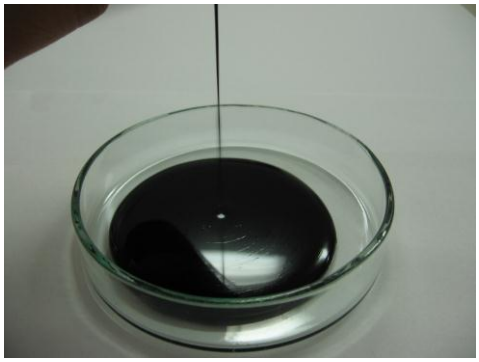
Liquefied wood-based coatings



Wood finishes containing binders, made of renewable resources – ligno-cellulose materials, can contribute to prevention of pollution of the environment. Appropriate renewable candidate for production of binders with the improved environmental profile are ligno-cellulose liquefied mixtures that are the product of their solvolysis with polyfunctional alcohols.

The main goals of the project are: liquefaction of ligno-cellulose materials at optimal liquefaction conditions, preparation of wood finish or adhesive binders from liquefied materials, preparation of wood coatings and adhesives from new biocopolymers, their characterisation and comparison of their properties with the commercial wood paints and adhesives. The following materials are liquefied: residues of poplar wood processing, residues obtained during production of tannins from chestnut wood – "celolignin", and waste spruce wood, contaminated with CCB biocides. The poplar wood was chosen because it can be relatively simply liquefied, the residue of the tannin and furfural production, "cellulignin" was delivered by the tannin and furfural producer, which financially supports the project and finally, the CCB contaminated waste wood was selected in order to examine alternative ways of its managing.

In the first part of the project the resources were liquefied at increased temperatures, using diethylene glycol as a reagent and with H_2SO_4 as a catalyst. The optimal liquefaction conditions were determined. Additional solvolysis conditions – other reagents and catalysts were examined as well. The complex compositions of the liquefied mixtures were only partially elucidated, just to get the most necessary data for further syntheses. We determine the number of free -OH groups, that are available for subsequent reactions and make a composition a bit more clear by using the FT-IR and HPLC methods. Afterwards, thin cured films were prepared on glass plates and the curing processes of liquefied ligno-cellulose materials is studied. Two approaches are applied. In the first case, reactions are carried out by using curing agents, for instance di- or poly-isocianates to produce polyurethane films. The second approach is based on removal of excessive solvolysis reagent from the liquefaction process product by exposure to high enough temperatures under vacuum. The excessive reagent free liquefied wood is self-crosslinked. This approach is an important novelty in applications of liquefied materials and therefore, an important focus of the programme is just on research of crosslinked and selfcrosslinked coatings and adhesives made of liquefied biomass. Crosslinking and selfcrosslinking curing mechanisms are investigated with different instrumental methods, with a special impact on contemporary thermal analysis methods, for instance high pressure DSC. Waterborne coating and adhesive formulations on the basis of all three types of liquefied materials have been prepared. The liquid formulations have been characterised and applied to spruce or beech wood substrates. The

coating systems have been cured and characterised by various standard and non-standard methods (various physical properties, the ageing resistance and the resistance against biological pests will be determined and leachability of biocides from the coatings made of biocide containing waste wood are evaluated) and their properties compared to those of commercial products. On the basis of bio-copolymers one or two adhesive mixtures will be prepared and the bonds will be characterised by common methods. High frequency bonding with the excessive reagent free liquefied wood will be carried out as well. We will also economically evaluate the liquefied wood based coatings and the life cycle assessment (LCA) will be performed.

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