

## **PENGARUH PENAMBAHAN LIMBAH CAIR TAHU TERHADAP AKTIVITAS DAN EKSPRESI GEN *alkB* BAKTERI *Pseudomonas aeruginosa* DALAM MENDEGRADASI HIDROKARBON SOLAR**

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### **Intisari**

*Pseudomonas aeruginosa* yang diisolasi dari pertambangan minyak bumi tradisional di Kabupaten Blora, Jawa Tengah telah terbukti memiliki kemampuan untuk mendegradasi minyak mentah. Namun, kemampuannya dalam mendegradasi minyak solar serta tingkat ekspresi gen *alkB* yang mengode enzim alkana hidroksilase dan alkohol dehidrogenase yang berperan dalam degradasi hidrokarbon belum diketahui. Kemampuan bakteri untuk mendegradasi hidrokarbon erat kaitannya dengan komposisi media seperti sumber nitrogen, contohnya limbah cair tahu. Penelitian ini bertujuan untuk mengetahui waktu inkubasi dan konsentrasi solar optimum yang dibutuhkan oleh *Pseudomonas aeruginosa* dalam mendegradasi hidrokarbon solar, serta pengaruh penambahan limbah cair tahu terhadap aktivitas degradasi hidrokarbon solar dan ekspresi gen *alkB*. Uji optimasi dilakukan dengan menambahkan solar sebagai satu-satunya sumber karbon ke dalam media *Mineral Salt Medium* cair dengan variasi lama waktu inkubasi 7, 14, dan 21 hari, dan variasi konsentrasi solar 3%, 5%, dan 7%. Berdasarkan uji optimasi dengan indikator uji nilai pH, uji *Total Plate Count* (TPC), uji *Biological Oxygen Demand* (BOD), uji *Chemical Oxygen Demand* (COD), serta uji kadar karbon organik, diperoleh hasil paling optimum adalah konsentrasi solar 3% dengan waktu inkubasi selama tujuh hari terakhir. Isolat dengan konsentrasi solar dan waktu inkubasi paling optimum ini kemudian dilanjutkan ke uji biodegradasi dengan penambahan limbah cair tahu sebesar 2%, 4%, dan 6%. Hasil uji FTIR menunjukkan komposisi senyawa pada sampel yang diberi perlakuan limbah cair tahu didominasi oleh alkohol dan alkena, yang merupakan senyawa hasil sisa metabolisme mikroba, dibandingkan dengan sampel kontrol yang didominasi oleh senyawa alkana (hidrokarbon) dan amina (nitrogen). Hasil uji biodegradasi menunjukkan aktivitas *P. aeruginosa* terbaik pada konsentrasi limbah tahu 4% dengan peningkatan ekspresi relatif gen *alkB* sebesar 117 kali lipat atau 99,14%.

**Kata kunci:** *Pseudomonas aeruginosa*, Solar, Limbah Cair Tahu, Ekspresi Gen *alkB*.

## THE EFFECT OF TOFU WASTEWATER ADDITION ON THE ACTIVITY AND EXPRESSION OF THE *alkB* GENE OF *Pseudomonas aeruginosa* BACTERIA IN DEGRADING DIESEL HYDROCARBONS

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### Abstract

*Pseudomonas aeruginosa* isolated from traditional petroleum mining in Blora Regency, Central Java, has been shown to have the ability to degrade crude oil. However, its ability to degrade diesel oil and the level of expression of the *alkB* gene which encodes the enzymes alkane hydroxylase and alcohol dehydrogenase which play a role in the degradation of hydrocarbons are not known. The ability of bacteria to degrade hydrocarbons is closely related to the composition of the media such as a nitrogen source, for example, tofu wastewater. This study aims to determine the incubation time and optimum diesel concentration required by *Pseudomonas aeruginosa* in degrading diesel fuel, as well as the effect of adding tofu wastewater on the activity of diesel hydrocarbon degradation and the expression of the *alkB* gene. Optimization tests were carried out by adding diesel fuel as the only carbon source to the liquid Mineral Salt Medium with variations in incubation times of 7, 14, and 21 days, and variations in diesel fuel concentrations of 3%, 5%, and 7%. Based on the optimization test with pH value test, Total Plate Count (TPC) test, Biological Oxygen Demand (BOD) test, Chemical Oxygen Demand (COD) test, and organic carbon content test as the indicators, the most optimum result is a 3% diesel fuel concentration with time incubation for last seven days. The isolates with the most optimum diesel fuel concentration and incubation time then proceeded to the biodegradation test by adding 2%, 4%, and 6% of tofu wastewater. The results of the FTIR test showed that the composition of the compounds in the samples treated with tofu wastewater was dominated by alcohol and alkenes, which are compounds byproducts of microbial metabolism, compared to the control samples which were dominated by alkanes (hydrocarbons) and amines (nitrogen). The biodegradation test results showed the best activity of *P. aeruginosa* at 4% concentration of tofu wastewater with an increase in the relative expression of the *alkB* gene by 117 times or 99.14%.

**Keywords:** *Pseudomonas aeruginosa*, diesel fuel, tofu wastewater, *alkB* gene expression.