RINGKASAN

Pesatnya industri batik menghasilkan limbah zat warna, terutama napthol, yang sulit terdegradasi dan berbahaya bagi kesehatan. Untuk mengurangi dampak ini, metode dekolorisasi berbasis organisme seperti jamur, khususnya *Aspergillus* sp.3, efektif menghilangkan warna hingga 99,9%. Namun, penerapan teknologi ini di lapangan, seperti melalui bioreaktor berbahan akrilik, masih memiliki keterbatasan, seperti durasi penggunaan jamur yang tidak bertahan lama. Penggabungan metode biologi, fisika, dan kimia terbukti meningkatkan efektivitas dekolorisasi limbah hingga 79%. Penelitian ini mengusulkan modifikasi bioreaktor *double filter*, dengan filter pertama mengadopsi metode fisika-kimia menggunakan *Multi Soil Layering* (MSL), dan filter kedua berbasis biologi menggunakan jamur. Efisiensi dekolorisasi dipengaruhi oleh konsentrasi inokulum spora jamur, yang menentukan keberhasilan proses. Penelitian ini bertujuan mengetahui pengaruh *Aspergillus* sp.3 dalam mendekolorisasi limbah batik napthol pada bioreaktor *double filter* dengan variasi konsentrasi inokulum dan untuk mengetahui konsentrasi inokulum efektif dalam dekolorisasi.

Penelitian dilakukan di Laboratorium Mikologi dan Fitopatologi Fakultas Biologi Universitas Jenderal Soedirman menggunakan metode eksperimental dengan Rancangan Acak Kelompok (RAK). Inokulum *Aspergillus* sp.3 dibagi menjadi 6 kelompok (kontrol dan perlakuan) yang masing-masing dilakukan pengulangan sebanyak empat kali. Semua perlakuan diberi limbah napthol dengan pemberian inokulum, sementara kontrol tanpa inokulum jamur. Kelompok yang dimaksud diantaranya P1 (kontrol tanpa jamur), P2 (konsentrasi inokulum 10^4 spora/ml), P3 (konsentrasi inokulum 10^6 spora/ml), P4 (konsentrasi inokulum 10^8 spora/ml), P5 (konsentrasi inokulum 10^{10} spora/ml), P6 (konsentrasi inokulum 10^{12} spora/ml). Parameter utama yang diukur adalah persentase dekolorisasi warna limbah batik dan parameter pendukungnya adalah nilai DO, berat kering miselium, suhu, dan pH. Variabel bebasnnya adalah konsentrasi inokulum dan variabel terikatnya kemampuan *Aspergillus* sp.3 untuk mendekolorisasi limbah cair batik dalam bioreaktor *double filter.* Data persentase dekolorisasi selanjutnya dianalisis menggunakan analisis variansi (ANOVA) dengan tingkat kesalahan 5%.

Hasil penelitian menunjukkan bahwa *Aspergillus* sp.3 pada bioreaktor *double filter* mampu mendekolorisasi limbah cair batik pada variasi konsentrasi inokulum dengan persentase dekolorisasi 0%-95,8%. Variasi konsentrsi inokulum paling efektif pada konsentrasi inokulum 10^8 spora/ml sebesar 95,8%.

Kata kunci: *Aspergillus* sp.3*, bioreaktor double filter*, *dekolorisasi, konsentrasi inokulum, limbah batik napthol*

SUMMARY

The rapid development of the batik industry has led to the generation of colored wastewater, particularly containing napthol based dyes, which are highly resistant to degradation and pose significant health risks. To mitigate these impacts, biological decolorization methods using organisms such as fungi specifically *Aspergillus* sp.3 have demonstrated high efficacy, achieving up to 99.9% color removal. However, the practical implementation of this technology, particularly via acrylic-based bioreactors, remains limited by factors such as the short lifespan of fungal activity. Integrating biological, physical, and chemical approaches has been shown to enhance decolorization efficiency by up to 79%. This study proposes a modified double-filter bioreactor system. The first filter utilizes a physicochemical method based on Multi Soil Layering (MSL), while the second filter employs a biological treatment using fungal cultures. The success of the decolorization process is influenced by the concentration of fungal spore inoculum, which directly affects process efficiency. This research aims to evaluate the decolorization performance of *Aspergillus* sp.3 on napthol containing batik wastewater in a double-filter bioreactor across varying inoculum concentrations, and to determine the most effective inoculum concentration.

The experiment was conducted at the Laboratory of Mycology and Phytopathology, Faculty of Biology, Universitas Jenderal Soedirman, employing a Randomized Block Design (RBD). The inoculum of *Aspergillus* sp.3 was divided into six treatment groups (including a control), each replicated four times. All treatment groups received napthol-containing wastewater with varying fungal inoculum concentrations, while the control group received no fungal inoculum. The treatment groups consisted of: P1 (control, no fungi), P2 (10^4 spores/mL), P3 (10^6 spores/mL), P4 (10^8 spores/mL), P5 (10^{10} spores/mL), and P6 (10^{12} spores/mL). The primary parameter measured was the percentage of color removal, while supporting parameters included dissolved oxygen (DO), fungal dry biomass, temperature, and pH. The independent variable is the inoculum concentration, while the dependent variable is the decolorization ability of *Aspergillus* sp.3 in treating batik wastewater using a double filter bioreactor. The color removal data were statistically analyzed using Analysis of Variance (ANOVA) at a 5% significance level.

The results indicated that *Aspergillus* sp.3 in the double-filter bioreactor effectively decolorized batik wastewater at varying inoculum concentrations, achieving color removal rates ranging from 0% to 95.8%. The optimal inoculum concentration was identified at 10^8 spores/mL, yielding the highest decolorization efficiency of 95.8%.

Keywords: *Aspergillus* sp.3, *double filter bioreactor, decolorization, inoculum concentration, napthol batik wastewater.*