DESCRIPTION FOR THE GENERAL PUBLIC

Brown coal is one of the most exploited sources of energy in Poland. World brown coal resources are sufficient for about 250 years, while oil and natural gas will be exhausted within 50 – 60 years. Unfortunately, there are many factors, which disqualify the use of this material for the energy production, among others: low calorific value, emissions of sulfur and nitrogen oxides, the problems with mining, etc. Therefore, there is a need for developing "clean coal technologies" which enable conversion of brown coal into a cleaner liquid. Biosolubilization is a process that uses microorganism for this purpose. The products may be used not only as a biofuel but also as a basis for production of aromatic compounds and polymers so valuable for many industries. The Institute of Technical Biochemistry at Lodz University of Technology is involved in the project which aims to design the effective method for biosolubilization of brown coal deposits. To make this possible it is necessary to investigate the mechanism of the process. According to several independent studies the ability of some bacteria and fungi for biodegradation of lignite results from the action of the following agents produced by the microorganisms: chelators, alkali substances, detergents and ligninolytic enzymes, among others, laccases. *Fusarium oxysporum* is one of the fungi capable of brown coal biosolubilization. The aim of our project is to thoroughly characterize the laccase produced by this strain and to examine its impact on biosolubilization process. Laccases are now among the most desirable enzymes, they are able to catalyze a wide range of reactions, which can be used in many different fields of industry – paper industry, textile, food, diagnostics, waste water treatment, synthesis of chemical compounds, etc. Moreover, their environmental friendly nature continuously focuses attention on the enzyme.

F. oxysporum laccase is a novel enzyme, hitherto not described, which differs significantly in its amino acid content from other well known laccases. We plan to produce the enzyme in a different host than the original one using modern molecular biology techniques, which would allow us to produce a satisfactory amount of the enzyme. The next step includes characterization of the protein and studies of the impact of the laccase on biosolubilization. We will examine if the addition of pure enzyme to brown coal during biosolubilization by microorganisms and solubilizing agents increases the efficiency of the process. Furthermore, the enzyme will be engineered towards more effective lignite biodegradation. Changing the amino acid content of the protein will allow determining which positions are crucial for its activity and preservation of the characteristic features. The studies will deepen the knowledge of this family of enzymes and will help to design effective laccases with characteristics awaited by the industry.