

## INTISARI

Limbah Tandan Kosong Kelapa Sawit (TKKS) sangat berpotensi dimandatkan sebagai bahan baku bioetanol karena memiliki kandungan lignoselulosa yang tinggi. Diketahui kadar selulosa, hemiselulosa, dan lignin pada Tandan Kosong Kelapa Sawit berturut-turut adalah 45,95%; 22,84%; dan 16,49%. Namun, kandungan lignin yang tinggi pada TKKS menghambat proses hidrolisis enzimatis dalam produksi gula sebagai substrat fermentasi. Penelitian ini bertujuan untuk menentukan kondisi optimal perlakuan awal kombinasi konsentrasi NaOH dan waktu pemanasan *microwave* yang optimal terhadap komposisi selulosa, hemiselulosa, lignin dan kadar gula reduksi. Metode yang digunakan adalah *Response Surface Methodology* (RSM) dengan pendekatan *Central Composite Design* (CCD) untuk mengevaluasi pengaruh dua variabel bebas terhadap empat respon: selulosa, hemiselulosa, lignin, dan gula reduksi. Perlakuan awal dilakukan dengan variasi konsentrasi NaOH (0,17%–5,83%) dan waktu pemanasan *microwave* (1,89–23,11 menit) pada suhu 180°C. Hasil penelitian menunjukkan bahwa perlakuan kombinasi NaOH dan *microwave* efektif menurunkan kadar lignin serta meningkatkan gula reduksi tanpa menurunkan kandungan selulosa dan hemiselulosa secara signifikan. Kondisi optimal diperoleh pada konsentrasi NaOH 3% dan waktu pemanasan 5 menit, dengan hasil: selulosa 37,07%, hemiselulosa 14,26%, lignin 22,44%, dan gula reduksi 0,621%.

Kata kunci: Lignoselulosa, Gula Reduksi, TKKS, RSM

## ABSTRACT

*Empty Fruit Bunches (EFB) from oil palm have significant potential to be utilized as a raw material for bioethanol production due to their high lignocellulosic content. The cellulose, hemicellulose, and lignin contents in EFB are known to be 45.95%, 22.84%, and 16.49%, respectively. However, the high lignin content in EFB hinders the enzymatic hydrolysis process for sugar production, which serves as the substrate for fermentation. This study aims to determine the optimal pretreatment conditions combining NaOH concentration and microwave heating time to affect the composition of cellulose, hemicellulose, lignin, and reducing sugar content. The method used is Response Surface Methodology (RSM) with a Central Composite Design (CCD) approach to evaluate the effects of two independent variables on four responses: cellulose, hemicellulose, lignin, and reducing sugars. The pretreatment was carried out with variations in NaOH concentration (0.17%–5.83%) and microwave heating time (1.89–23.11 minutes) at a temperature of 180°C. The results showed that the combined NaOH and microwave pretreatment effectively reduced lignin content and increased reducing sugars without significantly decreasing cellulose and hemicellulose contents. The optimal conditions were achieved at a NaOH concentration of 3% and a heating time of 5 minutes, resulting in: cellulose 37.07%, hemicellulose 14.26%, lignin 22.44%, and reducing sugars 0.621%.*

*Keywords: Lignocellulose, reducing sugar, OPEFB, RSM*