Ligninolytic organisms and their enzymes are being investigated for their potential interest in paper industry. Some agricultural wastes can be alternative raw materials for paper manufacture, and they can be better substrates than wood for biological delignification. *Pleurotus* species are well-adapted to grow on cereal straw, and some of them cause preferential removal of lignin. Enzymes producing extracellular H$_2$O$_2$ have been investigated in ligninolytic fungi, as a source for the peroxide necessary for the action of lignin peroxidases. Moreover, the hydroxyl radical derived from H$_2$O$_2$ could exert a direct effect on plant cell-wall polymers. An extracellular H$_2$O$_2$-producing aryl-alcohol oxidase (AAO) has been described in *Pleurotus* *sajor-caju*, *P. eryngii* and *P. ostreatus*. In the former fungus two AAO isoenzymes were reported, whereas a unique protein with AAO activity was found in the other species.

In the present study, 6 *Pleurotus* species were grown in static and shaken cultures, and AAO were recovered and compared by PAGE. AAO activity on gels was evidenced by the formation of a starch-iodine complex, after iodine oxidation by the H$_2$O$_2$ generated during AAO oxidation of veratryl (4,4-dimethoxybenzyl) alcohol. With this procedure, the existence of two isoenzymatic forms of AAO in *P. sajor-caju* and *P. flaridanus* was confirmed, and a unique enzyme was found in *P. comatus*, *P. eryngii*, *P. ostreatus*, and *P. pulmonarius*. The abundance of the two isoenzymes seems to be affected by growth conditions, and one of the isoenzymes was predominant in agitated cultures. Polyclonal antibodies against AAO from *P. eryngii* were obtained and cross reaction with the AAO from the other species was shown by Western blotting.

AAO oxidizes polyunsaturated primary alcohols to the corresponding aldehydes. The presence of such compounds in cultures of the 6 *Pleurotus* species was analyzed by GC-MS. $p$-Anisaldehyde ($p$-methoxybenzaldehyde) was the main aromatic compound detected, showing the highest levels in cultures of *P. pulmonarius*. Lignocellulose addition to the medium stimulated $p$-anisaldehyde production, whereas it was not affected by Kraft or straw lignin. The fungal production of aromatic aldehydes is connected with H$_2$O$_2$ production, since an intracellular aryl-alcohol dehydrogenase, a cometabolization enzyme, was detected in the mycelium of *Pleurotus*. This enzyme can reduce the $p$-anisaldehyde to $p$-anisyl alcohol, the latter compound being oxidized by the AAO. In this way, aromatic compounds synthesized by the fungus could be the substrate for a cyclic system of extracellular H$_2$O$_2$ production.

**MODELLING SUBSTRATE INHIBITION IN UASB SYSTEMS**

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The present study represents a feasibility analysis of Haldane equation for modelling substrate inhibition in granules, the characteristic biomass structure in UASB reactors. However, the generalisation of the biokinetic parameters obtained with such models requires the separation of observed and true kinetic rates. Consequently, the possibilities of mass transfer limitations on the observed rates were also assessed analysing: a) the impact of the diffusion coefficient and diameter value on Weisz-Prater modulus, and b) substrate removal rate versus stirring velocity.

The Haldane equation, comprising a first order coefficient for the inhibition reaction, correlated the substrate removal rate and the volatile fatty acids (VFA) effluent concentration of an UASB continuous reactor. The inhibition constant ($K$) was 17296 mg/l and the substrate critical concentration (Sc) was 1760 mg/l, both expressed as COD. These values suggest that VFA have a limited toxic potential over the tested experimental conditions. On batch tests with a sacarose, VFA and phenol substrate, with a variable phenol concentration, to fit the data a generalisation of Haldane equation was required, considering the inhibition reaction order as an additional degree of freedom. According to this assumption, it was possible to correlate the specific removal rate with the phenol concentration. The results obtained were $n=1.7$, $K=3359$ mg/l and $Sc=390$ mg/l as phenol-COD.

The Weisz-Prater modulus for the VFA essay, assuming an acetate diffusivity of $0.148*10^{-4} m^2/day$, gave a result higher than 1, for granules with 3 mm diameter. The degradation of sacarose and VFA with stirring was faster than without stirring. Consequently, the possibility of external and/or internal mass transfer limitations on the model’s biokinetic constants should be taken into account.