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Catalytic steam reforming of polyalcohols in microchannel reactors – hydrogen production from cellulosic biomass

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Hydrogen production and its utilization, as fuel or for energy production, seems to be a promising way to minimize the actual dependence on fossil fuels. Thus, the energetic transition should be based on green energy production in order to solve the greater concerns; environmental pollution and guaranteed availability. In this sense, the use of bio-renewable organic sources such as polyalcohols, in an intensified process through the use of a micro reactor seems to be a promising and sustainable alternative.

In the case of ethylene glycol, few studies have been addressed being most of them focused on its aqueous phase reforming (APR). Ethylene glycol (EG) can be produced directly and efficiently via catalytic hydrogenation of cellulose or cellulosic biomass derived oxygenated compounds. Cellulose, as the most abundant component of biomass (accounting for 35-50%), is being considered as a promising alternative to fossil resources. In addition, EG is the most abundant molecule of compounds derived from the catalytic conversion of cellulose, accounting for more than 70% of cellulose derivatives. Another EG production route was described which is based on the bio-oil obtaining through the pyrolysis of the biomass. Departing from this bio-oil and after the water addition, a water soluble fraction of biomass pyrolysis liquid can be obtained (around 20% of organics and 80% water), mostly composed by acetone, ethylene glycol and acetic acid.

The current contribution not only describes catalyst development for hydrogen production from EG, but also the development of a complete polyalcohol fuel processor, which serves as hydrogen source for fuel cells. The system envisaged is designed for the power supply of aircrafts.

Therefore, the renewable and non-volatile nature makes the EG to be considered as a promising feedstock for hydrogen production via steam reforming. This process is one of the primary methods for the conversion biomass-derived oxygenates for being able to make full use of water in the feed and produce hydrogen-rich gas with high efficiency [2].