WHITE ROT FUNGI CAPABLE OF DECOLOURISING TEXTILE DYES UNDER ALKALINE CONDITIONS

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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 in order to treat their waste effluents prior to their final discharge in the environment (Husain 2010). Textile effluents are characterised 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). Accordingly, 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 (Ottoni el al, 2011).

Aim

Find the best conditions to WRF decolourise the reactive black 5 (RB5) and Poly R-478 (PR478) in high alkaline pH values.

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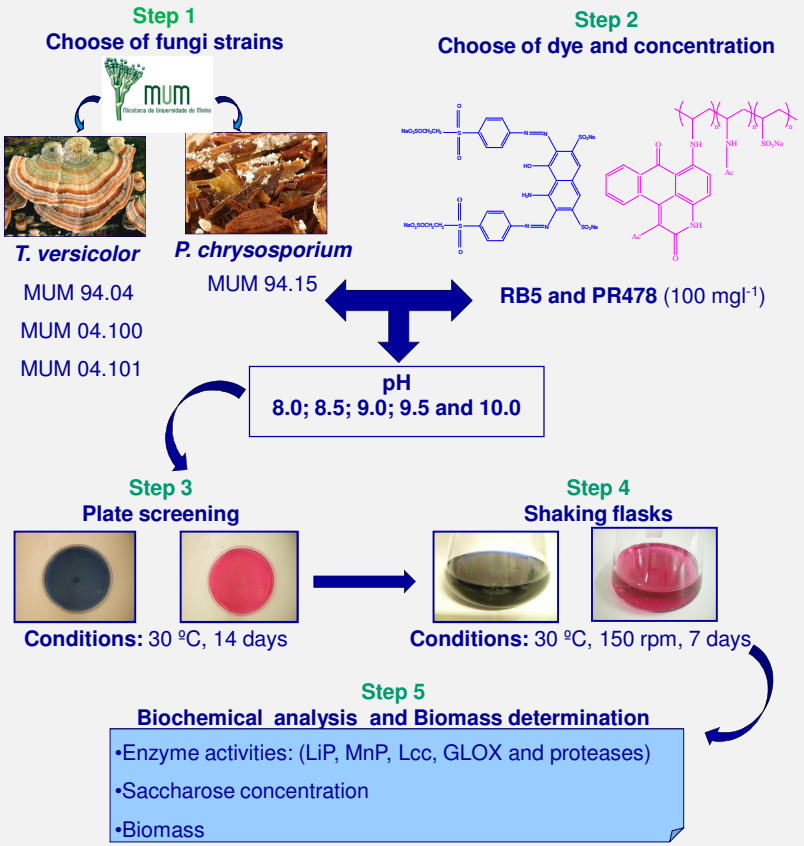
Strategy

Three different *Trametes versicolor* (MUM 94.04, MUM 04.100 and MUM 04.101) and one *Phanerochaete chrysosporium* (MUM 94.15) strains obtained from the Micoteca da Universidade do Minho (MUM) Fungal Culture Collection were used. The respective dyes was carried out on plates containing yeast nitrogen base, saccharose and RB5 with a pH range from 8.0 to 10.0 (Scheme 1, steps 1 to 4). The strains producing decolourisation by radial fungal growth were further studied on liquid medium under the same conditions (Scheme 1, steps 4 to 5).



Scheme 1: Strategy used for the decolourisation screening of RB5 and PR478 by *Trametes versicolor* and *Phanerochaete chrysosporium* in plate and liquid media.

Results

The four strains decolourised more efficiently RB5 than Poly R-478. The Fig. 1 shows the decolourisation process for RB5 by *T. versicolor* (MUM 94.04, MUM 04.100 and MUM 04.101) *and P. chrysosporium* MUM 94.15 at pH 9.5, that was the best pH value. At these conditions, the two *T. versicolor* strains (MUM 94.04 and MUM 04.100) achieved the best results with 100% of decolourisation (Fig. 1 A and C). In contrast, MUM 04.101 and MUM 94.15 only reached 75% of decolourisation (Fig. 1 B and D). Furtermore, among the ligninolytic enzymes produced by the two *T. versicolor* strains (MUM 94.04 and MUM 04.100) Lcc had the highest activity. Activities of LiP, MnP, GLOX and proteases were also quantified (Fig. 1 A to D). In contrast, for *P. chrysosporium* strain MUM 94.15 Lcc was not detected. However, the main dye degradative capability of this strain on RB5 was believed to the LiP and GLOX activities.

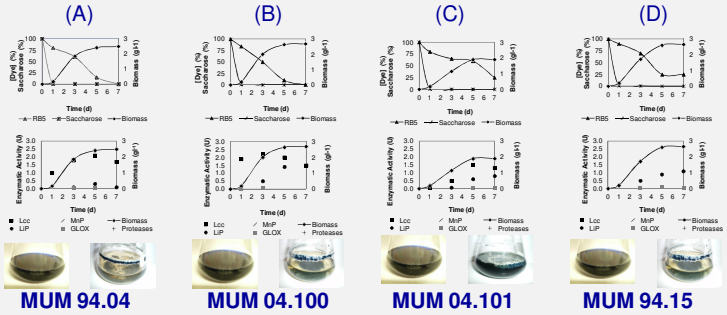


Figure 1: Decolourisation of RB5 by: (A) *P. chrysosporium* MUM 94.15, (B) *T. versicolor* MUM 94.04, (C) *T. versicolor* MUM 04.100 and (D) *T. versicolor* MUM 04.101 at pH 9.5, 30 ºC and 7 days.

Conclusions

The results obtained show that the analysed strains present high potentiality to degrade textile dyes in alkaline conditions, achieving decolourisation between 75 and 100%. Mechanisms of dyes degradation for each strain are now under studied.

References

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