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UTILIZATION OF WHITE ROT FUNGI FOR TEXYILE DYE DECOLOURISATION UNDER ALKALINE CONDITION AND HIGH SALT CONCENTRATION IN SOLID MEDIUM

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ABSTRACT

A large amount of azo dyes are used for dyeing textiles. However, the dyes contaminate wastewaters and need to be treated. This is important because of the aesthetic, toxic and carcinogenic effects of the affected waters. Recently there has been an increase in interest in using white rot fungi (wrf) which degrade xenobiotic compounds including azo dyes. Wrf degrade lignin and others recalcitrant molecules using nonspecific extracellular enzymes. Four white rot fungi obtained from the Micoteca da Universidade do Minho (MUM) culture collection were used to screen for degradability capabilities. Reactice Black 5 (RB5) was selected in the present work because these dyes are most commonly used in the textile dyeing. Screening for RB5 decolourisation was carried out on solid medium in plates. Two wrf showed good growth and decolourisation abilities. These are now under study to determine which ligninolytic enzymes are produced.

INTRODUCTION

Wastewater from textile industries has been characterized as; extremely colored and alkaline with high load of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), dissolved and suspended solids [1].Synthetic dyes represent a large group of chemically different compounds, which are classified by their chromophore [2]. Among all dyes and pigments used *azo* dyes constitute the major class of environmental pollutants accounting for 60–70% [3].

Nowadays, environmental regulations in most countries require that textile effluents must be decolourised before they discharge. This has led to the necessity of find an innovative and an environmentally friendly treatment technologies to complement or replace the conventional ones [4]. To protect the environment, strategies that extend the range of xenobiotic compounds degraded in wastewater treatment or the capacities of degradation of microorganisms are required [5].

White rot fungi (WRF) produce several enzymes that have been related to their ability to degrade natural polymers such as lignin and cellulose, but can also attack different synthetic chemicals, usually recalcitrant to biodegradation [6].

The aim of this work was to expand the study about the dye decolourisation of RB5 using wrf in solid medium under alkaline condition and high salt concentration

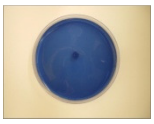
METHODOLOGIES

Four different WRF strains, *Trametes versicolor* MUM94.04, MUM04.100, MUM04.101 and *Phanerochaete chrysosporium* MUM94.15 obtained from the Micoteca da Universidade do Minho (MUM) culture collection were used. Decolourisation of Reactive Black 5 (RB5) at 0.1 gl^{-1} concentration was carried out in solid medium containing Yeast Nitrogen Base supplemented with 5 gl^{-1} saccharose. The effect

of high level of pH (9.50) and salt (5.0-20.0 gl^{-1}; intervals 5.0) concentrations were studied. Plates were inoculated in the centre with an 8 mm disc of fungus grown on TWA-cellulose medium for 7 days. The cellular growth and relative decolourisation of each fungus was recorded based on the clear zones formed around the mycelial disc after incubation at 30 ºC for 28 days.

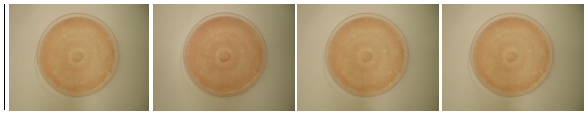
DISCUSSION OF OBTAINED RESULTS

The efficiency of four WRF strains for the decolourisation of the textile dye RB5 under strict conditions was assessed. The effect of salt concentration (NaCl) was investigated in a range 5-20 gl^{-1} with an pH 9.50 (value determinated on previous work) for 28 days. According **Figure 1** the effect of the interaction of high pH and salt concentration, MUM94.04 and MUM04.100 showed good growth and decolourisation abilities until 20 gl^{-1}above this value decreased the rate of decolourisation.

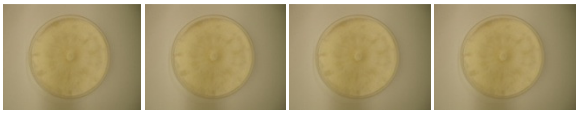


Control

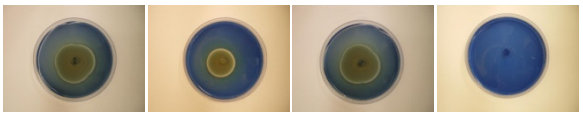
(A)



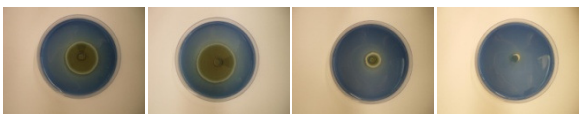
(B)



(C)



(D)



5.0gl^{-1} 10.0gl^{-1} 15.0gl^{-1} 20.0gl^{-1}

Figure 1: Decolourisation of RB5 by: **(A)** *T. versicolor* MUM 94.04, **(B)** *T.versicolor* MUM04.100, **(C)** *T.versicolor* MUM04.101, **(D)** *Phanerochaete chrysosporium* at pH 9.50; salt concentration (5.0-20.0 gL^{-1}); 30^{o}C after 28 days.

CONCLUSION

The white rot fungus *T. versicolor* MUM94.04 and MUM04.100 showed high capability to decolourise the recalcitrant diazo dye RB5 under restricted alkaline and salt conditions. The high alkaline condition plus salt concentration above 20gl^{-1} decreased the rate of decolourisation, indicating a probably enzymatic inibition. Aiming to expand the scale of studies, the best conditions obtained in the solid medium tests are being applied in. liquid medium The enzymes involved in the decolourisation of RB5 should be investigated and their interrelationships as well.

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