN), and Artificial Neural Network (ANN). The PCA results showed that six principal components represented 93.7% of total variance. Of the total 3353 data divided with a ratio of 80:20, the evaluation on the test data shows that KNN produces the lowest error with a Mean Absolute Error (MAE) of 0.0293, Mean Squared Error (MSE) of 0.0895, Root Mean Squared Error (RMSE) of 0.2991, and a coefficient of determination (R^2) of 0.9998. However, during direct inference using ESP32, Random Forest showed the most stable performance with MAE of 9.187%. These findings indicate that AS7265x spectral data are suitable for predictive modeling, while the best dataset-testing model is not necessarily the most suitable for embedded-device implementation. The system can support a portable, non-destructive seaweed moisture prediction device.

Keywords: AS7265x, *Kappaphycus alvarezii*, machine learning, moisture content, spectral data.