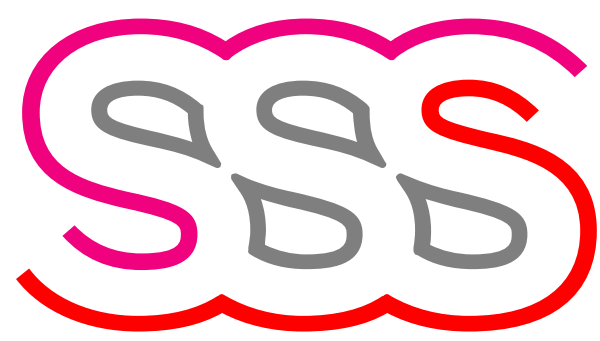


Laccase-aided bleaching treatments onto cellulosic fibers

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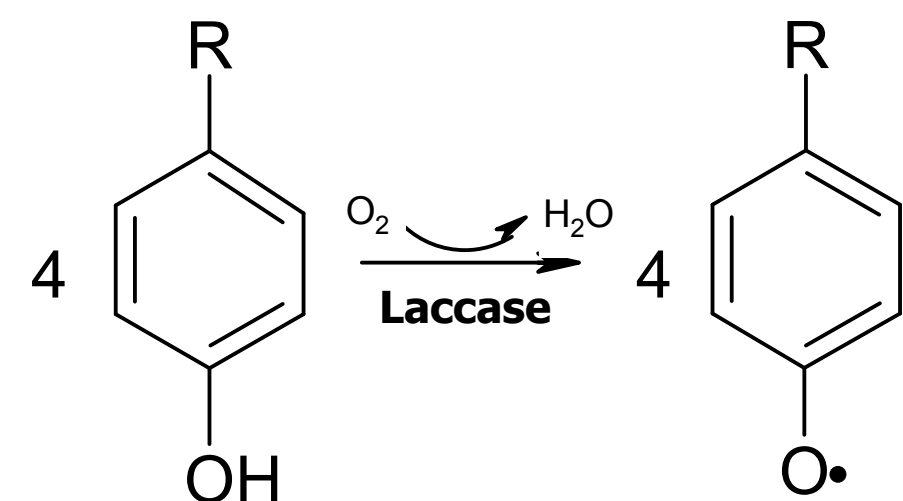
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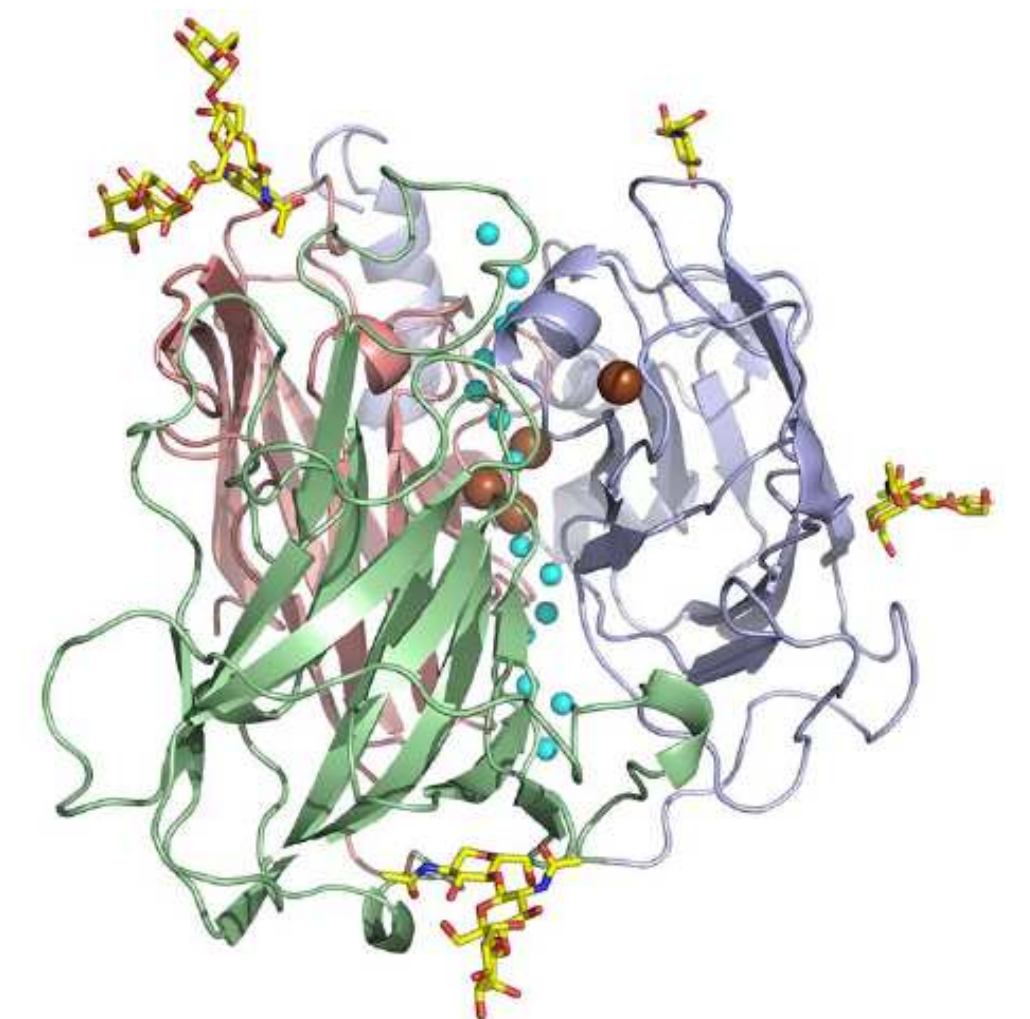
INTRODUCTION

- Laccases → blue multicopper oxidases generally obtained from the white-rot fungi and other natural sources.

- Mechanism:



- Use of laccase in textile industry → dyes degradation, textiles bleaching, fabric surface modifications.
- Laccase effects on cellulosic fibers → oxidizing lignin, mainly responsible for the yellow color of raw cellulosic fibers.

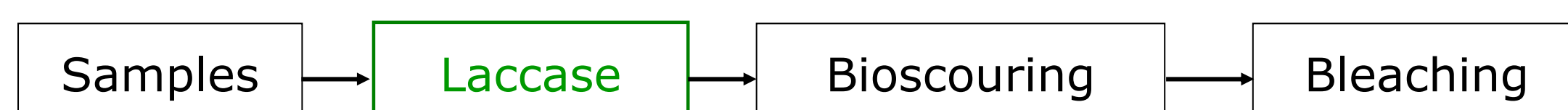
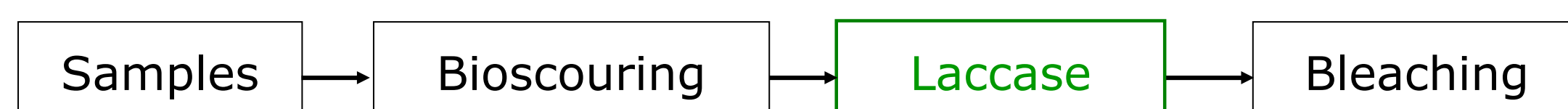


Aim of the work

Improving bleaching performance of cellulosic fibers and in the meantime keeping good features regards textile material, using a lower amount of chemical agents on samples pretreated with laccase.

MATERIALS AND METHODS

- Samples:** cotton or flax fabrics.
- Laccase:** cotton samples were treated with laccase (0.05 g/L, Denilite IIS, Novozymes) in sodium acetate buffer pH 4.5 with wetting agent (0.5 g/L) for 30 min at 55°C. Flax samples were treated with laccase (8 g/l) for 60 minutes at 50°C in sodium acetate buffer 0.1M at pH 5.
- Bioscouring** was carried out with pectinases and cutinase (Novozymes), a sequestering agent (0.5 g/L) and a wetting agent (1 g/L) at 55°C for 30 min, pH 8.5 in a Mathis Labomat equipment.
- Bleaching** was realized with H₂O₂ (40% v/v, from 1 to 12ml/l for cotton, from 1 to 10ml/l for flax), sodium hydroxide (36 Bè) and a stabilizer for 30 min at 98°C in a Mathis Labomat equipment.
- Samples were characterized by spectrophotometric analyses in order to determine the white index.
- Several tests were performed by varying the sequence of the different processing steps :



CONCLUSIONS

- Laccase pre-treatment could aid bleaching process thanks to its capability of oxidizing lignin substances.
- This effect is appreciable especially on textile materials rich in lignin, which is the natural laccase substrate.
- It's possible to reduce the environmental impact, using a lower amount of hydrogen peroxide and in the same time obtaining comparable white index than treatments using higher amount of bleaching agent.

RESULTS

- Cotton samples** (Fig. 1a):
 - laccase treatment ⇒ same White Index obtained with multi-steps process.
- Flax samples** (Fig. 1b):
 - "only laccase" ⇒ best treatment;
 - laccase treatment, before or after scouring ⇒ better White Index than treatment without laccase;
- ↑ [H₂O₂] ⇒ ↑ White Index

Advantages of laccase treatment in term of bleaching process are more appreciable on flax samples probably because of different percentage of lignin contained.

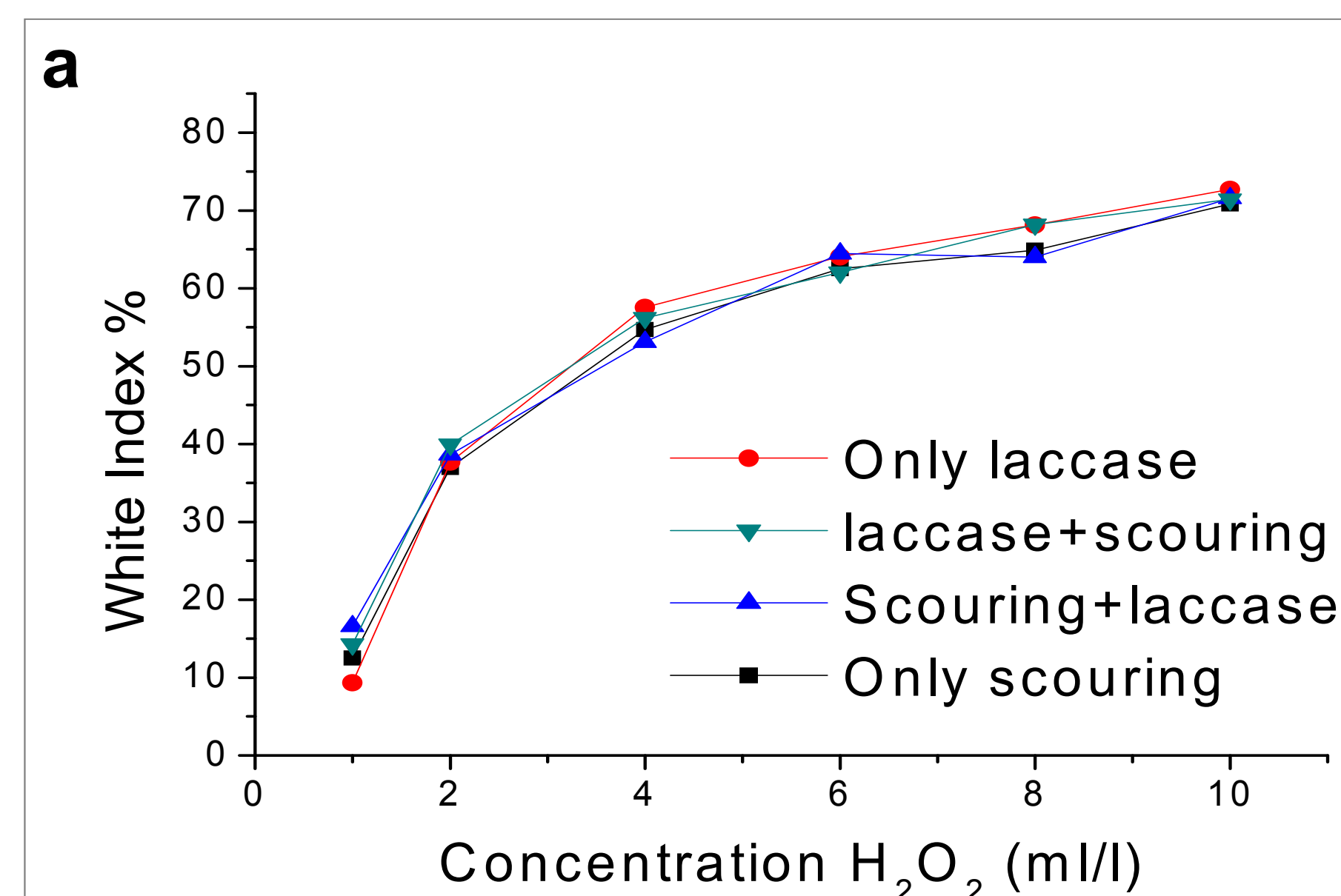
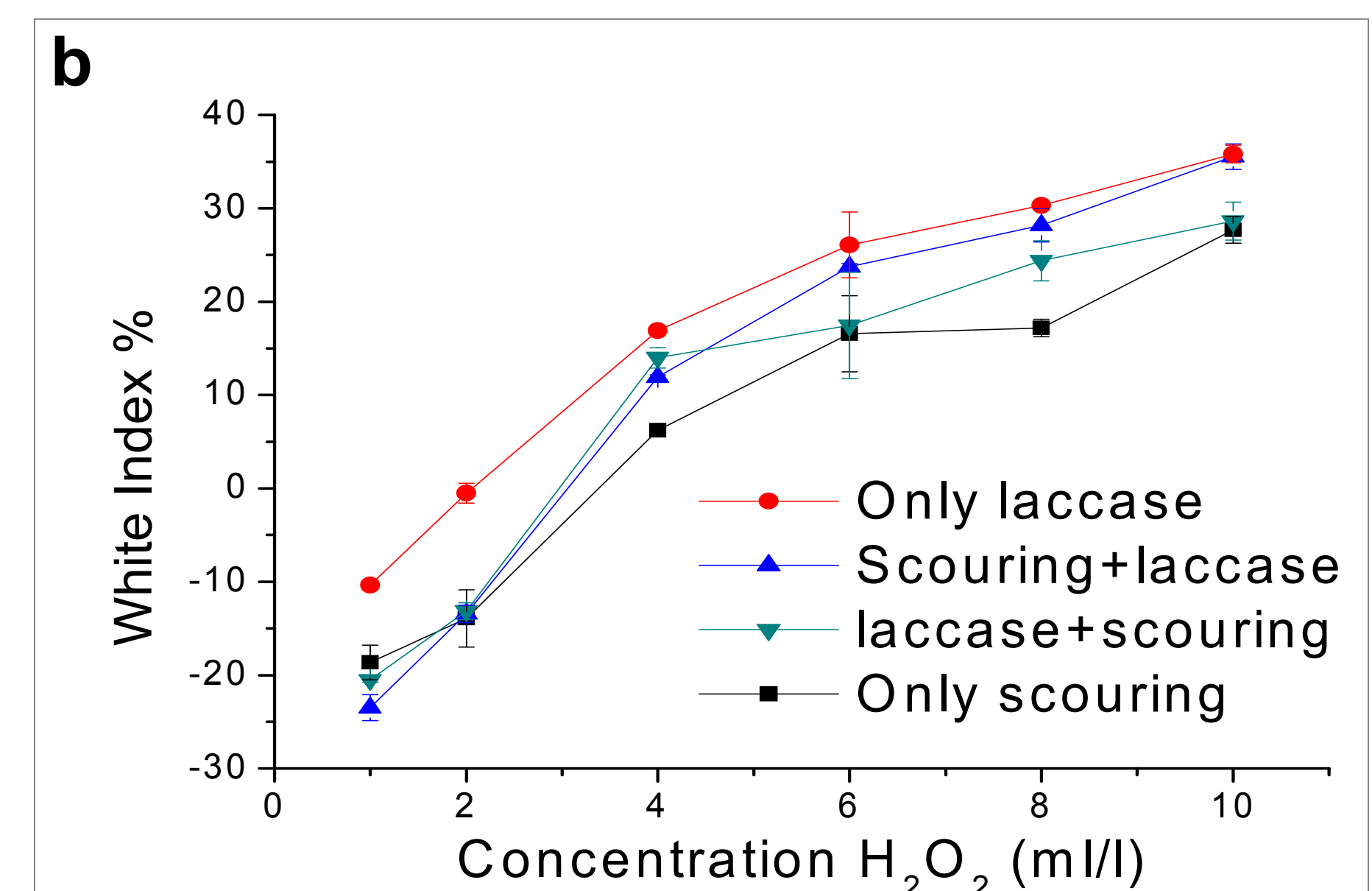


Figure 1: White Index of samples treated in different ways (only scoured, scoured and then treated with laccase, treated with laccase and then scoured, only treated with laccase) and then bleached with H₂O₂ at different concentration: a) cotton; b) flax.



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