462e Hydrogen Production from Biomass Wastes through Ethanol Fermentation and Catalytic Reforming

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Fuel cells use hydrogen to produce electricity. Currently fossil fuels are mostly used to produce hydrogen by catalytic reforming, but there are ongoing efforts to broaden the available resources and also to increase the production yields of hydrogen.

In this project, we used the waste water from various bioprocesses and food industries, which are significant source of polysaccharides, as feedstock for hydrogen production by reforming. The approach can not only provide a viable source of hydrogen but also mitigate the waste disposal cost, thus improving the economy of these industries significantly.

The catalytic reforming of the food-processing waste water at atmospheric pressure gave 50% of theoretical yields. Instead of directly using food-processing waste water which is rather raw source for reforming, ethanol is used for producing hydrogen. Ethanol is thought to significantly reduce the deactivation of catalyst and improve the hydrogen production yield. It is well known that ethanol, if used to produce hydrogen for fuel cells, would be nearly three times efficient than when it is used along with gasoline as a fuel.

For ethanol fermentation, we used genetically modified *Escherichia coli KO11*, which is capable of efficiently producing ethanol from all sugar constituents of lignocellulose. One more advantage of using this strain is that it grows at a wide range of temperature and pH and highly acid -tolerant. In this work ethanol is produced from waste water by simultaneous saccharification and fermentation (SSF) using saccharification enzymes such as *α-amylase*,*glucoamylase* and ethanol tolerant bacteria *E. coli KO11* in 250ml batch processes. This ethanol from renewable resources is then used to produce hydrogen by catalytic reforming at atmospheric as well as high pressures. The effect of using ethanol instead of other hydrogen sources such as *xylose*, *glucose* and other sugars on hydrogen production and coking of catalyst has also been studied.