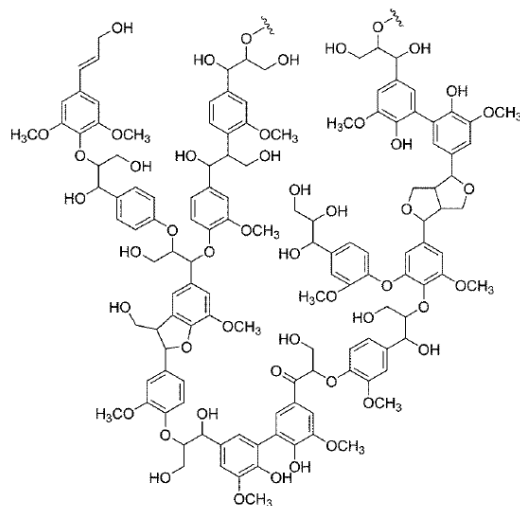


Electrochemical Transformation of Lignin

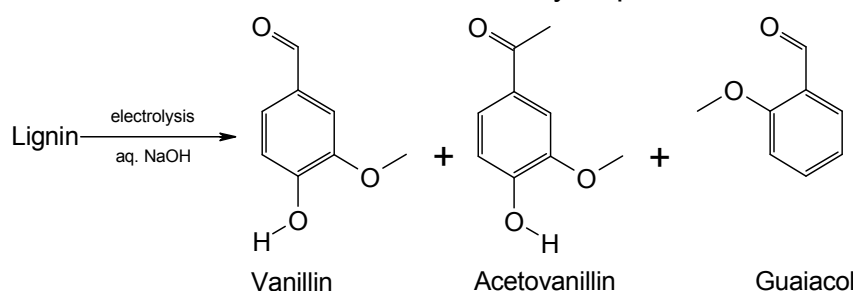
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Lignin (a simplified of the suggested structure is shown left [1]) is a complex organic biopolymer being an important structural material in cell walls of wood and bark. Chemically speaking it is an aromatic macromolecule, it is among the most abundant renewable feedstocks. It has the potential to become an alternative source for presently crude oil-based products, one of its advantages is the fact that it is a non-food biomass. It is a major waste product in the pulping industry [2 - 4]. Breakdown of the biopolymer into fragments amenable for further chemical transformation can be afforded by electrolysis. Conceivable electrolysis products are:

Despite extended efforts in the past suggested procedures of selective breakdown including catalytic, microbial, photochemical, sono- and electrochemical procedures lack yield selectivity. Electrochemical procedures have the fundamental advantage of being free of catalysts, in particular metallic ones, which might be difficult to separate from the reaction mixture. Starting with a procedure reported elsewhere [5, 6] yielding almost exclusively vanillin from Kraft lignin we have assembled a simple electrolysis procedure.



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Electrolysis was performed with alkaline solutions of Kraft lignin in an undivided cell at elevated temperature using nickel alloy electrodes. Vanillin was formed at high selectivity. Results of cyclic voltammetry indicate, that oxidative depolymerization of lignin proceeds at electrode potentials in the range of dioxygen evolution, possibly reaction intermediates of the dioxygen evolution reaction participate in the lignin breakdown reaction.

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