

Investigation wood properties of selected cultivars and transgenic lines of poplar from the viewpoint of physico-chemical methods of its processing

The aim of the project is conducting a comprehensive characterisation of poplar wood of selected hybrid and transgenic lines designed for such uses as the technology of enzymatic hydrolysis of polysaccharides, the source of pulp for paper industries as well as raw solid fuel. A correlation between the type of genetic modification and the resulting characteristics of wood is to be verified.

Progressing devastation of forest areas, as a result of global warming and human activities, leads the scientists in the world to biotechnology research in order to improve the industrial properties of trees. The research is proposed on the role of genes and proteins encoded in poplar (*Populus* sp.) as a model tree. Selection of the *Populus* genus is supported on the one hand, scientific considerations, which consists of a complete knowledge of its genome and the advancement of biotechnology research, on the other hand, practical considerations. Poplars are among the trees for of the fastest growth rate of biomass, which makes it possible to use as a raw material in liquid biofuel production. They are pioneer species that are tolerant of unfavourable environmental conditions and can be used for reclamation of industrial land.

The investigations on chemical composition of obtained biomass have a great importance from the viewpoint of the potential use of the wood. For example, papermaking industry shows an interest in the question, due a demand for bioenergy sources. Therefore, breeding transgenic cultivars with increased cellulose content can bring real economic and environmental benefits. In the case of poplar wood applications related to question of renewable energy sources, we can distinguish direct burning, simple but limited to energy production in stationary objects, and the more advanced wood processing technologies for liquid biofuels. Selection of varieties of fast-growing species is the prime consideration when assessing the profitability of biofuel production. In this direction particularly important application is the search for varieties with a high increase of biomass, with higher content of polysaccharides, as well as a reduced ratio of pentosans to hexosans content.

The material (biomass) will come from plant culture under the project WELCOME 2008/1 of Prof. Karpinski, who has the required permission. The project will not deal with genetically modified organisms, i.e. live plants, but exclusively with the dead matter of those organisms origin.

Wood properties important in the project are at first the content of structural components, namely cellulose, hemicelluloses and lignin. An important parameter is the chemical composition of polysaccharides, particularly the content of pentosans and hexosans, and the polymerization degree of cellulose. Another important factor is the kind and the content of extractives, especially ecotoxic substances, namely fatty acids and phenolic compounds. A comprehensive analysis of these substances should be made, in order to identify toxic compounds and determination of their content in various poplar cultivars. Recognition of potential inhibitors of hydrolytic enzymes is of equal importance. Other wood properties planned to investigate are the calorific value and ash characteristics.

The end result of this project will be indication the best hybrid and transgenic lines of poplar for particular applications. A correlation between the type of genetic modification and the resulting characteristics of the wood will be tested. It will be particularly important to verify a scientific hypothesis that the modified poplar signal pathway of salicylic acid and reactive oxygen species (ROS) would have changed the composition of cell wall in such a way that increases its usefulness as a raw material in bioethanol technology and paper industry. The results of the design research will create a perspective for the applied

technological research with selected varieties of poplar, which may affect significantly the use of renewable energy sources.