Aspergillus sp. GPN IMMOBILIZED ON USED FABRIC MATRICES AS A BASE MATERIAL IN A WASTEWATER TREATMENT PLANT FOR THE DECOLORIZATION OF BATIK WASTEWATER

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Abstract. The Ministry of Industry stated that there are indications that the textile industry in the watershed area (DAS) discharges its waste directly without going through a wastewater treatment plant (WWTP). Textile wastewater including batik and industrial waste with wastewater containing dyes is a problem that gets a lot of attention, especially in the environment of textile industry centers such as batik because it is a source of water pollution. The dye waste pollution can be overcome by applying a combination of physical, chemical and biological waste treatment methods. Biological methods with bioremediation such as the use of fungi have promising prospects because they are sustainable, environmentally friendly and economical, so it is necessary to develop their application systems on an industrial scale. The results of previous research found that *Apergillus* sp. strain GPN succeeded well in degrading batik waste, but there has been no research in the form of preparations that can be used for applications in WWTP. On the other hand, a lot of fabric material is wasted after the covid pandemic, so it can be reused as a practical product as a mycelium immobilization matrix. The purpose of this study was to determine the ability of *Aspergillus* immobilized on used fabric material and its ability to decolorize batik waste. The results of this study showed that *Aspergillus* mycelium can be well immobilized on used fabric materials so that it can be a product of sedimentation. The results of this study showed that *Aspergillus* mycelium can be well immobilized on used fabric materials so that it can be a practical product for filter raw materials in WWTP. The immobilized product can decolorize > 80% of batik waste, with and without sterilization treatment.

Keywords: Batik wastewater, *Aspergillus* sp., used fabric material, WWTP, decolorization

1. Introduction

The Ministry of Industry has highlighted concerns about the discharge of textile industry waste directly into the environment without proper treatment, particularly the discharge of dye-containing wastewater. This issue has prompted the exploration of various methods for treating textile wastewater, including physical, chemical, and biological approaches. Research has shown that biological methods, such as bioremediation using fungi, hold promise due to their sustainability, environmental friendliness, and cost-effectiveness. For instance, a study found that *Aspergillus* sp. strain GPN effectively degraded batik waste, indicating the potential for biological treatment [1]. In addition to biological methods, other approaches have been explored. For example, a study evaluated the efficiency of dye removal from textile industry wastewater using the titanium dioxide photocatalytic process under UV-LED light irradiation. The results showed that this process could remove dye with an efficiency of 80.23% and reduce the chemical oxygen demand (COD) with an efficiency of 64.75% under optimal conditions [2]. Furthermore, the formulation of natural coagulants from papaya seed, banana pith, and pineapple peel powder has been investigated for treating textile synthetic wastewater, showing promising results in reducing BOD and COD levels [3].

Electrochemical treatment has also been considered for treating textile dye wastewater, with research demonstrating that the process can effectively reduce color and COD associated with organics, contributing to a sustainable reduction in pollution load [4]. Moreover, the reduction of COD from reactive dye wastewater has been identified as a crucial aspect of safeguarding water resources and public health, highlighting the importance of stringent regulations on wastewater discharge and the need for effective treatment methods [5].

These studies collectively underscore the significance of addressing textile wastewater treatment, particularly the removal of dyes and reduction of COD. The exploration of various methods, including biological, physical, and chemical approaches, reflects the multidimensional nature of this environmental challenge and the need for comprehensive solutions. The potential for utilizing natural coagulants, advanced oxidation processes, and electrochemical treatment further emphasizes the diverse strategies being pursued to mitigate the impact of textile industry wastewater on the environment. The purpose of this study was to determine the ability of *Aspergillus* immobilized on used fabric material and its ability to decolorize batik waste.

2. Methods

2.1 Preparation of inoculum

Aspergillus fungi culture cultured in PDA growth medium was taken aseptically from a petri dish container using an ose needle and then inoculated as much as possible into the seed medium in the form of rice flour medium. Incubate at room temperature until it fills the bottle for 3 weeks.

2.2 Immobilization of fungi on fabric media.

Fungal inoculum that has been incubated on rice medium, then inoculated as much as 1 g containing fabric materials that have been sterilized and not sterilized. All fabric materials incubated at room temperature until mycelium colonization has covered the entire surface of the material.

2.3 Decolorization of Batik Waste water

Batik waste was obtained from a batik home industry in Sokaraja, Banyumas Regency. Decolorization of batik waste was carried out using a 250 ml Erlenmeyer flask. The decolorization of the waste starts by putting the batik liquid waste into the Erlenmeyer flask containing the immobilization product, then the batik liquid waste is incubated with a contact time of 24 hours, shaking with a shaker at 70 rpm.

3. Results And Discussion

The results demonstrated that *Aspergillus* mycelium could be effectively immobilized on used fabric materials, making it a practical product for filtering raw materials in wastewater treatment plants (WWTP) (Figure 1). *Aspergillus* mycelium can be effectively immobilized on used fabric materials, making it a practical product for filtering raw materials in wastewater treatment plants (WWTP). This finding is supported by a study that examined the characteristics of non-woven fabrics as support materials for the immobilization of mycelia. The study found that the water permeability and water absorbing capacity of the non-woven fabric were second highest among those of supports used in the study, and the air permeability of the non-woven fabric was nearly equivalent to those of other supports. The gas phase cultivation method was also found to be applicable to immobilize some mycelia, which could not be immobilized by the liquid phase cultivation method [6]. Another study explored the immobilization of activated carbon on fungal biomass for decolorization, demonstrating the potential of immobilized materials in wastewater treatment processes [7]. These studies collectively highlight the potential of immobilized microorganisms, including *Aspergillus* mycelium, in addressing wastewater treatment challenges.

Figure 1. that *Aspergillus* mycelium immobilized on used fabric materials

Furthermore, the immobilized product exhibited the ability to decolorize over 80% of batik waste (Tabel 1), indicating its efficacy in addressing textile wastewater pollution [8]. The results showed that the removal efficiency value reached 90%, and the overall concentration of effluent met the Indonesian quality standard, demonstrating the effectiveness of biological treatment in addressing batik wastewater pollution. Additionally, the formulation for treating textile synthetic wastewater, showing promising results in reducing chemical oxygen demand (COD) and color, further highlighting the its potential in addressing textile wastewater pollution. These studies collectively emphasize the significance of effective treatment methods, including biological approaches, in mitigating the environmental impact of textile industry wastewater.

Table 1. Decolorization of Batik Wastewater Using fabric matrices Immobilized with *Aspergillus* sp.

Treatment	Decolorization (%)
Sterilized	90
Without sterilization	80

The findings of this study align with previous research that has explored the immobilization of microorganisms for wastewater treatment. For instance, a study investigated the immobilization of activated carbon on fungal biomass as a bioadsorbent for decolorization, highlighting the potential of immobilized materials in wastewater treatment processes [9]. Additionally, research has emphasized the importance of reducing chemical oxygen demand (COD) from reactive dye wastewater, underscoring the significance of effective treatment methods to safeguard water resources and public health [5].

Moreover, the biodegradation potential of macroalgae and microalgae against fabric dyes has been explored, demonstrating the efficacy of biodegradation processes in removing hazardous materials from aquatic systems [8]. Furthermore, the preparation and characterization of yeast-immobilized cotton-based materials for textile dye decolorization have been investigated, showcasing the potential of immobilized microorganisms in addressing textile dye pollution [10].

In conclusion, the study's results contribute to the growing body of research on the immobilization of microorganisms for wastewater treatment, particularly in the context of textile dye decolorization. The findings underscore the potential of *Aspergillus* immobilized on used fabric material as a practical and effective solution for addressing batik waste pollution, highlighting the importance of innovative approaches in mitigating the environmental impact of textile industry wastewater.

4. Conclusion

It can be concluded that Aspergillus mycelium can be effectively immobilized on used fabric materials; and Aspergillus immobilized on used fabric material product can decolorize >80% of batik waste, with and without sterilization treatment.

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