**Hydrogen Production through Biomass Gasification**

Hydrogen is **Green & Sustainable** fuel that has highest energy content (**142kj/g**) that can be produced through few number of methods, e.g, Natural Gas Reforming, Biomass Gasification, Coal Gasification, Electrolysis (sun light, wind, high temperature), Photo Biological, Photo-catalytic water splitting, Microbial Biomass Conversion, Bio Derived Liquidetc. Hydrogen Energy laboratory, Chattogram, Bangladesh focuses biomass gasification, Pho-catalytic water splitting to produce/generate hydrogen.

**Hydrogen production from Biomass Gasification**

Biomass gasification is amatured technology, not combustion, involves high temperature, controlled oxygen and steam to convert biomass to hydrogen along with other value added products. To reduce the net carbonaceous emissions, Biomass Gasification is assembled with carbon capture, utilization and long term storage

**Biomass**

Biomass is a renewable organic resource which includes agriculture crop residues (such as rice straw,wheat straw orcorn stover), forest residues, special crops grown specifically for energy use,animal wastes, andorganic municipal solid waste. Hydrogen along with other value added byproductscan be produced from this renewable resource via gasification. Renewability, abundance, carbon neutral and cost efficiency is the main features considered to use Biomass for hydrogen production by Gasification.

**Gasification technology**

Gasification or Biomass gasificationin which solid fuels is undergone to high temperature (>7000C)with controlled oxygen/steam ratio to produce high efficient hydrogen rich gaseous fuelor producer gas. The main composition of this yield gasis steam (H2O), carbon dioxide (CO2), carbon mono oxide (CO) and Hydrogen (H2). The reaction between CO and steam increases the hydrogen content in the mixture. High quality membrane or adsorbers are used to obtain pure hydrogen.

General reaction-

C6H12O6*(\*)*+ O2 + H2O → CO + CO2 + H2 + other species ; \*a surrogate of cellulose.

Commonly Water Gas Shift (WGS) reaction, Scrubbing, membrane or Pressure Swing Adsorption (PSA)is followed to remove the contaminationsfrom producer gas to get pure hydrogen.

***Water Gas Shift reaction***

In this reaction, CO is reacted with steam to produce hydrogen by reducing the CO content as following reaction.

CO + H2O → CO2 + H2 (+ small amount of heat, ΔH=41:1 kJ mol-1)

Generally, temperature 6000C-10000C with various catalysts is frequently used to optimize the process. A significant performance in converting CO into hydrogen is noticed from different authors.

***Scrubbing***

Different scrubbing agents such as water, RME, glycol are used to remove Tar, NH3, steam and other particulates at various temperature and pressure. Improved tarcleaning is noticedby combining cyclone, ceramic filter, air cooler, watercoolers venturi scrubber and packed bed absorber consecutively. Activated carbon, biodiesel and char are also used as scrubbing agent. Sometimes, the removal of 99.70% ammonia, 98% tar, 70% sulfur is observed.

***Membrane Separation***

It provides a high purity ofhydrogen in the gas mixture at low cost and effectively and3 mm thickmetallic membrane with Zeolitic-imidazolateframework-8 at temperature 200 C modest performance onhydrogen separation from biomass derived gas. Differentcatalyst based membrane isdeveloped to optimize themembrane performance. Pd based catalysts are an excellentchoice but its cost is very high and that's why different Pd alloyis being developed to compensate the cost without compromising performance. Producer gas is passedthrough the membrane at different conditions. Selective gascan pass through the membrane to allowed side driven bychemical potential.

***Pressure Swing Adsorption (PSA)***

After reforming and CO processing, the hydrogen content insyngas increase significantly. The present syngas is rich inhydrogen but further purification is necessary as CO causesthe deactivation of the catalyst of the proton exchangemembrane fuel cell (PEMFC) electrode.Different pressureswing adsorption systems on the basis of adsorption size,velocity, regeneration, and choice of the adsorbent materialare designed for better performance.Activated carbon and activated carbon-Zeolite or only zeolites act as good adsorbets.