

# Laccase-aided bleaching treatments onto cellulosic fibers

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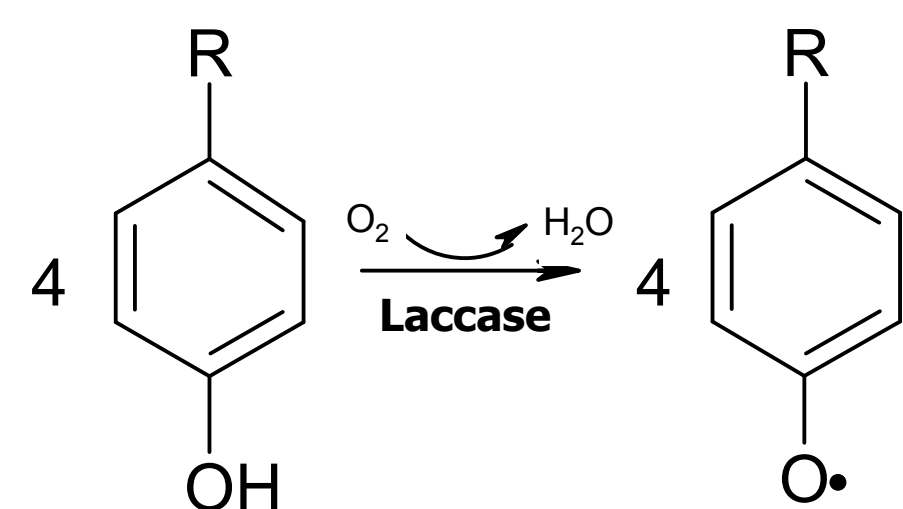
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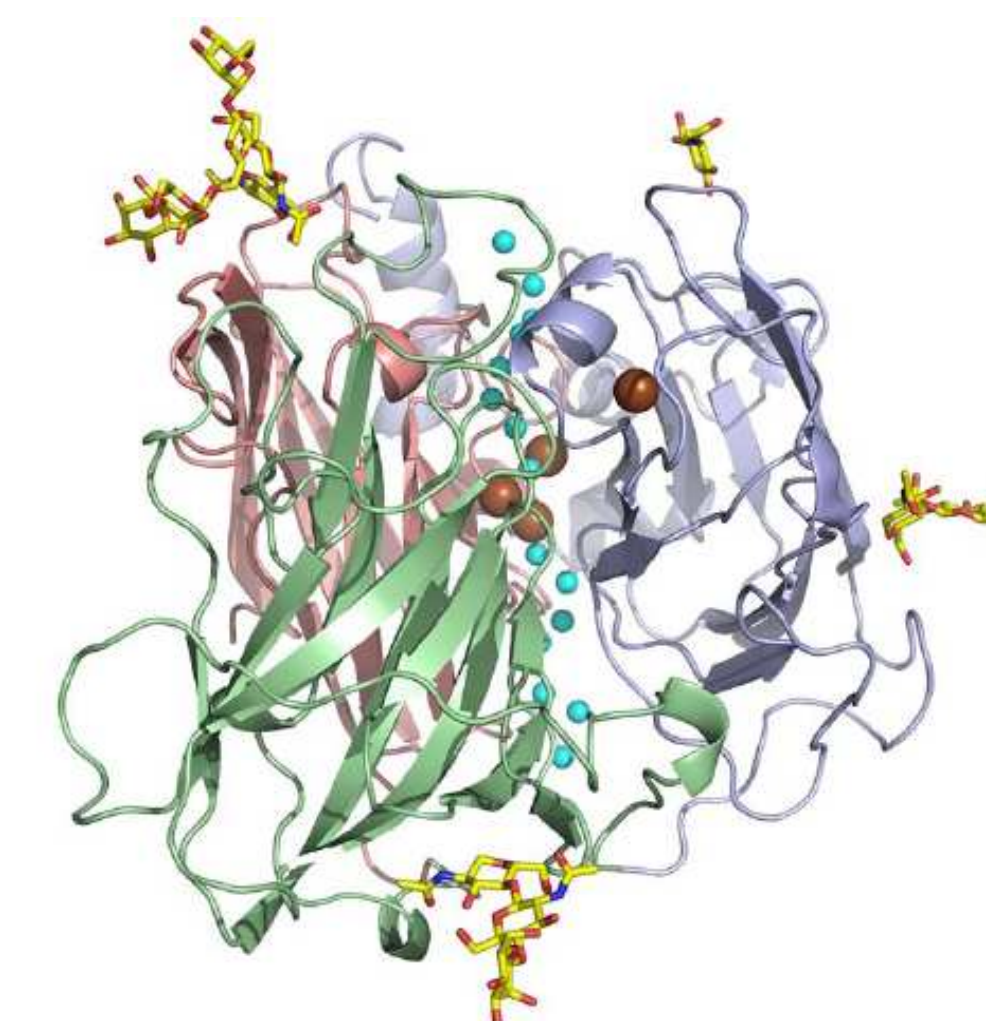
## INTRODUCTION

- 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.

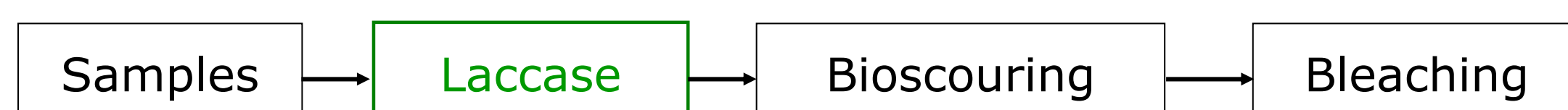
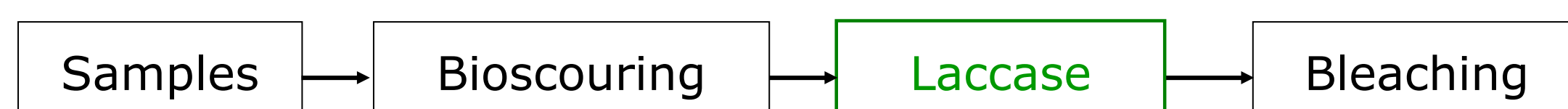


## Aim of the work

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 H<sub>2</sub>O<sub>2</sub> (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 :



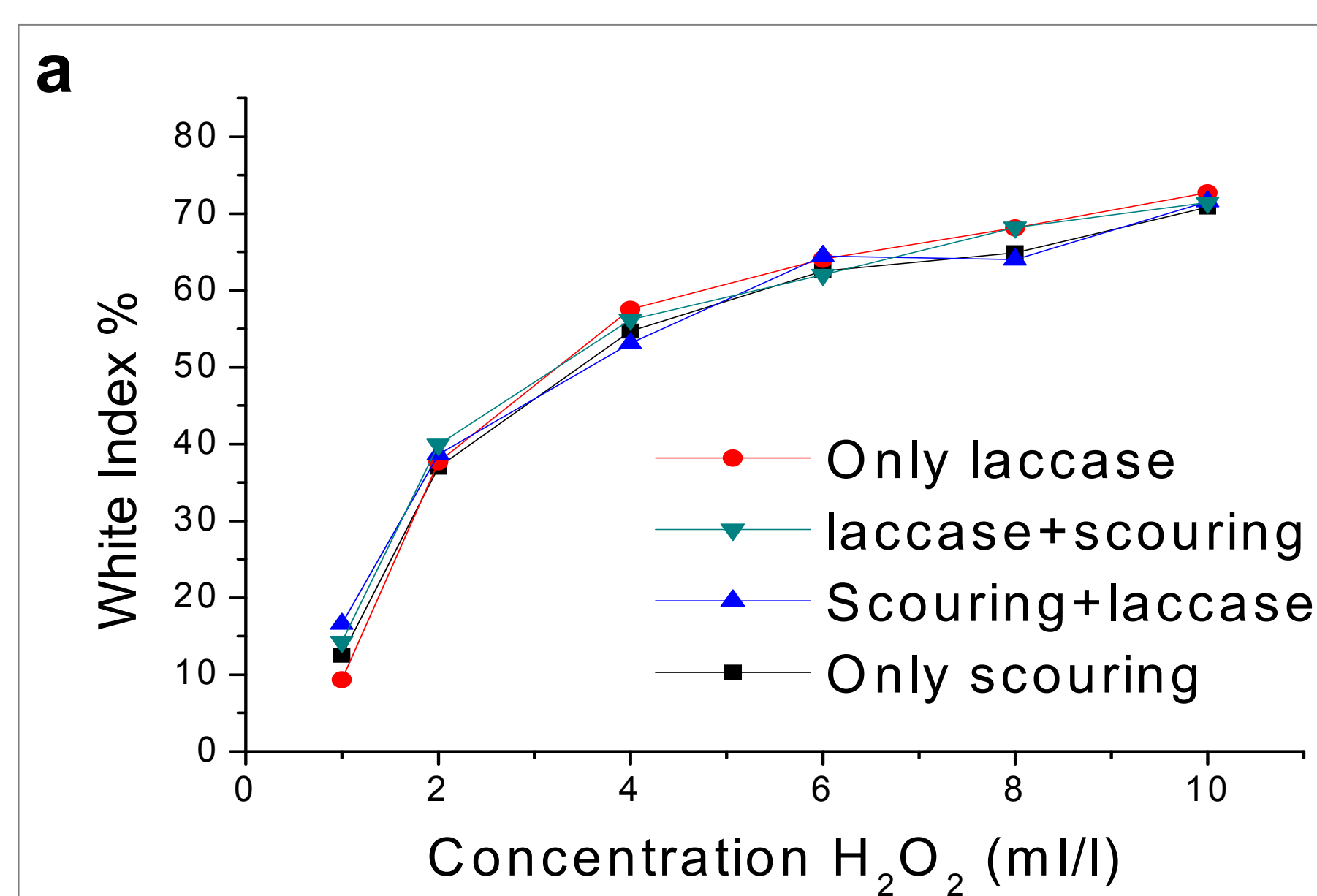
## CONCLUSIONS

- 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.

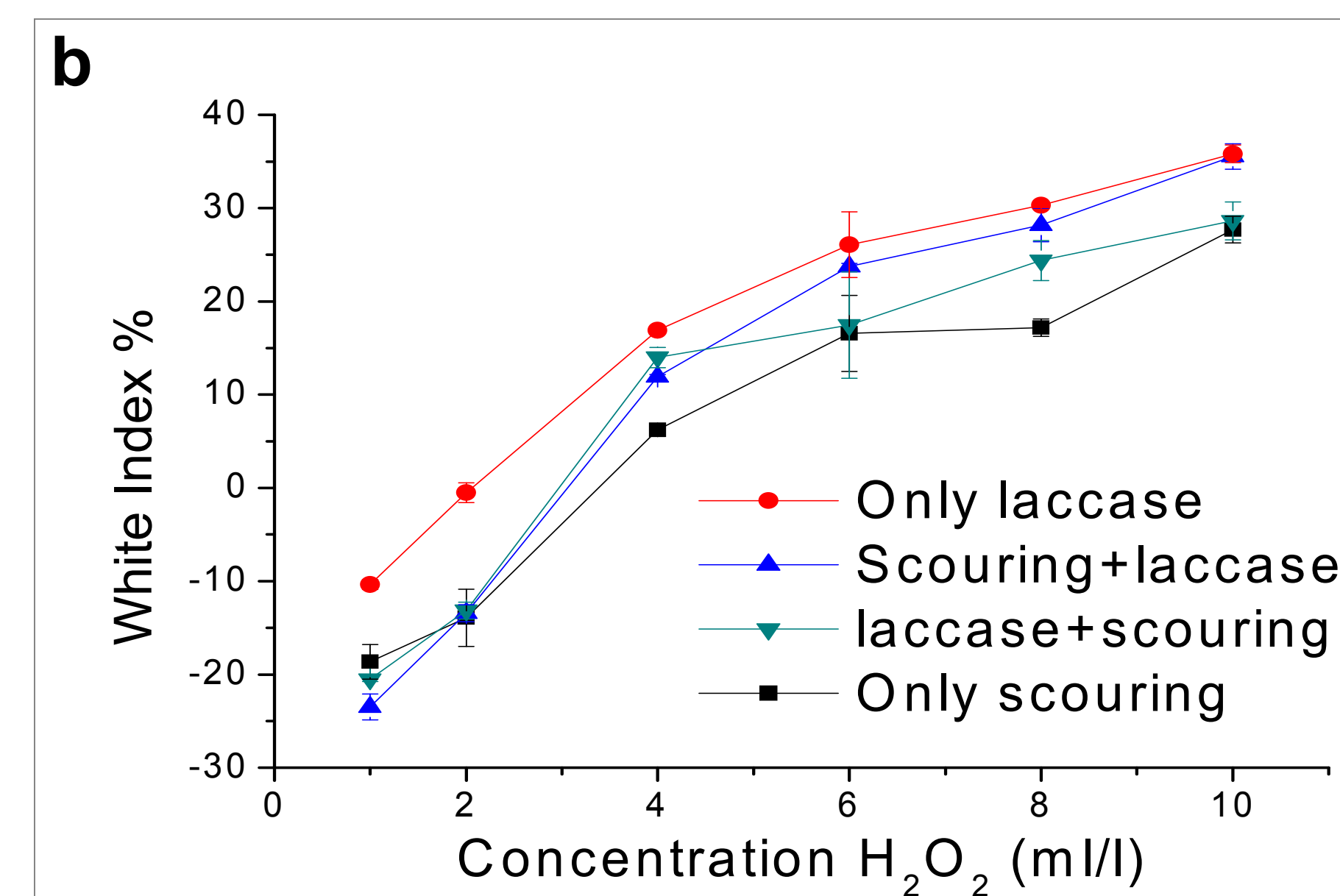
## RESULTS

- 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;
- ↑ [H<sub>2</sub>O<sub>2</sub>] ⇒ ↑ 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 H<sub>2</sub>O<sub>2</sub> at different concentration: a) cotton; b) flax.



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