Advertisement for Incubation of Technology

Iodine-Sulphur thermochemical process plant for Hydrogen production by splitting water

General Information

Iodine-Sulphur (IS) thermochemical process is an efficient method to decompose/split water into hydrogen and oxygen. Here water is decomposed indirectly through series of three chemical reactions. Water and heat energy are the input, hydrogen and oxygen are the output, and all other intermediate chemicals are recycled within the system. Maximum temperature required in this process is ~850 °C. The maximum achievable thermal efficiency of IS process is ~50% (reported). Being a pure chemical process, this process is scalable for mass production of hydrogen.

Features / Specification of system

IS process with 150 NLPH production rate has been demonstrated using water and electrical energy as inputs. The existing facility has been operated at atmospheric conditions with a hydrogen purity of > 99 %. The process is scalable and has huge potential for mass production of hydrogen.

General Specifications of IS pilot plant facility:

- Facility in industrial materials with instrumentation, control, alarm and with all safety features
- Plant with remote operation
- Maximum operating temperature ~ 850°C
- Operating pressure slightly above atmospheric pressure
- Indigenous and in-house developed components

Features of the current and Target systems:

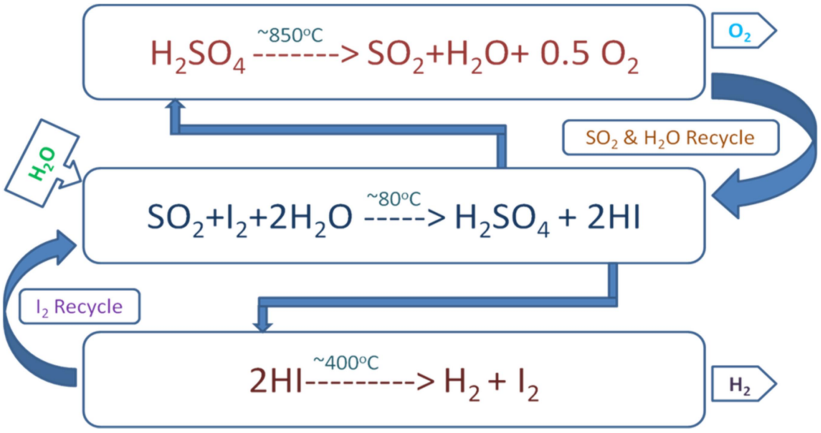
Parameter	***For Current system***	***For Target System***
Capacity	*150 NLPH*	*100-500 Nm^3/hr (can be decided mutually)*
Pressure	*Slightly above Atmospheric*	*Around 5 bar or higher*
Heating	*Electric*	*Electric / PV cell / high grade industry heat*

Schematic block diagram of the System

Closed loop operation of the process has been carried out, where all intermediate chemicals are recycled within the system. Entire facility has been broadly classified into three sections based on following three reactions; Bunsen section, sulphuric acid section and hydriodic acid section.

In Bunsen section, sulphuric acid and hydriodic acid are generated through Bunsen reaction, acids are separated and purified. In sulphuric acid section, sulphuric acid is first concentrated and then decomposed in presence of catalyst to form sulphur

dioxide, water and oxygen. In hydriodic acid section, excess iodine is removed from hydriodic acid and then decomposed to produce hydrogen and iodine in presence of catalyst. Hydrogen and oxygen are taken out and all other chemicals are recycled within the process.



Three reactions in Iodine-Sulphur (IS) process

Applications

- Large scale production of green hydrogen from water using high grade industry heat.
- Large scale IS plants would be, step towards hydrogen economy and net zero target, as envisaged by GOI
- Hydrogen production from water can contribute towards energy security of the nation

Facility and Infrastructure requirements

Sl	Resources	Supported by BARC	Supported by Incubatee
1	Manpower/ expertise	• Process design of critical equipment • Technical support for plant and system design • Electrical load & philosophy of control system design	• Process design of all other remaining equipment • Mechanical design of all the equipment • Detailed plant and system design • Entire system design for Electrical & Instrumentation
2	Machinery and Equipment	NIL	Fabrication of all plant components
Special Requirements:			
1. Incubatee with experience of operation of small/medium scale chemical plant with hazardous and corrosive chemicals operating for more than 3 years. 2. Expression of interest to set up the plant at the cost of Incubatee			