492f An Integrated Catalytic Process for Conversion of Biomass to Hydrogen

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Renewable resources, such as biomass from food processing waste, waste agricultural products and agricultural products grown for conversion to energy represent one of the few opportunities for sustainable production of hydrogen. The development of a steam or autothermal reforming catalyst optimized for the production of hydrogen from the products from a fermentation process represents an opportunity for on-site hydrogen production that can be incorporated into a local fuel cell for energy generation in small scale operations. Autothermal reforming of glucose, used as a surrogate for the biomass, using a palladium/nickel/copper based catalyst, at different steam-to-carbon ratio and oxygen to carbon ratio gives hydrogen yield as high as 60% at 750°C. High rates of char formation were observed, causing the reactor to plug after 6 – 8 hours of operating time. Almost 10% of the total weight of the glucose fed into the reactor got decomposed. Increasing the oxygen concentration in the feed decreased the rate of char formation. This problem of char formation can be eliminated using the aqueous phase reforming (APR), as an alternative process for the steam or autothermal reforming. But the amount of hydrogen produced in the APR relative to autothermal reforming is very small. Autothermal reforming of glycerol, major by-product of bio-oil process, can be very effectively used for the hydrogen production. This catalytic reforming approach can be also used for the production of hydrogen from industrial waste water. The waste water from potato industry and brewing industry has been tested. Around 75 % of hydrogen yield was observed in the reforming of the brewing process waste water without char formation. The approach for converting waste agricultural products into hydrogen is based on consecutive conversion steps, first from biomass to aqueous organic products through bioprocessing, and then secondly to hydrogen through catalytic steam reforming. The advantage of the proposed process is that it capitalizes on the strengths of each processing unit, and minimizes the need for these existing technologies to be substantially modified for highly unconventional feed or product requirements.