Effect of biological treatment and supercritical liquid treatment on enhancement of kraft lignin degradation

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Kraft lignin of a very high molecular weight was successfully degraded into oligomers by a novel stepwise treatment of combination of biological treatment with supercritical liquid treatment. Under fixed temperature and pressure, 420°C and 50 MPa, 20 min reaction time was found to be the optimal time length. After sequential treatment by mutant *Pseudomonas fluorescens* esterase F162L, almost complete degradation was achieved. The obtained degraded lignin had a high molecular peak with an M_p (peak molecular weight) of about 650 g/mol, which was lower than the M_p (3000 g/mol) of original lignin. By comparing the degraded lignin products to *p*-coumaric acid (MW = 150 g/mol), it was confirmed that the products were lignin monomers and dimers. New product that was nonexistent in sole supercritical liquid treatment was detected in co-treatment with biological treatment and supercritical liquid treatment. The degraded lignin products were characterized using HPLC, SEC, GC-MS and IR. Combinatorial treatment performed well at accelerating the degradation of kraft lignin.