

HAGER, A. (2003): Zum Effekt von Laccasen beim Altpapier-Deinking. Dissertation an der Universität Hamburg, Fachbereich Biologie. 228 S. (*On the effect of laccase for deinking. Doctoral thesis at Hamburg university, faculty of biology. 228 p.*)

keywords

bleaching, deinking, deinked pulp, delignification, groundwood, HBT, hydroxybenzotriazole, laccase, lignin, mediator, paper, pulp, recycling, thermomechanical pulp, wastepaper, yellowing

abstract

Lignocellulosic fibers can be delignified by means of a laccase mediator system (LMS) in the 4 – 6 pH range with pressurised oxygen and subsequent alkaline extraction. A few authors also report on the use of laccase in a neutral or faintly alkaline medium without mediators. Pressurised bleaching or alkaline extraction are not commonly employed for recovered paper treatment, though. A study has been conducted to investigate the suitability of LMS for deinking processes run in a neutral medium, i.e. to determine whether the oxidising effect of LMS could be harnessed for ink detachment and dirt speck reduction.

Initial investigations were aimed at studying the pH influence on the activation of ABTS, HBT and violuric acid by the laccases *Trametes villosa* L. and *Myceliophthora thermophila* L. under atmospheric pressure. The oxygen consumption under neutral or faintly alkaline conditions measured by a CLARK electrode indicated a laccase-induced activation of the mediators even though the reactions were not as strong as at a pH of 4.5, for example.

Laccase or LMS treatments were found to lower the brightness levels after flotation of artificially aged prints. The same was observed with deinked pulps and unprinted recycled papers. A significant reduction of dirt specks was not visible. Changes in the chromaticity co-ordinates L*, a*, b* indicated a yellowing of the lignin contained in these fibers. The brightness losses and yellowing (as compared to an enzyme-free reference) could not be compensated for by alkaline extraction, peroxide or FAS bleaching processes employed downstream of the flotation stage.

Subsequent bleaching tests of different virgin fibers under identical LMS conditions yielded more detailed information: Brightness and delignification gains were achieved in oxygen-delignified pine kraft pulps, whereas the LMS bleaching of groundwood and TMP resulted in brightness losses, yellowing and no further delignification. The yellowing effects could not be reversed by subsequent alkaline extraction or peroxide bleaching.

Even though the oxidising potential of Laccase and the LMS system is rather limited in the faintly alkaline range under atmospheric pressure, it is still high enough to modify the lignin portion of wood containing fibers. This affects the brightness and bleaching behaviour of recycled fibers under lignin preserving conditions.

The missing potential of speck reduction and the observed lignin modification renders laccase unsuitable for practical ink elimination of wood containing waste paper.