Production of Xylitol from cellulosic feedstock's.

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Ravikumar Rao
Synopsis

Praj: Who are we?

Science we do?

Technology

- LC to Ethanol
- Biorefinery Concept
- Xylitol
Praj: Who are we?
‘We aspire to be the most preferred organization for all stakeholders through environment friendly and sustainable solutions that can make the world a better place’

Established in 1983 by first generation technopreneur, Pramod Chaudhari (Executive Chairman).

Globally leading Company with over **600 references** in more than **60 countries across 5 continents**.


Develop and deliver cost-effective, safe, clean and reliable solutions that will maximize prosperity of our Customers.

Catering to **Social Responsibility**.
Praj: Journey to Future

1985-1995
- Inception of Praj.
- Diversification into synergistic fields like development of process technology and Engineering and process equipment and systems for breweries.
- First international order from Indonesia for multi-pressure distillation.

1995-2000
- Commissioning of grain based ethanol plants in India.
- Ventures into South America in 2000 for ethanol plants.

2000-2005
- Enters into East European Market with engineering order for a grain-based plant.
- Launches Multi-feed & Multi-product Ethanol technology for distillery. Launch of PRAJ-Matrix - The Innovation Center for advanced applied research in the field of ethanol and brewing process.

2005-2010
- Groundbreaking of 2nd Generation (2G) Cellulosic Ethanol Demo Plant.
- Acquisition of Neela Systems.
- Enters CRSS business.

2010-2015
- Break-through in US market. Skid Mounted Ethanol Plant designed, manufactured for CSR, Australia. Manufacturing facility in Kandla (SEZ), India commissioned. Praj received orders from USA, UK, Europe.
- The state-of-the-art R&D facility, Praj Matrix established.
- The Cellulosic Ethanol Pilot Plant inaugurated.
Science we do?
Vision

“To be a Global Leader in Break-Through, Sustainable and Commercializable Technologies for Renewable Energy and Biobased Chemicals and Materials, Environment and Health Solutions while enhancing Societal and Stakeholder Value”.

Establishment

- Established in 2008
- Located at Pune
- Investment of above USD 25 Million

Infrastructure

- 5 acre expanse
- 85,000 sq. ft. of Research and Pilot facilities endowed with 14 well equipped Laboratories
- ISO 9001:2008 certified Analytical Facility
- 2 Pilot Plants (Cellulosic and Multipurpose)

Organization

Praj Matrix employs a Centre of Excellence (COE) model as its operating mechanism. It includes 100 and even growing number of Technologists organized within 5 Centre of Excellence

Focus Area

BioFuels
BioChemicals
Health & Wellness products
Advanced Strain Development
Livestock Health & Nutrition

Recognitions

Recognized Research Center by DSIR, Govt. of India
ABLE 10th Anniversary Award, 2013
Bio-Excellence Award 2009, 2012
IGCW Green Innovation Award, 2011
Innovation Award, IIT Bombay, 2007
Matrix, the R&D Center (division of Praj Industries), offers wide range of customized research services and solutions that will help Companies and innovators to:

- Develop and take new products to market rapidly.
- Accelerating new product/process development.
- Addressing new market opportunities by developing new products and targets.
- Improving commercial viability of validated targets.
- Bridging gaps in expertise and capability in microbial development, bio-processing, and process engineering.
- Scaling up production processes for viability at commercial scale.
Over 100,000 man days of R&D on the pilot plant and thereafter
PACE Technology Highlights...

- Proprietary pretreatment at moderate temperature with higher solids.
- High efficiency of cellulose and hemicellulose conversion at low enzyme dose.
- Co-fermentation of C-5 and C-6 sugars to ethanol.
- High yield of ethanol based on the feedstock composition (70-85 Gallons per dry metric ton).
- Integrated energy to reduce the steam and power requirement.
- Process operation is designed to recycle high levels of process water.
- Plant is designed for zero process liquid discharge.
- Designed for multiple feedstock (corn cobs, corn stover, sugarcane bagasse & sugarcane trash).
- Flexibility to ‘Bolt On’ to First Generation Plants.
A **BIOREFINERY** is characterised by an explicitly integrative, multifunctional overall concept that uses biomass as a diverse source of raw materials for the sustainable generation of a spectrum of different intermediates and products (chemicals, materials, bioenergy/biofuels), allowing the fullest possible use of all raw material components. The co-products can also be food and/or feed. These objectives necessitate the integration of a range of different methods and technologies.

The biorefinery process chain consists essentially of system components for the pre-treatment and preparation of biomass, as well as for the separation of biomass components (primary refining) and the subsequent conversion/processing steps (secondary refining).
Praj’s Lignocellulosic Biorefinery

Lignocellulose

- Size Reduction + Hydrothermal

Furfural

- Catalytic conversion

Dehydration

C5 Sugars

- Acid Hydrolysis

Fermentation

C6 Sugars

- Enzymatic Hydrolysis

Slurry Solids

- Fermentation

- Chemical Catalysis

Levulinic acid / Ethyl levulinate

Bioethanol

2,3-BDO

Xylitol

- Power

- Phenolics

Lignin

Tetrahydrofuran (THF)
Why Xylitol ???

- Natural sweetener
- Anti-cariogenic properties
- Benefits used in chewing gums and toothpaste
- No side effects compared to artificial sweeteners viz., Saccharin, Aspartame, etc.
- Non-nutritive
- Benefits as an alternative sweetener for diabetics
- Potential for higher value product association with ethanol
Xylitol: Process Flow Diagram

**Upstream Process**
- **Biomass**
- **Acid treatment**
- **Solid-Liquid Separation**
- **Neutralization**
- **Fermentation**

**Downstream Process**
- **Broth**
- **Water**
- **Cation/Anion Tandem chromatography**
- **Vacuum Evaporator**
- **Crystallizer**
- **Recycle to column**
- **Mother Liquor**
- **Xylitol Crystal/Powder**
Xylitol: Process Highlights

- The organism (GRAS status) involved is genetically stable and not amenable to changes by mutation, adaptation or genetic engineering.
- 75% Fermentation efficiency consistently achieved in 5L, 10L and 40 L batches with bagasse and corn cob streams.
- Non-sterile Fermentation.
- No detoxification required prior to fermentation.
- Robust and flexible DSP process which can perform irrespective of feed streams (corn cob, bagasse, etc).
- Xylitol Yield of 85-95 Kg/Dry Metric Ton of cellulosic feedstock.
- Product purity as per USP above 99%.
- Cost competitive technology for Xylitol.
Thank you