A Disruptive Technology – Co-production Hydrogen and Fine Chemicals

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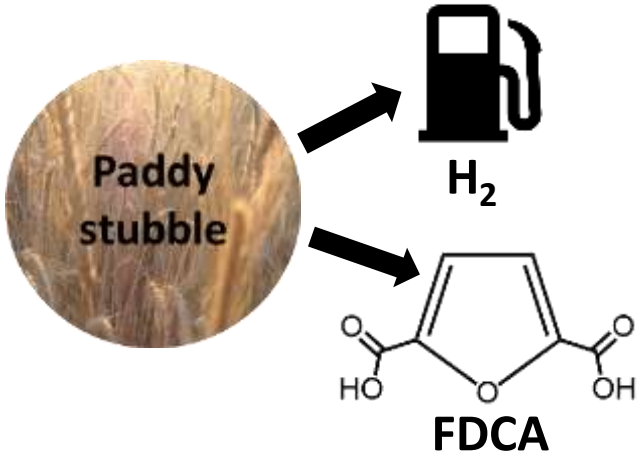
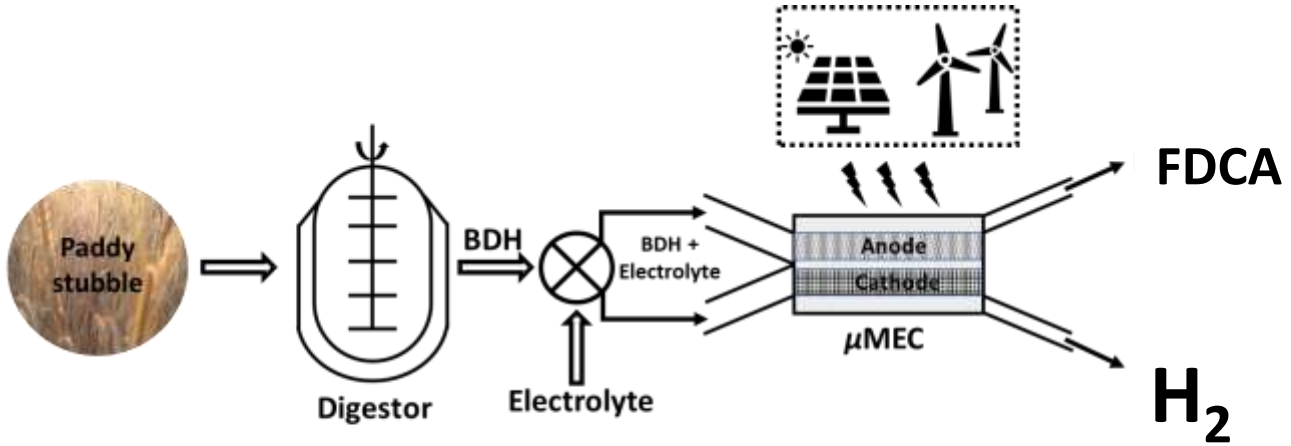
H2DC12 Mobile Biomass Converter (BMC)

Paddy stubble can be converted to hydrogen (H_2) and furandicarboxylic acid (FDCA).





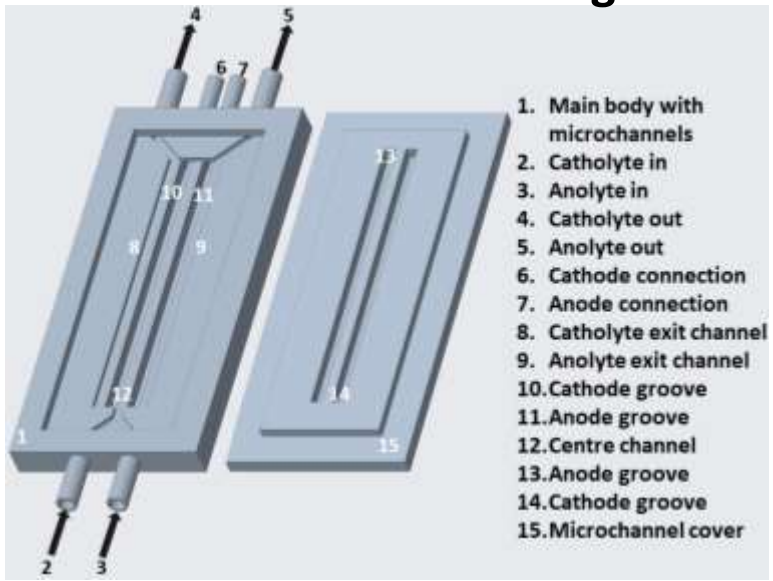
BDH: Biomass-derived 5-Hydroxymethylfurfural
FDCA: 2,5-Furandicarboxylic acid
μMEC: Microfluidic Membraneless Electrolysis Cell

The H2DC12 BMC would convert 1-1.5 kg/h equivalent of biomass to produce 0.8 – 1.0 L/h of H_2 and 0.5 – 0.75 kg/h of FDCA

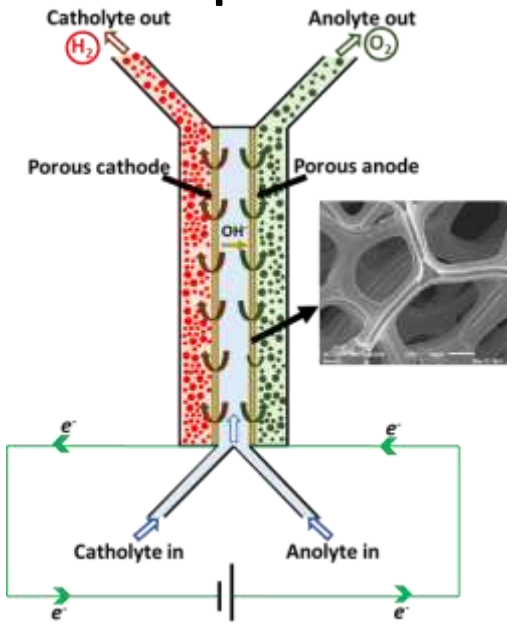
- Digestor converts the paddy stubble to 5-hydroxymethylfurfural referred to as biomass-derived 5-hydroxymethylfurfural (BDH).
- BDH is mixed with an electrolyte and introduced in the μMEC (microfluidic electrolyser cell) to generate H_2 by reduction and FDCA by oxidation simultaneously at the cathode and anode, respectively.
- The μMEC used in the process is indigenously fabricated using additive manufacturing technology.

H_2 Production Results

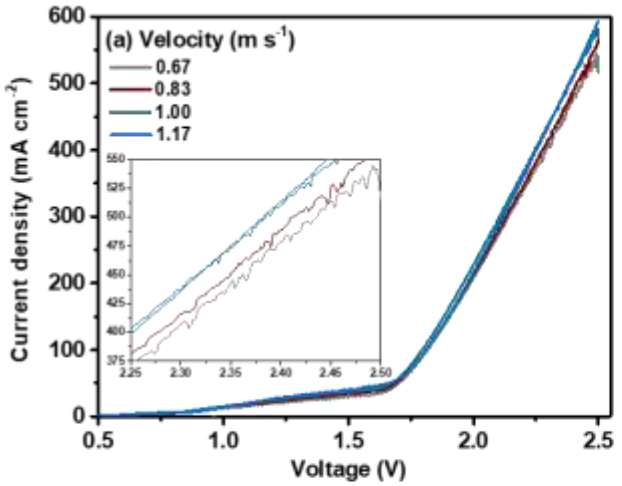
3D model of the μMEC – Additive Manufacturing

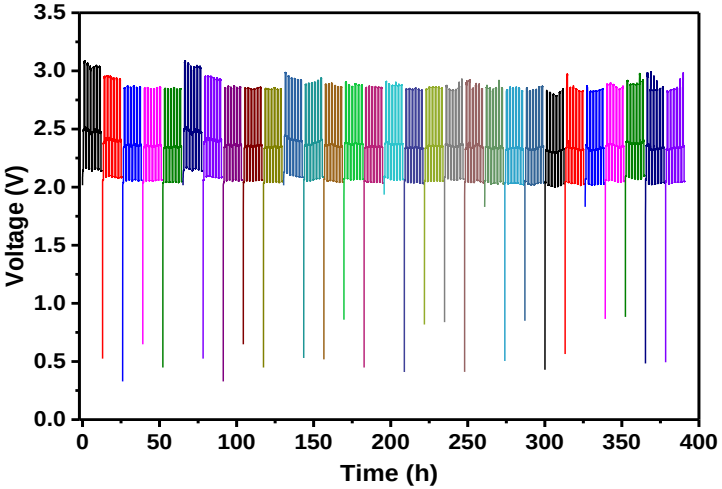


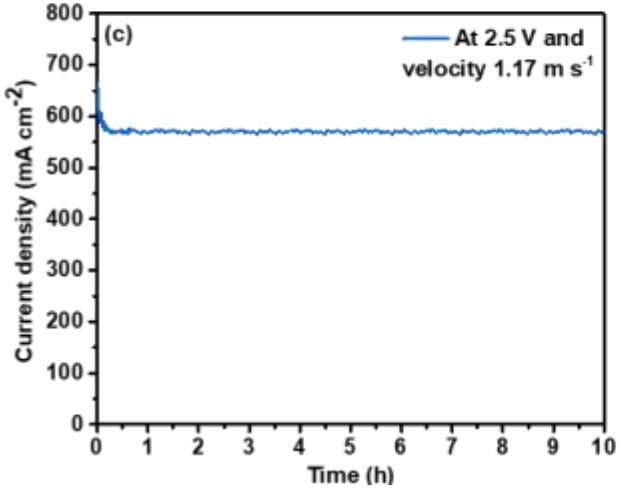
Schematic representation of the μMEC

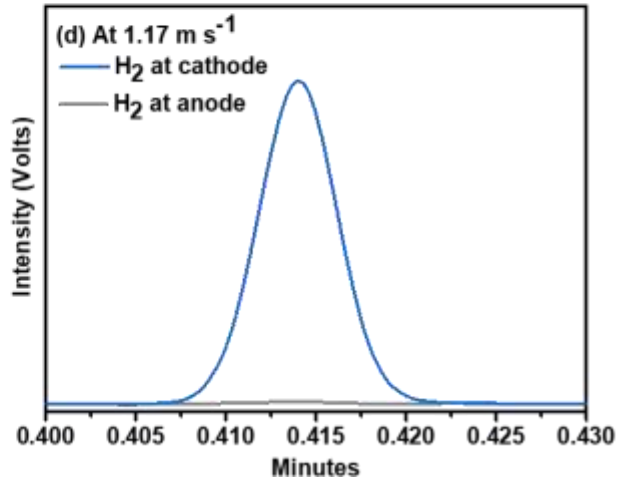


Electrochemical Performance Evaluation

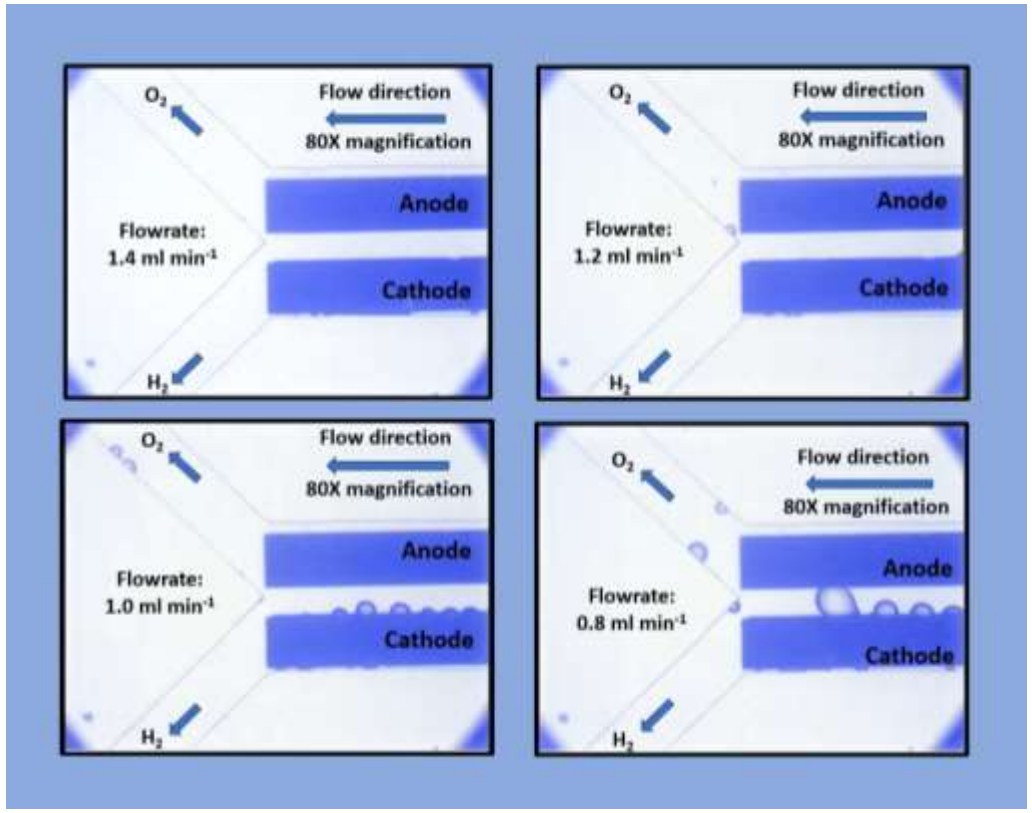






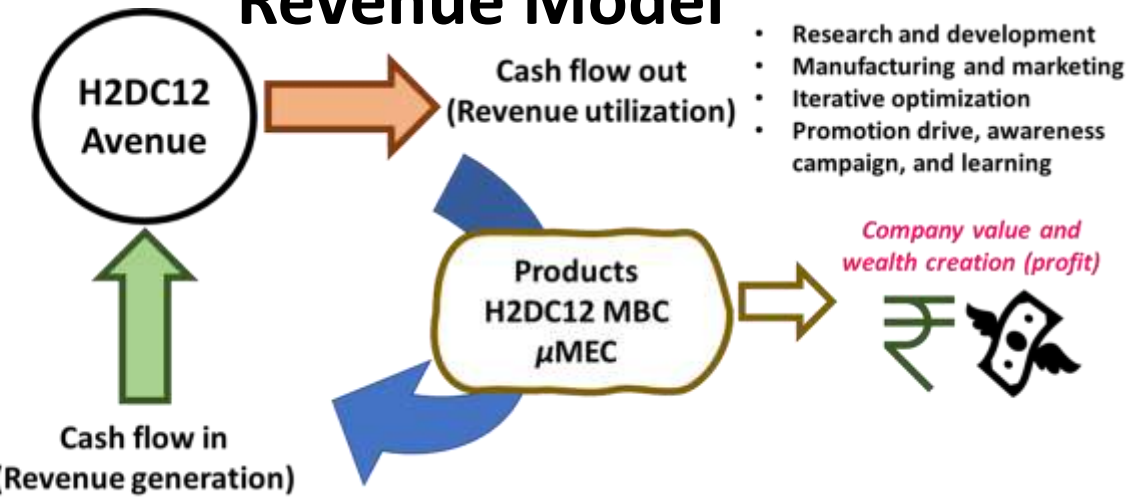


- ✓ A single μMEC exhibits 592 mA/cm^2 at 2.5 V corresponding 38.5 mL/h H_2 production.
- ✓ Low resistance is offered by the μMEC at an optimized electrolyte velocity of 1.17 m/s.
- ✓ The μMEC exhibited stable operation of 10 h and no gas intermixing.
- ✓ Accelerated stress testing done – stable reactor



H2DC12 Avenue Ltd.

Revenue Model



Sell products
- Green/clean H_2
- FDCA
- μMEC
- H2DC12 MBC

Services
- Lease/rent H2DC12 MBC and μMEC
- Install and operate
- Maintenance charges

Advertisements/ Sponsors/ Licensing
- Display advertisement on H2DC12 MBC
- Receive sponsorship
- Provide license for 3rd party use.

5-year Roadmap

Novelty – coproduction of H_2 and FDCA

- Biomass conversion to H_2 and FDCA via electrochemical process
- Conversion occurs in a μMEC developed indigenously
- H_2 and FDCA coproduction adds value
- Price of the green H_2 (300-500 INR/kg) and FDCA (10,000 INR/kg). Possibility of further reduction of price.

Acknowledgement:

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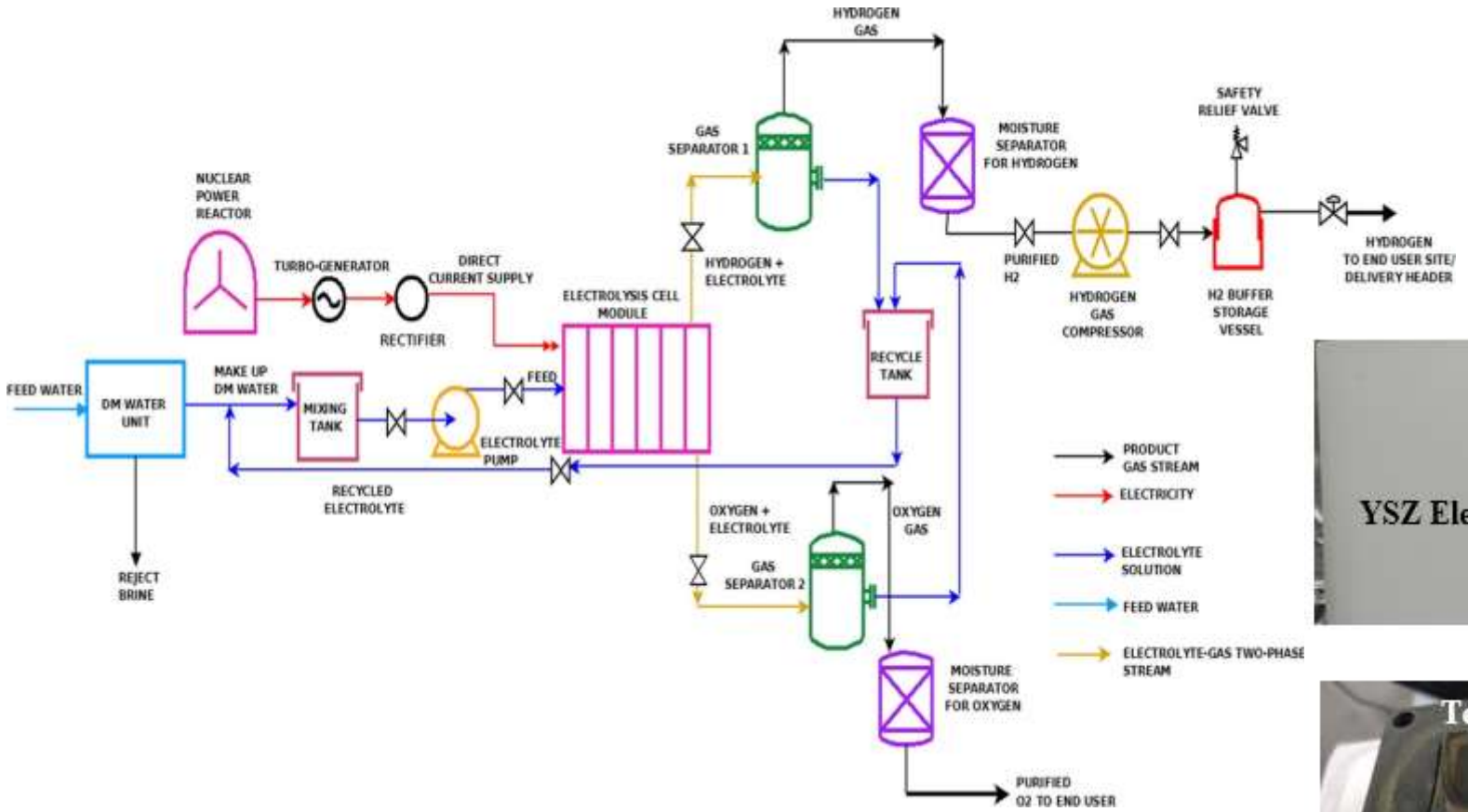
Ph.D. Students: Biswajit S De, Aditya Singh, Ram Ji Dixit

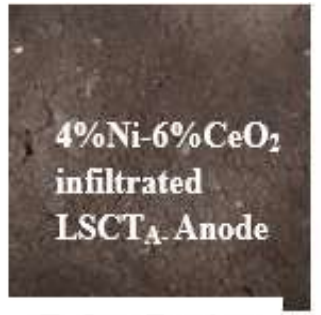
Coproduction – Nuclear Power and H2 using Solid Oxide Cell (SOEC)



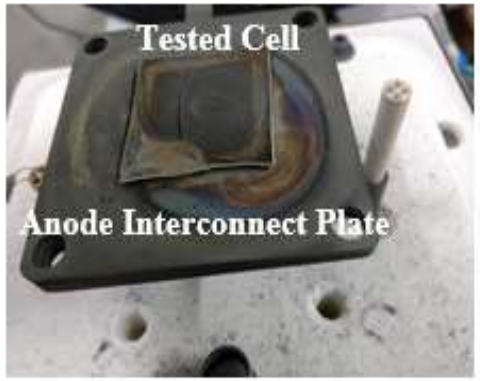
Coupled nuclear cogeneration plants

O-SOFC/O-SOEC
P-SOFC/P-SOEC

Test Station



Before Testing



After testing

SOFC Test Setup

Acknowledgement

Steps Taken By The Government

Institute For Energy Economics & Financial Analysis (IEEFA)

- Green Hydrogen Policy: 25% of world's energy market US$ 10 trillion by 2050
- Adoption of Electric Vehicle: 80% two and three wheelers, 70% commercial vehicle by 2030
- Market Based Economic Dispatch (MBED): Central Electricity Regulatory Commission (CERC) proposed self- scheduling by Discoms
- General Network Access (GNA): interstate transmission system
- Green Energy Corridors
- National Monetisation of Pipeline (NMP)
- Production Link incentives (PLI)
- Discom privatisation

- **Annual hydrogen demand in India** is 7.2 million tonnes (Primary demand arises from refineries and fertiliser plants)
- **Hydrogen demand in India** is projected to be 12 million tonnes in 2030 and 28 million tonnes by 2050

Government Policies Driving Corporate Plans in the Indian Energy Sector (Stationary Power)