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WHITE ROT FUNGI CAPABLE OF DECOLOURISING TEXTILE DYES UNDER ALKALINE CONDITIONS

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ABSTRACT

Four different white rot fungi were screened to study the decolourisation of the textile dyes Reactive Black 5 (RB5) and Poly R-478 on plates under alkaline condition. Three strains of *Trametes versicolor* (MUM 94.04 MUM 04.100 MUM 04.101) and one strain of *Phanerochaete chrysosporium* (MUM 94.15), showed better decolourisation results. The strains were used for decolourisation study in liquid culture medium (LCM). All four strains presented more efficient decolourisation on dye RB5, but they differed in decolourisation capacity depending on the analised pH value. In LCM the decolouration of dye reached 100% for the two strains of WRF studied.

INTRODUCTION

The textile industry wastewater are rated as the most polluting among all industrial sectors in terms of both volume and composition of the effluents (Asgher et al. 2009). Stringent regulations have been imposed on industries to treat their waste effluents prior to their final discharge in the environment (Husain 2010). Textile effluents are characterized by extreme fluctuations in many parameters, such as, chemical oxygen demand (COD), biochemical oxygen demand (BOD), pH, colour and salinity (Ramachandran et al. 2009), Chemical and physical methods for treatment of textile effluents are not widely applied because of exorbitant costs and disposal problems(Verma et al. 2010). Thus, there is need to search microorganisms for treating textile effluents, that could be able of growing under strict conditions and having strong ligninolytic system. White rot fungi (WRF) can produce several enzymes which have been related to their ability to degrade natural polymers, such lignin and cellulose, but can also degrade different synthetic chemicals, usually recalcitrant to biodegradation like textile dyes (Martins et al. 2003). The ability to degrade such a diverse group of compounds depends on the nonspecific fungal ligninolytic enzymatic system, presenting lignin peroxidases (LiP), manganese peroxidases (MnP) and laccase (Lcc) (Martins et al. 2002). Moreover, proteases and glyoxal oxidase (GLOX) appear as important enzymes to be studied since they are also

produced by WRF and can influence the overall biodegradation performance.

METHODOLOGIES

Four different WRF strains, *Trametes versicolor* MUM94.04 MUM04.100 MUM 04.101 and *Phanerochaete chrysosporium* MUM94.15 obtained from the Micoteca da Universidade do Minho (MUM) culture collection were used. Decolourisation of Reactive Black 5 (RB5) and Poly R-478 (PR478) at 0.1 gl^{-1} concentration were carried out in solid and liquid medium containing Yeast Nitrogen Base supplemented with 5 gL-1 saccharose. The effect of pH in a range from 8 to 10 was studied. The mycelia growth and decolourisation of each fungus was recorded based on the clear zones formed after incubation at 30 ºC over 14 days. In liquid medium the samples were incubated at 30 ºC with shake (150 rpm) during 7 days. On days 1, 3, 5 and 7 the decolourisation, saccharose and enzymatic activities (LiP, MnP, Lcc, glioxal oxidase (GLOX) and proteases) were assessed using absorbance, HPLC and colorimetric methods, respectively. The fungal biomass was also evaluated by dry-weight method.

DISCUSSION OF OBTAINED RESULTS

The four strains decolourised more efficiently RB5 than PR478. The decolourisation process of RB5 by *T. versicolor* (MUM 94.04, MUM 04.100 and MUM 04.101) *and P. chrysosporium* MUM 94.15 at pH 9.5 achieved the best results by two strains studied. Cem percent of decolourisation was obtained by *T. versicolor* MUM 94.04 and MUM 04.100. In contrast, MUM 94.15 and MUM 04. 101 only reached 75% of decolourisation. Furthermore, among the ligninolytic enzymes produced by *T. versicolor* MUM 94.04 and MUM 04.100 Lcc had the highest activity. Activities of LiP, MnP, GLOX and proteases were also quantified. For *P. chrysosporium* MUM 94.15 very low LiP and MnP activities were detected at pH 8.5-10.0 in the samples although the decolourisation was similar to that observed in *T. versicolor* MUM 04.101.

CONCLUSION

The four strains decolourised more efficiently RB5 than PR478. Concerning RB5, MUM 94.04, MUM 04.100 yielded best results rising 100% of decolourisation at pH 9.5. Among the ligninolytic enzymes produced by MUM 94.04 and MUM 04.100 Lcc had the highest activity. Activities of LiP, MnP, GLOX and proteases were also quantified. For *P. chrysosporium* MUM 94.15 very low LiP, MnP, activities were detected at pH 8.5-10.0 in the samples although the decolourisation was similar to that observed in *T. versicolor* MUM 04.101.The results showed that increase alkaline conditions turn the fungal decolourisation more strictly. Mechanisms of dyes degradation for each strain are now under studied.

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