TECHNOLOGICAL IMPROVEMENT FOR ETHANOL PRODUCTION FROM LIGNOCELLULOSE (TIME)

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BIO-ENERGY
ENLARGED PERSPECTIVES

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TECHNOLOGICAL IMPROVEMENT FOR ETHANOL PRODUCTION FROM LIGNOCELLULOSE

- Acronyme:
  - TIME
- Project number:
  - NNE5-2001-00447
- Duration:
  - 36 months, started 1.11.2002
- Coordinator:
  - VTT Biotechnology

ETHANOL – A FLEXIBLE FUEL

- Production of fuel-ethanol from lignocellulose enables the reduction of CO_2 emissions in the transport sector in a range of 90%
- Interesting in short to medium term as a blend with gasoline (directly or as ETBE)
- Applicable in existing vehicles and distribution systems
- Ethanol based fuels reduce the emission from motor vehicles
- Extension of renewable raw material sources to the energy and transport sector
- Positive contribution to the quality of life of the citizens

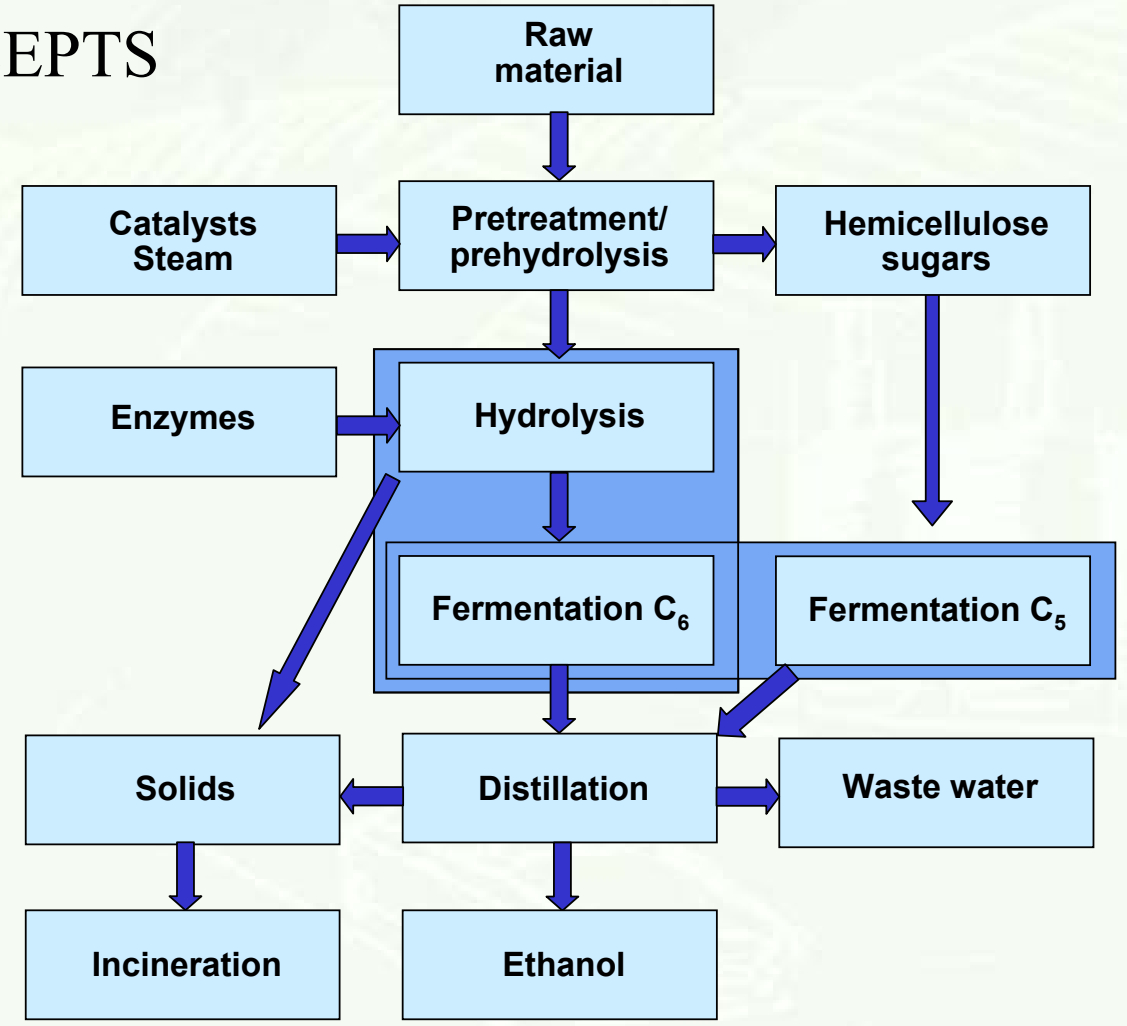
BOTTLENECKS OF PRESENT CONVERSION TECHNOLOGIES

- Resistant structure of cellulose >> efficient pretreatment technologies
- Efficiency of the enzymatic hydrolysis of cellulose low
- Fermentation of pentoses restricted on real substrates
- Low yield and concentration of product (ethanol)
- High energy demand in the production process

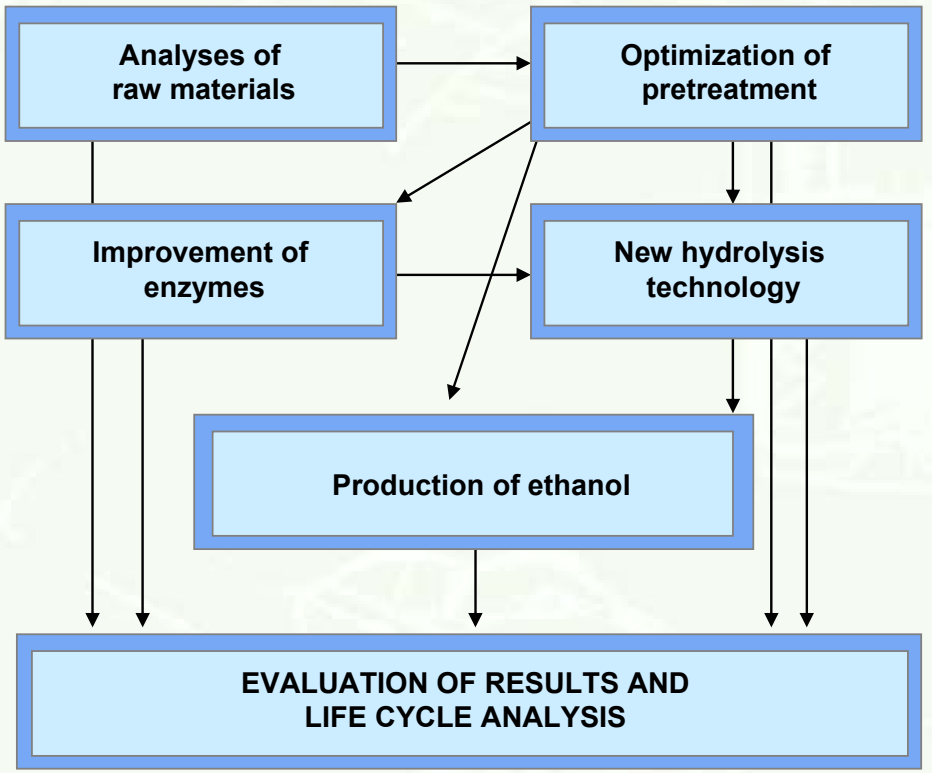
OBJECTIVES OF THE PROJECT

- To reduce the overall production costs of ethanol by 10-20 % through new developments
- To improve the design and performance of the key steps in the lignocellulose-to-ethanol process (pretreatment, enzymatic hydrolysis and increased process integration)
- To develop technologies for the available lignocellulosic raw materials or energy crops in Southern, Eastern and Northern Europe
- To exploit new biotechnical methods for hydrolysis and fermentation
- To evaluate the production costs and to assess the environmental impacts by LCA

PROCESS CONCEPTS



PROJECT OUT-LINE



SCIENTIFIC AND TECHNICAL OBJECTIVES, CONTRIBUTION TO THE GOALS IN THE THEMATIC PRIORITIES AND TARGET ACTIONS OF THE WORK PROGRAMME AND INNOVATION

Parameter	**Current status for the envisaged technology**	**Improvement expected at the end of project**	**Long term potential for improvement**
Production costs	Current estimated production cost 0,4 Euro/litre ethanol	0.35 Euro/litre (15% reduction)	0.35-> 0.2 Euro/litre (25-50% reduction)
Investment cost	Depends on scale; high due to low consistency and low volumetric productivities	10% reduction	30% reduction
Running costs	Present enzyme costs up to 30% of total production costs	20-40% reduction	Inhibition kinetics solved
Efficiency for energy (heat and/or electricity) production in %	20% of energy in the raw material used for process heat and electricity (3.5 kWh/litre ethanol)	10% reduction	20% reduction

COMMUNITY ADDED VALUE AND CONTRIBUTION TO EU ENERGY -RELATED POLICIES

Parameter	**Current status for the envisaged technology**	**Improvement expected at the end of project**
GHG emissions & climate change	Based on grain ethanol 35-60% reduction in GHG	90% reduction as compared with fossil fuel
EU – member state (ERA) and other international collaboration	Crops utilised suited for cultivation in new member states; IEA and other existing collaboration	
Security and diversification of energy supply.	Fuel ethanol produced in EU will diminish the oil dependency	
Increase the share of new and renewable energy sources (RES)	Liquid fuels from RES have an unlimited market	

CONTRIBUTION TO THE ENVIRONMENT AND EU SOCIAL OBJECTIVES

Parameter	Current status for the envisaged technology	Improvement expected at the end of project
Reduced environmental impact		
VOC	Varies	Emissions of VOC diminish up to 20% compared with gasoline
SO_2	Varies	Emissions of SO_2 diminish up to 60% compared with diesel
NO_x	Varies	Decreased NOx emissions compared with gasoline and diesel
Health and safety	Increased number of population having breathing disorder, aggravated by emissions of gasoline and diesel in cities.	Decreased breathing problems in cities caused by gasoline
Employment		Up to 900 new jobs for every 100 000 m^3 ethanol produced

ECONOMIC IMPACT AND S&T PROSPECTS

Parameter	Current status for the envisaged technology	Improvement expected at the end of project
Market prospects	Presently no markets for total lignocellulose hydrolysis enzymes	Increased markets
Exploitation plans & dissemination strategy	Several industrial sectors can exploit	Fist semi-commercial enzyme preparations

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Project website address: http://timeproject.vtt.fi