

## EXTRACTING SODA LIGNIN FROM THE BLACK LIQUOR OF OIL PALM EMPTY FRUIT BUNCH

M. N. MOHAMAD IBRAHIM<sup>1\*</sup> & H. AZIAN<sup>2</sup>

**Abstract:** Soda lignin from oil palm empty fruit bunches was directly isolated by sulfuric acid at different experimental factors, i.e. acid concentration, pH, extraction temperature and extraction time. In this study, Taguchi Robust Design Technique was used to rank the above factors that may effect the yield of soda lignin. The Taguchi orthogonal array  $L_9$  was used for the experimental design with three levels of consideration for each factor. The response (yield of lignin) was analyzed based on the Taguchi signal to noise ratio (S/N) and analysis of variance (ANOVA). The results showed that the most notable factor influencing the yield of lignin was the extraction temperature, followed by concentration of sulfuric acid, time of extraction and pH. The optimum yield of lignin, which is 3.016 g from every 200 mL of black liquor, was then predicted based on these results. The presence of soda lignin was confirmed by FT-IR analysis.

**Keywords:** Soda lignin, Taguchi method, Taguchi orthogonal array, yield of lignin, optimum yield of lignin

**Abstrak:** Lignin soda telah dipencilkan daripada likuor hitam tandan sawit kosong dengan menggunakan asid sulfurik pada parameter eksperimen yang berbeza, iaitu kepekatan asid, pH, suhu dan masa pengekstrakan. Dalam kajian ini, kaedah Taguchi telah digurakan untuk menyusun faktor di atas mengikut keutamaan masing-masing, berdasarkan pengaruhnya terhadap dapatan soda lignin. Susun atur ortogonal Taguchi  $L_9$  telah digunakan untuk merancang eksperimen dengan 3 tahap bagi setiap faktor. Data yang diperoleh telah dianalisis berdasarkan nisbah isyarat kepada kebisingan Taguchi dan analisis varians. Keputusan menunjukkan faktor yang paling mempengaruhi dapatan lignin ialah suhu pengekstrakan dan diikuti dengan kepekatan asid sulfurik, masa pengekstrakan dan pH. Dapatan lignin yang paling optimum, iaitu 3.016 g daripada setiap 200 mL likuor hitam diramalkan berdasarkan kepada keputusan analisis yang diperoleh. Lignin soda yang dipencilkan dalam kajian ini telah ditentusahkan menerusi analisis inframerah.

**Kata kunci:** Lignin soda, kaedah Taguchi, susun atur orthogonal Taguchi, dapatan lignin, dapatan lignin yang optimum

### 1.0 INTRODUCTION

In Malaysia, it is estimated that 2.5 million hectares of land is being cultivated with oil palm trees. Besides producing palm oil, the industry also generates massive amounts of lignocellulosic wastes such as trunks, fronds and empty fruit bunches (EFB). This

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<sup>1&2</sup> School of Chemical Sciences, Universiti Sains Malaysia 11800 Minden, Pulau Pinang  
\*Corresponding author: Tel: 04-6533554, Fax: 04-6574854, Email: [mnm@usm.my](mailto:mnm@usm.my)