Textile dye biosorption using residual fungal biomass.

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Abstract: During the fermentation process for enzyme production or other metabolites, it is common resulting fungal biomass to be discarded without reuse. However, this biomass can be employed as a biosorbent to treat effluents [1], especially relevant in textile industries, where the disposal of effluents containing dyes and other contaminants represents a significant environmental challenge [2]. In this study, the biomass from the fungus *Botryosphaeria ribis* EC-01, cultivated in a medium optimized for lipase production [3], was used as a biosorbent to treat solutions containing reactive dyes. The biomass was previously lyophilized and characterized using various analytical techniques, including Thermogravimetric Analysis (TGA), Nitrogen Physisorption, determination of the Zero Charge Point (pHPCZ), Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM). Treatment of reactive dye solutions was conducted using a 2^3 factorial design, resulting in a discoloration of up to 80.32% in 165 minutes, with a dye concentration of 55 mg L^{-1} and 125 mg of biomass. When optimizing pH and temperature conditions for treating real effluents, it was observed that temperature did not have a significant impact on the discoloration, while variations in pH positively contributed to the process. This study demonstrates the feasibility of using residual fungal biomass as a biosorbent for the removal of reactive dyes, highlighting its effectiveness in effluent treatment.

Keywords: *biosorbent, Botryosphaeria ribis EC-01, adsorption, textile effluent.*

Biomass after lyophilized and characterized presented a low specific area, and a smooth surface with no pores. Although there are large cavities that can allow dye molecules to enter the lignocellulose structure and interact with the surface [4]. Dye decolorization analysis of variance (ANOVA) using biomass is presented in Table 1 that shows the model is reliable and statistically significant ($p \leq 0.1$), with $R^2 = 0.89$ and Fcal > F tab for the model and Fcal < F tab for the lack of fit.

Table 1 Analysis of variance (ANOVA) for dye biosorption using lyophilized biomass of *Botryosphaeria ribis* EC-01

Response	Source of Variation	Sum of Squares (SS)	Degrees of Freedom (DF)	Mean Squares (MS)	*F* teste F_{calc}	F_{list}
Discoloration (%)	Regression	3354,7	4	838,67	[a] 23,74	2,48
	Residual	423,91	12	35,326		
	Lack of Fit	372,68	10	37,268	[b] 1,45	9,39
	Pure Error	51,234	2	25,617		
	Total	3778,6	16			

R^2=0,89; [a]F 90%4,12; [b]F 90%10,2

Figure 1 presents the three-dimensional curves generated for this model showing variable interactions.

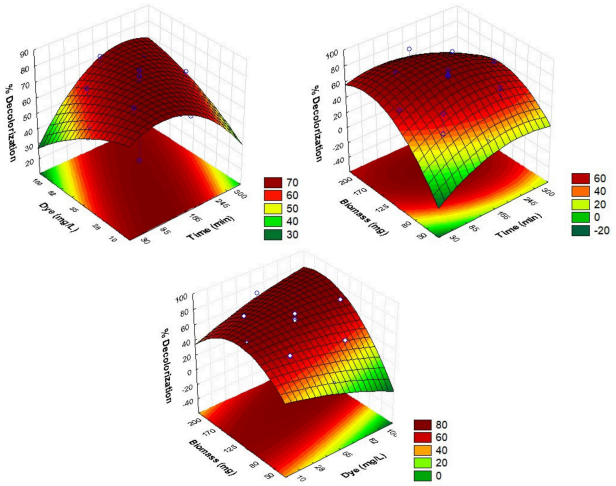

Figure 1 Response surfaces for dye decolorization

According to the desirability profile,discoloration of 81.83% can be achieved when time, dye concentration and biomass is 67 min., 100 mg L^{-1} and 200 mg, respectively. This optimal condition was tested and discoloration of 77.0 ± 1.05 was obtained, showing that the model is predictive experimentally.

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