INTISARI

MODEL ALGORITMA *RANDOM FOREST* PADA *NANOFIBER* PVA-*CHITOSAN* HASIL *ELECTROSPINNING* UNTUK MEMPREDIKSI DIAMETER DAN KONDISI SERAT *NANOFIBER*

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Meskipun minat terhadap teknologi *electrospinning* (ES) sangat luas, sangat sedikit studi simulasi yang telah dilakukan. Oleh karena itu, penelitian saat ini menghasilkan sistem untuk menyediakan proses ES yang berkelanjutan dan efektif dengan menggabungkan desain eksperimen dengan model prediksi *machine learning* (ML). Secara khusus, untuk memodelkan hubungan parameter ES dengan karakteristik *nanofiber* PVA-*Chitosan* serta memperkirakan morfologi *nanofiber* yang optimal, pengembangan model dilakukan dengan algoritma *random forest* (RF). RF merupakan bagian dari *supervised learning* yang digunakan untuk tugas-tugas klasifikasi dan regresi. Algoritma RF digunakan untuk menentukan model RF *output* klasifikasi, yaitu "fiberCondition" dan "isApproved" serta *output* regresi, yaitu "avfiberDiameter" dan "standardDeviation". Keakuratan prediksi model dievaluasi bedasarkan *accuracy*, *sensitivity*, *specificity*, *precision*, *F1-Score*, *confusion matrix*, ROC-AUC untuk tugas klasifikasi. Sedangkan untuk evaluasi model regresi menggunakan MAE, MSE, RMSE, dan *R-squared*. Setelah mendapatkan model RF terbaik target klasifikasi dan regresi, model dievaluasi kembali dengan metode *K-Fold Cross Validation* (KCV). Hasil penelitian menunjukkan model RF dengan *test size* 0.1 dan *random state* 40 memberikan performa terbaik dalam menentukan *output* "fiberCondition". Sedangkan model RF dengan *test size* 0.1 dan *random state* 60 memberikan performa terbaik dalam menentukan *output* "isApproved", "avfiberDiameter", dan "standardDeviation". Tidak hanya itu, RF telah berhasil mengidentifikasi morfologi *nanofiber* PVA-*Chitosan*.

Kata kunci: *Electrospinning* (ES), *nanofiber*, PVA-*Chitosan*, *Random Forest* (RF), *Machine Learning* (ML), *K-Fold Cross Validation* (KCV).

ABSTRACT

RANDOM FOREST ALGORITHM MODEL ON PVA-CHITOSAN NANOFIBERS WITH ELECTROSPINNING RESULTS TO PREDICT THE DIAMETER AND CONDITION OF NANOFIBER

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Despite widespread interest in electrospinning (ES) technology, very few simulation studies have been conducted. Therefore, the current research develops a system to provide a sustainable and effective ES process by combining experimental design with machine learning (ML) predictive models. Specifically, to model the relationship between ES parameters and PVA-Chitosan nanofiber characteristics and to estimate the optimal nanofiber morphology, the model was developed using the random forest (RF) algorithm. RF is a supervised learning technique used for both classification and regression tasks. The RF algorithm was employed to develop models for classification outputs, namely "fiberCondition" and "isApproved," and regression outputs, namely "avfiberDiameter" and "standardDeviation." The accuracy of the predictive models was evaluated based on accuracy, sensitivity, specificity, precision, F1-Score, confusion matrix, and ROC-AUC for classification tasks, while regression model evaluation used MAE, MSE, RMSE, and R-squared. After obtaining the best RF model for classification and regression targets, the models were further evaluated using the K-Fold Cross Validation (KCV) method. The research results showed that the RF model with a test size of 0.1 and a random state of 40 performed best in determining the "fiberCondition" output. Meanwhile, the RF model with a test size of 0.1 and a random state of 60 performed best in determining the "isApproved," "avfiberDiameter," and "standardDeviation" outputs. Furthermore, RF successfully identified the morphology of PVA-Chitosan nanofibers.

Keywords: *Electrospinning* (ES), *nanofiber*, PVA-*Chitosan*, *Random Forest* (RF), *Machine Learning* (ML), *K-Fold Cross Validation* (KCV).