Introduction
Biofuels production for use as liquid motor fuels or for blending with conventional gasoline is increasing worldwide. Ethanol alone makes up the largest share of such biofuels. Conventionally, ethanol is produced from readily fermentable carbohydrates such as sugars and starches. The availability of such agricultural feedstocks is limited, because of competition with food and feed production, arable land usage, and water availability. Consequently, forest residues, trees from plantations, straw, grasses and other agricultural residues may become viable feedstocks for biofuel production. However, the very heterogeneous nature of lignocellulosic materials makes them inherently recalcitrant to bioconversion. An alternative technology is biomass gasification to syngas and then ferment it with anaerobic microorganisms to produce biofuels such as ethanol, n-butanol or chemicals such as acetic acid, butyric acid and the like.

SYNFERON
The technological focus and scientific objectives within SYNFERON are:
1. Fermentation of syngas to liquid (alcohols) and gaseous (methane) biofuels
2. Design of novel bioreactors, pressure control and use of suitable surfactants for increasing the gas/liquid mass transfer efficiency
3. Use of biomimetic membranes and development of diabatic distillation for gentle and cost-efficient purification of liquid biofuels
4. Development of an optimized process design and comparison with existing technologies

Differently from the current commercial technologies, which mainly focus on liquid biofuels production, a more flexible layout will be considered, merging Combined Heat and Power (CHP) production with the fermentation of syngas. When the heating demand is high, the syngas will mainly be exploited through CHP but when the heating demand is low, the syngas will be fermented to storable liquid or gaseous biofuels, thus matching the energy markets requirement

Mixed microbial consortia for syngas fermentation
SYNFERON targets the challenging aspect of eliminating the need of maintaining sterile conditions during syngas fermentation by applying open mixed culture fermentation (MCF). The big asset of MCF is the lower operation cost compared to pure wild and/or genetically engineered microbial strains.

Concentrating and separation of liquid alcohols
Biomimetic (aquaporin) membranes will be applied for concentrating the liquid products based on forward osmosis.

Process simulation
In the contest of WP4, regarding engineering analysis of the existing platforms, after the identification of the most probable products and side-products from the fermentation, a thermodynamic consistency study was conducted in order to verify the reliability of the models available in Aspen Plus in explaining equilibrium data found in literature for similar systems.

References