54f Effect of Cultures Grown from Brewery Waste Waters on Kraft Lignin

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Lignin, second only to cellulose as a source of fixed carbon in the biosphere, is generally considered to be resistant to rapid biological degradation. Steric hindrances and lack of regular structure impede enzyme-substrate interaction. Lignin is a complex biopolymer, and its depolymerization involves complex reactions of bond scission and functional group alteration. Depolymerized lignin has many industrial applications like vanillin, adhesives for linoleum, binder for laminated or composite wood products, etc.

High-Performance Size Exclusion Chromatography (UV detector), Atomic Force Microscopy (AFM) and Fluorescence Microscopy were used to determine the effect of inoculation on treated Kraft lignin. Culture broth (Coors Brewery) was initially grown with corn stover (NREL) and soytone peptone as substrate in 3L fermentors. After a week, 1 g/L lignin was added daily for the second week to replenish the carbon source and acclimatize the culture for a lignin substrate. pH was maintained at 7.5 with makeup HCl.

Batch studies (200 ml) were conducted in duplicate with this culture, using yeast malt extract media (YM), to track changes in the molecular weight and size distribution of lignin over 30 days. pH and the presence of YM had a substantial effect on depolymerization. Lignin without YM showed only polymerization, but lignin samples with YM showed depolymerization after initial polymerization. AFM studies showed spherical lignin molecules, ranging from 350 to 650 nm in size initially and depolymerizing to range from 135 to 220 nm by day 30. Initial pH was adjusted to 8 with 0.1 N NaOH. pH declined with incubation for flasks containing yeast malt extract (YM, YM+L). Bacterial colonies were counted for the initial and final day samples. The count showed increased growth for flasks with YM+L, compared to YM only. Cultures in lignin only showed the least growth.