Isolation and screening of yeast strains possessing synthetic dye-decolorizing activity

Silva, A.R.S., Vaz, M.J.S., Kwiatkowska, B., Malcata, F.X., Pintado, M.E. and Moreira, P.R.*

CBQF / College of Biotechnology, Rua Dr. António Bernardino de Almeida, P-4200-072 Porto, Portugal.

* prmoreira@mail.esb.ucp.pt

Introduction

Synthetic dyes — although extensively used in several industrial sectors, due to their aromatic moieties, are often highly recalcitrant. Furthermore dyes can cause considerable environmental pollution, so their removal has received considerable attention. A few microorganisms have been found that can degrade dyes; including filamentous fungi due to their extracellular enzyme systems (Moreira *et al.*, 2001). Yeasts, however, possess the advantage of growing faster than filamentous fungi, and some can easily resist to adverse environments. Nevertheless, degradation of synthetic dyes by yeasts has not been extensively studied to date.

Materials and Methods

Four commercial dyes were used — Remazol® Black BA, Levafix® Blue Ca, Levafix® Yellow CA and Levafix® Red CA (Dystar). A standard anthraquinone dye, Remazol Brilliant Blue R (RBBR, Sigma) was also used. Dye stock solutions were added to solid or liquid decolorization media, up to 200 mg.L^{-1} final concentration. Rose Bengal Agar and Potato Dextrose Agar (both from Difco) were used for yeast isolation and maintenance. Normal Solid Decolorization Media (NSDM) and Normal Liquid Decolorization Media (NDM) were prepared, as described by Pajot *et al.* (2007), and used for decolorization assays. Yeast strains were isolated from wastewater samples collected at biological treatment and homogenization tanks, from two wastewater stations receiving textile effluents. Newly isolated yeasts, as well as a few ones isolated previously from cheese were evaluated for decolorization ability in in NSDM at 30 ºC, along 48 h. Three isolates were selected for further evaluation of decolorization ability in NDM at 30ºC (120 rpm) for 72 h.

Results

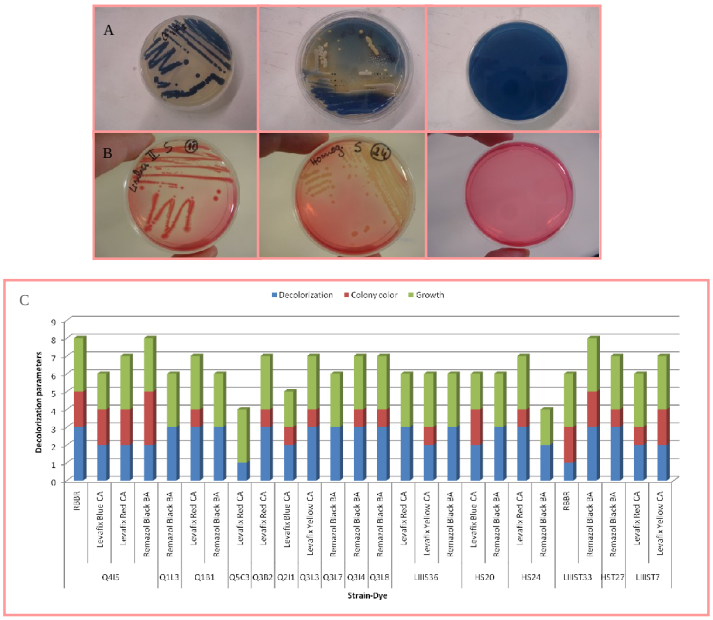

Figure 1. Preliminary observation of decolorization characteristics of strains with performance tested for dye decolorization on NMD medium: (A) Examples of decolorization for Remazol Black BA. (B) Examples of decolorization for Levafix Red CA. (C) Decolorization parameters, 0 to 3: no decolorization (0) to maximum halo of decolorization (3); no colony color (0) to deeply colored colony (3); and no growth detected (0) to maximum growth (3). Strains with references starting with letter Q refer to institutional isolates (cheese) and others to isolates from wastewater treatment stations.

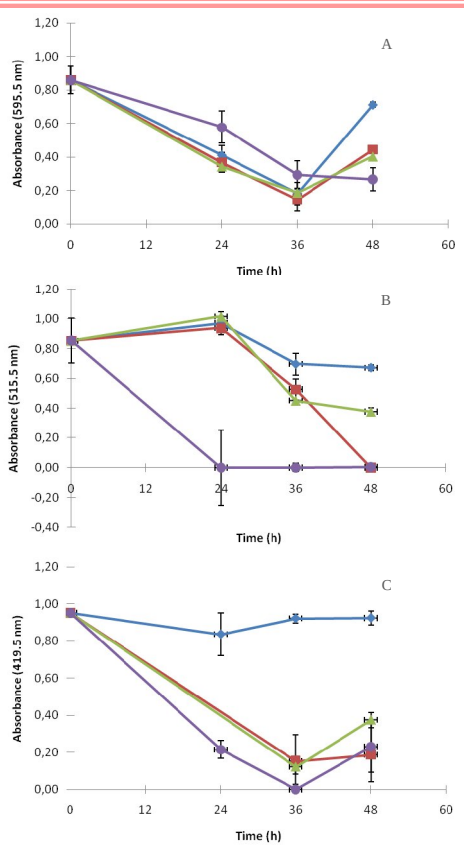

Figure 2. Yeast decolorization of Remazol Brilliant Blue R (A), Levafix Red CA (B) and Levafix Yellow CA (C), in NDM medium after 48 h of cultivation. Abiotic control (◆), isolate HS20 (■), isolate HS24 (▲) and isolate LIIIS36 (●).

Discussion and Conclusions

The preliminary screening from wastewater station samples allowed to isolate 46 yeast isolates. Remazol Black BA was, by far, the dye decolorized fastest (Fig. 1). Isolates HS20, HS24 and LIIIS36 were selected for further evaluation on NDM liquid media, due to their high decolorization ability coupled with low dye adsorption to yeast cells (Fig. 1). Among those, LIII36 exhibited the best performance and the possibility to decolorize various dyes with the same strain (Fig. 2). The results obtained provide a useful background to propose new environment-friendly alternatives to treatment of textile dye effluents.

References

Moreira, P.R. *et al.* 2001. Decolorization of a Remazol Brilliant Blue R via a novel *Bjerkandera* sp. Journal of Biotechnology, 89: 107-111.

Pajot, H.F. *et al.* 2007. Dye-decolorizing activity in isolated yeasts from the ecoregion of Las yungas (Tucumán, Argentina). Enzyme and Microbial Technology, 40: 1503-1511.

Acknowledgments

Author P.R. Moreira acknowledges Fundação para a Ciência e a Tecnologia (Portugal) for a postdoctoral grant (ref. SFRH/BPD/26527/2006), under the supervision of author F. X. Malcata. The authors would like to acknowledge Eng. João Marques (Mapril), Eng. Claúdio Costa (Tratave) and Eng. António Soares (LanXess), for their helpful collaboration throughout this study.