

OPTIMIZATION OF CATALYST ADDITION AND TEMPERATURE ON BIOSURFACTANT FROM OIL PALM EMPTY FRUIT BUNCHES FOR OILY PRODUCED WATER REMEDIATION

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING FACULTY OF AGRICULTURAL ENGINEERING AND TECHNOLOGY **IPB UNIVERSITY** 2025



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ABSTRACT

RAHMAH DWI CAHYANI. Optimization of Catalyst Addition and Temperature on Biosurfactant from Oil Palm Empty Fruit Bunches for Oily Produced Water Remediation. Dibimbing oleh ALLEN KURNIAWAN dan YUDI CHADIRIN.

Oil drilling operations generate water containing hazardous substances, including O&G, COD, and ammonia. Biosurfactants derived from oil palm empty fruit bunches (OPEFB) have been shown to reduce surface tension, facilitate oilwater separation, and enhance the biodegradation of contaminants. Research indicates that the addition of an NaOH catalyst at concentrations ranging from 20% to 30% significantly decreases the O&G, with the most substantial reduction observed at a 20% catalyst concentration. However, increasing the catalyst concentration resulted in increase levels of COD (3%–35%) and ammonia (48%–88%). A temperature of 80°C, in conjunction with a surfactant dose of 6% and NaOH concentrations of 20–30%, yielded the most effective reduction of O&G and COD. Conversely, higher temperatures (100°C) lead to increased COD and ammonia levels owing to biosurfactant degradation. The Freundlich model accurately describes the adsorption of ammonia, O&G, and COD, demonstrating a strong correlation between the predicted and actual data, with no significant differences as per ANOVA testing.

Keywords: Biosurfactants, Catalyst, OPEFB, Produced Water, Temperature

ABSTRAK

RAHMAH DWI CAHYANI. Optimization of Catalyst Addition and Temperature on Biosurfactant from Oil Palm Empty Fruit Bunches for Oily Produced Water Remediation. Supervised by ALLEN KURNIAWAN and YUDI CHADIRIN.

Aktivitas pengeboran minyak menghasilkan air terproduksi yang mengandung senyawa berbahaya seperti minyak dan lemak, COD, dan amonia. Biosurfaktan yang diproduksi dari OPEFB dapat mengurangi tegangan permukaan, memfasilitasi pemisahan minyak dan air, serta meningkatkan biodegradasi kontaminan. Penelitian menunjukkan bahwa penambahan NaOH katalis pada konsentrasi 20%-30% mengurangi minyak secara signifikan, dengan penurunan terbesar pada 20% katalis. Namun, peningkatan katalis meningkatkan COD (3%-35%) dan amonia (48%-88%). Suhu 80°C dengan dosis surfaktan 6% dan NaOH 20%-30% menghasilkan pengurangan minyak dan COD terbaik, meskipun suhu lebih tinggi (100°C) meningkatkan COD dan amonia akibat degradasi biosurfaktan. Model Freundlich terbukti efektif memodelkan adsorpsi amonia, minyak dan lemak, dan COD, dengan korelasi yang kuat antara data prediksi dan aktual, dan tidak ada perbedaan signifikan menurut uji ANOVA.

Kata kunci: Air Terproduksi, Biosurfaktan, Katalis, TKKS, Temperatur

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RAHMAH DWI CAHYANI

Undergraduate thesis as one of the requirement to obtain Bachelor's Degree in Civil and Environmental Engineering Department

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING FACULTY OF AGRICULTURAL ENGINEERING AND TECHNOLOGY IPB UNIVERSITY 2025



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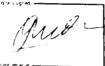
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PREFACE

All praise and gratitude the author extends to Allah subhanahu wa ta'ala for His blessings, through which the author was granted health and strength to complete this thesis. The title of the research, which was conducted from February 2025 to June 2025, is 'Optimization of Catalyst Addition and Temperature on Biosurfactant from Oil Palm Empty Fruit Bunches for Oily Produced Water Remediation.

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The author has prepared this thesis to the best of their ability, but is also aware that there are still many shortcomings. Therefore, the author openly welcomes any suggestions and constructive corrections for improvement. It is hoped that this thesis will be beneficial to those in need and contribute to the advancement of knowledge.

Bogor, July 2025

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