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**Formation of microbial inhibitors in steam-explosion pretreatment of softwood  
impregnated with sulfuric acid and sulfur dioxide**

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**Abstract**

Wood chips of Norway spruce were pretreated by steam explosion at 195-215°C after impregnation with either sulfuric acid (SA) or sulfur dioxide (SD). The effects of different pretreatment conditions on formation of microbial inhibitors were investigated, and the inhibitory effects on yeast of pretreatment liquids and of specific inhibitors that were found in the pretreatment liquids were elucidated. Whereas the concentrations of most inhibitors increased with increasing pretreatment temperatures, there were exceptions, such as formaldehyde and *p*-hydroxybenzaldehyde. The highest concentration of each inhibitor was typically found in SD-pretreated material, but formic acid was an exception. The toxic effects on yeast were studied using concentrations corresponding to loadings of 12 and 20% total solids (TS). Among individual inhibitors that were quantitated in pretreatment liquids, the concentrations of formaldehyde were by far most toxic. There was no or minimal yeast growth in the formaldehyde concentration range (5.8-7.7 mM) corresponding to 12% TS.

**Keywords:** Lignocellulose, Pretreatment, Sulfuric acid, Sulfur dioxide, Microbial inhibitors

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