

## Abstrak

### Karakterisasi dan Seleksi Fungi Pendegradasi Limbah Zat Pewarna Remazol Red dan Ekstrak Tingi (*Ceriops tagal* (Perr.) C.B. Rob) di Industri Batik Surakarta

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Kampoeng Batik Laweyan merupakan produsen batik terbesar di Surakarta. Penggunaan zat pewarna sintetik berupa remazol *red* dan pewarna alami dari kulit tingi (*Ceriops tagal* (Perr.) C.B. Rob) dapat bersifat reaktif dan karsinogenik pada lingkungan. Penelitian ini bertujuan untuk menyeleksi fungi yang memiliki kemampuan dalam mendekolorisasi zat pewarna remazol *red* dan pewarna alami tingi. Beberapa tahapan yang dilakukan pada penelitian ini yaitu isolasi fungi dari tiga jenis sampel yaitu tanah, air, dan lumpur yang sudah terkontaminasi zat pewarna. Seleksi dilakukan dengan beberapa tahapan yaitu seleksi menggunakan media asam tanat dan uji dekolorisasi dalam berbagai konsentrasi. Isolat yang memiliki potensi yang paling baik dalam mendekolorisasi zat pewarna dilakukan pengujian penurunan fisiko-kimia dan aktivitas enzim laccase menggunakan substrat ABTS (2,2' azino-bis 3-ethylbenzothiazoline-6-sulfonic acid). Isolat potensial dikarakterisasi secara morfologi dan molekuler. Sebanyak 97 isolat ditemukan dari sampel uji, selanjutnya setiap isolat fungi dilakukan *screening* untuk mengetahui aktivitas ligninolitik yang ditandai dengan terbentuknya zona berwarna coklat pada media asam tanat. Hasil dari *screening* didapatkan tujuh isolat potensial yang diberi kode (10 SPJ, 24 SPX, 41 SRP, 19 SPS, 12 SPL, 7 SPG, 64 WZB). Tujuh isolat potensial merupakan fungi Ascomycota pada genus *Trichoderma*, *Fusarium*, dan *Penicillium*. Isolat 41 SRP menghasilkan persentase dekolorisasi tertinggi pada zat pewarna remazol *red* dan tingi pada berbagai konsentrasi dengan aktivitas dekolorisasi pada waktu inkubasi selama 120 jam pada masing-masing konsentrasi (250, 500, 1000, dan 1500 ppm) secara beurutuan untuk remazol *red* 87,772%, 76,053 %, 68,615%, dan 34,778% dan zat pewarna alami tingi dengan persentase 98,832%, 90,065%, 85,905%, dan 79,537%. Uji dekolorisasi limbah campuran menggunakan isolat 41 SRP dan diikuti dengan uji fisiko-kimia pra dan pasca perlakuan. Hasil yang didapatkan menunjukkan bahwa isolat 41 SRP dapat menurunkan toksisitas limbah batik yang ditandai dengan penurunan setiap parameter fisiko-kimia. Isolat 41 SRP memiliki aktivitas enzim laccase dengan aktivitas tertinggi sebesar 3,917 U/mL. Berdasarkan karakterisasi secara morfologi dan molekuler isolat 41 SRP merupakan *Trichoderma atroviride*.

**Kata kunci:** Fungi, Remazol *red*, Tingi (*Ceriops tagal*), Dekolorisasi, ITS.

## Abstract

### Characterization and Selection of Wastewater Containing Remazol Red and Tingi (*Ceriops tagal* (Perr.) C.B. Rob) Extract- Degrading Fungi in Surakarta Batik Industry

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Kampoeng Batik Laweyan is the largest batik producer in Surakarta. The use of synthetic dyes in remazol red and natural dyes from tingi bark (*Ceriops tagal* (Perr.) C.B. Rob) can be reactive and carcinogenic to the environment. This study aims to select fungi that can decolorize remazol red dyes and natural tingi dyes. Several stages were carried out in this study, namely isolating fungi from three types of samples, soil, water, and sludge, contaminated with dyes. Furthermore, the selection was carried out in several stages: using tannic acid media and decolorization tests in various concentrations. The isolate which had the best potential to decolorize the dye was tested for Physico-chemical degradation and activity of the laccase enzyme using ABTS as a substrate (2,2' azino-bis 3-ethylbenzothiazoline-6-sulfonic acid). Potential isolates were characterized based on morphological and molecular characters. A total of 97 isolates were found from the test samples. Each fungal isolate was screened to determine ligninolytic activity, which was characterized by forming a brown zone on the tannic acid medium. The screening results showed that seven potential isolates were coded (10 SPJ, 24 SPX, 41 SRP, 19 SPS, 12 SPL, 7 SPG, and 64 WZB). Ascomycota in the genus *Trichoderma*, *Fusarium*, and *Penicillium* were seven potential isolates. Isolate 41 SRP produced the highest percentage of decolorization in remazol red and tingi dyes at various concentrations with decolorization activity during incubation for 120 hour at each concentration (250, 500, 1000, and 1500 ppm) respectively for remazol red 87.772%, 76.053%, 68.615%, and 34.778% and tingi dye with percentages of 98.832%, 90.056%, 85.905%, and 79.537%. The mixed waste decolorization test used 41 SRP isolate followed by pre and post-treatment Physico-chemical tests. The results showed that 41 SRP isolates could reduce the toxicity of batik waste which was indicated by a decrease in each physico-chemical parameter. The 41 SRP isolate had laccase enzyme activity with the highest activity of 3.917 U/mL. Based on the morphology and molecular characterization, 41 SRP isolates were *Trichoderma atroviride*.

**Key Word:** Fungi, Remazol red, Tingi (*Ceriops tagal*), Decolorization, ITS