

Investigation on the Interactions of Polyethylenimin (PEI) with Wood and Wood Components

**By: Alain Fabo
Thesis Adviser: Prof. Dr. R. Patt**

**An Abstract of the Thesis Presented in Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy**

March, 2004

The goal of this work was a deeper understanding of the bonding mechanisms between PEI and wood fibers. Investigations at spruce fibers, chemical pulp, ozone treated fibers, wood components as well as model substances in presence of PEI were carried out to study the effective bonding mechanisms. This is essential for the improvement of adhesives, fibers and the resulting MDF properties.

The interactions between PEI and wood fibers and/or -components were examined through extractions- and adsorption trials. First the fibers were blended with PEI, heat treated and extracted with water as well as HCl, NaCl and NaOH solutions. UV-microspectroscopy was used to localise PEI in cell walls. The reactivity of the mixture of PEI with fibers and/or fiber components was examined by DSC. Using UV-spectroscopy, additional information about the emerged substances and the kinetic of the reactions was obtained. FTIR-analysis of the degradation products originated from the reaction of PEI with fibers and/or cellulose and glucose were carried out. Finally the identification and evaluation of pyrolysis products of PEI, glucose and the mixture of PEI and glucose were accomplished using Py-GC/MS.

The results of this work show that the bonding mechanisms between PEI and fibers are based on a combination of mechanical interlocking, diffusion, adsorption and covalent bond. With fiber modification, like ozone treatment, it is in principle possible to increase the bond between PEI and fiber and thus to improve the properties of the MDF. It was shown that PEI and glucose react with each other to a high extent. Therefore glucose could be used as glue component in PEI adhesive for MDF.