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Assessment of coagulated and non-coagulated ASB performance used to treat *Pinus radiata* sulfite pulp and paper mill effluent by resin fractionation and HPSEC techniques

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HIGHLIGHTS

- Aerated stabilisation basins treating *pinus radiata* pulp (sulfite) effluent were investigated.
- ASB performances coupled with coagulation pre-treatment at various scales were examined.
- Resin fractionation, HPSEC UV and fluorescence were used to quantify system performance.
- Relative abundances of organic compounds present in the wastewaters were quantified.
- Significant different in VHA fraction at 1700 Da resulted significant different colour formation.

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ABSTRACT

Resin fractionation (XAD-8), high performance size exclusion chromatography (HPSEC) $UV_{260 \text{ and } 280 \text{ nm}}$ and HPSEC-fluorescence techniques were used to characterise very hydrophobic acid (VHA) and slightly hydrophobic to hydrophilic (Non-VHA) compounds in treated wastewater from a *Pinus radiata* (Sulfite) pulp and paper mill that incorporates aerated stabilisation basins (ASBs). The use of these techniques enabled a rigorous evaluation of ASB performance with coagulation pre-treatment, using laboratory-based simulation studies and a full-scale ASB. The laboratory scale ASB treatment comprised two parallel sets of three tanks (A and B) that were operated over three hydraulic retention times (HRTs) of 84 days. Simulations were based on the full-scale HRT. The influent used for both simulations was post-coagulated pulp mill mixed with paper mill wastewater (1:2). Sludge collected from the full scale ASB pond system was added to the tanks of both simulations for inoculation with indigenous microorganisms. In addition, settled sludge collected after coagulation of pulp mill wastewaters was added to simulation B to investigate the effects of alum flocculated material. Coagulation pre-treatment with alum removed HMW compounds (~3–8 kDa), and alum sludge addition to further simulate potential long-term application of coagulation as a pre-treatment step prior to ASB resulted in further removal of HMW components. SUVA and specific colour of wastewaters increased during ASB treatment with the least colour formation occurring in Simulation B. There were no significant differences in DOC, UV–visible absorbance and total relative abundance of VHA and Non-VHA compounds between pre-coagulated (A and B) and untreated waters following ASB, except for a HMW of VHA component of ~1700 Da, which was attributed to the significant colour development in the treated wastewater. The use of these analytical tools provided insight on the fate and transformation of recalcitrant organic compounds typically present in pulp and paper mill effluents.

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