

**STUDI PELARUTAN LIGNIN DARI MATERIAL LIGNOSELULOSA  
SERABUT KELAPA MENGGUNAKAN CAIRAN IONIK EUTEKTIK  
BERBASIS KOLINIUM KLORIDA**

**SKRIPSI**

diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada  
Program Studi Kimia



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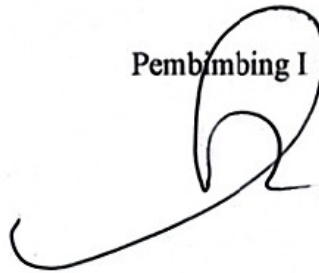
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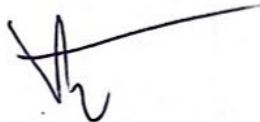
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## PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi yang berjudul “**Studi Pelarutan Lignin dari Material Lignoselulosa Serabut Kelapa Menggunakan Cairan Ionik Eutektik Berbasis Kolinium Klorida**” ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung risiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

Bandung, 28 Agustus 2023

Yang Membuat Pernyataan



Lewi Stefanus Anggiat

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Penulis berharap skripsi ini dapat memberikan wawasan dan bermanfaat bagi para pembaca dan semua pihak khususnya dalam bidang kimia. Penulis menyadari bahwa dalam skripsi ini masih banyak kekurangan dan keterbatasan. Oleh karena itu, penulis masih terbuka akan kritik dan saran yang membangun dari semua pihak sebagai bentuk nyata untuk perbaikan dan penyempurnaannya.

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## ABSTRAK

Lignin merupakan salah satu komponen utama dalam lignoselulosa, yang paling melimpah kedua setelah selulosa dalam biosfer. Meskipun demikian, struktur dan kekompleksan pada lignin membatasi pemanfaatan dan pengubahannya sebagai bahan kimia yang bernilai tambah. *Eutectic Based Ionic Liquids* (EILs), merupakan salah satu alternatif baru dari cairan ionik konvensional yang dinilai lebih murah, lebih ramah lingkungan, dan *biodegradable* untuk digunakan sebagai pelarut dalam proses kimiawi dari lignin. Sifat pelarut lignin yang baik ini hanya merupakan salah satu dari sekian banyak aplikasi EILs. Tujuan dari penelitian ini adalah untuk mempelajari proses kimiawi pelarutan lignin dan delignifikasi limbah biomassa yang mengandung lignoselulosa seperti serabut kelapa serta mempelajari sifat anti jamur menggunakan cairan ionik eutektik (EILs) berbasis kolinium klorida. EILs dalam penelitian ini disintesis dengan metode pemanasan sederhana pada dua komponen pembentuknya yaitu asam oksalat (CO) dan  $ZnCl_2$  (CZ). EILs yang berhasil disintesis dilakukan studi FTIR dan NMR serta diukur densitasnya. EILs hasil sintesis digunakan dalam pelarutan dan delignifikasi lignin dari serabut kelapa dan potensinya sebagai anti jamur diuji melalui uji ketahanan jamur. Uji ketahanan jamur dilakukan pada media padat PDA dengan tiga jenis jamur yaitu *Aspergillus niger*, *Penicilium*, dan *Trichoderma* sp. Hasil sintesis EILs menunjukkan cairan ionik berhasil disintesis dengan densitas  $1.2864\text{ g/cm}^3$  dan  $1.7526\text{ g/cm}^3$  masing-masing untuk EILs CO dan CZ. Studi FTIR dan NMR pada EILs mengkonfirmasi bahwa EILs berhasil disintesis. Studi kelarutan EILs hasil sintesis pada lignin dan selulosa adalah sebesar 42.03%; 5.44% dan 32.51%; 7.73% masing-masing untuk EILs CO dan CZ. Hasil delignifikasi serabut kelapa menunjukkan bahwa lignin dari serabut kelapa dapat larut ditandai dengan perubahan warna EILs setelah dilakukan delignifikasi dan pemisahan. Studi FTIR mengkonfirmasi lignin hasil delignifikasi yang ditunjukkan berada pada intensitas puncak di daerah  $1700\text{-}1400\text{ cm}^{-1}$  sebagai puncak karakteristik dari lignin dan studi NMR menunjukkan terdapat bagian lignin yang muncul pada spektra NMR. Karakteristik serabut kelapa setelah delignifikasi menunjukkan kenaikan intensitas untuk gugus fungsi yang ada dalam selulosa, sebagaimana ditunjukkan oleh hasil FTIR. Hasil uji ketahanan jamur menunjukkan pertumbuhan jamur pada bambu dihambat lebih baik oleh EILs CZ dibandingkan EILs CO.

**Kata kunci:** delignifikasi, *eutectic based ionic liquids*, kolinium klorida-asam oksalat/ $ZnCl_2$ , lignin, antifungal.



## ABSTRACT

Lignin is one of the main components in lignocellulose, the second most abundant after cellulose in the biosphere. However, the structure and complexity of lignin limits its use and conversion as a value-added chemical. Eutectic Based Ionic Liquids (EILs), are a new alternative to conventional ionic liquids which are considered cheaper, more environmentally friendly, and biodegradable to be used as solvents in the chemical process of lignin. This excellent lignin solvent property is only one of the many applications of EILs. The purpose of this study was to study the chemical process of lignin dissolution and delignification of lignocellulose-containing biomass waste such as coconut fibers while also studying antifungal properties using eutectic ionic liquids (EILs) based on choline chloride. EILs in this study were synthesized by simple heating method on two of its constituent components, oxalic acid and  $ZnCl_2$ . The successfully synthesized EILs were subjected to FTIR and NMR study and their density was measured. Delignification of lignin from coconut fiber and their antifungal properties in fungal resistance tests were conducted using the synthesized EILs. Fungus resistance test was carried out on PDA solid media with three types of fungi, namely *Aspergillus niger*, *Penicillium*, and *Trichoderma* sp. The results of the EILs synthesis exhibited that ionic liquids were successfully synthesized with a density of  $1.2864 \text{ g/cm}^3$  and  $1.7526 \text{ g/cm}^3$  for EILs CO and CZ, respectively. FTIR and NMR studies on EILs confirmed that EILs were successfully synthesized. The maximum solubility study of the synthesized EILs on lignin; cellulose was 42.03%; 5.44% and 32.51%; 7.73% for CO and CZ EILs, respectively. The results of delignification of coconut fiber evidenced that lignin from coconut fiber was soluble which was indicated by the color change of EILs after delignification and separation. FTIR studies confirmed delignified lignin which was shown to be at a peak intensity in the  $1700\text{-}1400 \text{ cm}^{-1}$  region as a characteristic peak of lignin and the NMR studies evidenced peaks for lignin moieties shown by the spectra. FTIR results of coconut fiber after delignification displayed an increase in intensity for the functional groups present in cellulose. The results of the fungal resistance test revealed that the growth of fungi on bamboo could be inhibited better by EILs CZ rather than EILs CO.

**Keyword:** delignification, eutectic based ionic liquids, choline chloride-oxalic acid/ $ZnCl_2$ , lignin, antifungal.

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