EMERGING TECHNOLOGIES IN DISTILLERY INDUSTRY

Presented

By

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A Group Company Of Shree Renuka Sugars Ltd.

All India Distillers Association, Hyderabad
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DISTILLERY INDUSTRY IN INDIA – A REVIEW

- Molasses based distilleries = About 400
- Molasses based installed capacity = 4.00 billion Lit/ Annum
- Grain based distilleries = About 100
- Grain based installed capacity = 1.80 billion Lit/ Annum
- Status of distilleries = Mostly attached to Sugar factories
DEMAND AND SUPPLY OF ALCOHOL IN INDIA

A. DEMAND

- For Potable – Approx. 1000 m Litres
- For industrial – Approx. 1000 m litres
- For Fuel – Approx. 1040 m litres
- Total demand – Approx. 3000 m litres

B. PRODUCTION

- Total alcohol production in India – 1938 m litres (2009-10)

Government of India has implemented Ethanol blending program which is @ 5% and target @10 % by 2017, for which demand is approx. 1040 m litres today.
### RAW MATERIAL FOR BIO-ETHANOL PRODUCTION

1. **Sugar Based:**
   - Cane Juice
   - Cane Syrup
   - Molasses
   - Beet sugar
   - Sweet sorghum

2. **Starch Based:**
   - Corn
   - Maize
   - Rice
   - Wheat
   - Various Grains
   - Cassava

3. **Cellulosic based:**
   - Bagasse
   - Rice Straw
   - Wheat straw
   - Other biomass

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Continuous Research & Development is undergoing on other feed stocks for generation of 3-G bio-fuels which is under process of implementation on large commercial scale.

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FERMENTATION & DISTILLATION PROCESSES

FERMENTATION PROCESS
- BATCH TYPE
- FED BATCH TYPE
- CASCADE
- BIOSTIL CONTI.
- VACUUM

DISTILLATION PROCESS
- ATMOSPHERIC
- MULTI PRESSURE
Challenging aspects/issues of distillery industry

• Distillery industry has been kept into red category of polluting industries.

• Mandatory for each distillery to achieve Zero Liquid Discharge as per CREP norms.

• Spent wash generated by molasses based distillery is having high COD, BOD, high SS, inorganics solids, low pH, strong odor and dark brown color.

• High energy consumption.
PROTOCOL/ GUIDELINES OF TREATMENT / DISPOSAL OPTIONS OF DISTILLERY EFFLEUNT

EXISTING MOLASSES BASED DISTILLERIES
Zero liquid discharge (100% by Dec2015) by following ways:

- Bio composting
- Concentration and incineration
- Biomenthanation followed by two stage secondary treatment followed by ferti irrigation
- Biomethanation followed by treatment and discharge into deep sea.
TREATMENT TECHNOLOGIES FOR DISTILLERY SPENT WASH

- Biomethanation followed by multi effect evaporation followed by drying/incineration/co processing/ bio composting
- Biomethanation followed by reverse osmosis followed by drying / incineration / co processing / bio composting
- Biomethanation followed by RO followed by MEE followed by drying / incineration/ co processing/ bio composting
- Concentration through RO/ MEE / followed by incineration / co processing
FACTOR AFFECTING THE SPENT WASH GENERATION IN DISTILLERY

- Type of fermentation process (batch, fed batch or continuous)
- Type of distillation (Atmospheric or Multi pressure)
- Distillation with or without reboiler
- Distillation with integrated evaporation system or
- Stand alone evaporator
- Alcohol concentration in wash due to molasses quality
- Selection of yeast strain
- Spent wash recycling
COMPETING TECHNOLOGIES FOR SPENT WASH EVAPORATION

- Thermal evaporators
- Reverse Osmosis
- Evaporation Ponds
- Deep well injections
- Spray Dryers
- Forward Osmosis
- Enhanced Evaporators
TYPE OF EVAPORATORS

- Natural / Forced circulation Evaporators
- Falling Films Evaporators
- Rising film (Long tube) evaporators
- Plate evaporators
- Multiple effect Evaporators
ZERO LIQUID DISCHARGE BY COMPOSTING

Distillery → Spent wash → Biogas → Biomethanation → Boilerm

Steam → Process condensate → Condensate polishing Unit

Biogas → Biogas → Composting

Concentrated spent wash → Evaporation

Water Recycling
ZERO LIQUID DISCHARGE BY SPENT WASH INCINERATION

Distillery

Steam & power for process

Incineration Boiler

Spent wash

Evaporation

Concentrated Spent wash

Condensate polishing Unit

Water Recycling

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SAILENT FEATURE OF KBK’S TECHNOLOGY...

Raw Spent wash Evaporation & Bio Methanated Spent Wash

Analyzer Column Bottom

Raw Spent Wash

Integrated Evaporation

5% Solids

High Efficiency Degasser Column + Integrated Evaporation

Bio-methanation

Stand Alone Evaporation

13% Solids

8.5-9 lit / per lit of alcohol

10% Solids

3.5-4.25 lit / per lit of alcohol

Stand Alone Evaporation

5% Solids

8.5-9 lit / per lit of alcohol

60% Solids

1.5-1.7 lit / per lit of alcohol

Bio Composting

10% Solids

3.5-4.25 lit / per lit of alcohol

30% Solids

1.5-2 lit / per lit of alcohol

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SAILENT FEATURE OF KBK’S TECHNOLOGY...

Raw Spent wash Evaporation & Bio Methanated Spent Wash

- CIP – Once a Month
- 50% Energy saving
- Low fixed and operating cost
- Good heat transfer coefficient
- System Operation At Optimum thermal Efficiency
- High Efficiency distributor for optimizing recirculation
- Optimization of tube size & passes for less power consumption
- High efficient vapor liquid separator avoids carryover and contamination

High Efficiency degasser for effective removal of dissolved gases in Biomethanated spent wash

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SAILENT FEATURE OF KBK’S TECHNOLOGY …

Fed Batch Fermentation

- High alcohol concentration irrespective of quality of molasses
- High alcohol production
- No Contamination carryover to next fermentor
- Reduction in Process water consumption
- Alcohol concentration can increase as per requirement with high brix feed
- Less Power and steam consumption in distillation
- Lesser generation of Effluent
- Lesser cost of effluent treatment

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SAILENT FEATURE OF KBK’S TECHNOLOGY …

Bio-digestor

- Ease of operation
- Optimum hydraulic retention time
- 60 to 65% COD reduction
- High methane content in biogas
- Handles high COD feed
- High TSS handling capacity
- Mesophilic operation, hence no external steam
- Equipment with Vacuum & pressure safety devices

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SAILENT FEATURE OF KBK’S TECHNOLOGY

- Lower capital cost
- Higher BOD/COD removal efficiency
- Colorless treated water
- 90% to 95% water to be reused for cooling tower makeup after treatment
- Less Operation Cost
- Ease for operation
- Less chemical consumption
- Less power requirement

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KBK’s TECHNOLOGICAL INNOVATION

A. FERMENTATION

( High Feed Brix Fed Batch Technology)

1. Achieved maximum alcohol percent in wash upto 12 %
2. Minimum byproducts formation
3. Reduction in spent wash generation (less than 7 lit/lit of alcohol) at source
4. High alcohol percent even in molasses with high volatile fatty acids
5. Less chemical consumption
6. Lower power consumption
KBK’s TECHNOLOGICAL INNOVATION

B. DISTILLATION TECHNOLOGY

1. Maximum waste heat recovery
2. Less steam consumption (molasses 2.80 Kg/lit of total alcohol (ENA) & Grain 2.60 Kg/lit of total alcohol for ENA.
3. Distillation design at low steam pressure.
4. 99 % Distillation efficiency
5. Less power consumption
6. Fully automatic single chair operation
7. Maximum spent lees recycling
8. Product quality of high strength
KBK’s TECHNOLOGICAL INNOVATION

C. EVAPORATIVE TECHNOLOGY

1. Expertise in biomethanated as well as raw spent wash evaporation system. Having proven technology.

2. KBK has proven degassifier technology for biomethanated spent wash evaporation

3. Evaporation is designed at low steam pressure with best possible steam economy.

4. Less steam consumption with maximum heat recovery.

5. Maximum instrumentation for single chair operation.

6. Maintaining adequate wetting ratio resulting into less scale formation

7. Less CIP / cleaning frequency (25 days / 8 hrs)

8. Clear and transparent process condensate

9. Falling as well as forced circulation evaporators / in combination

10. More than 20 references of RSW and BSW.

11. Capacity ranging from 150 m3 to 1600 m3/day.
MOLASSES BASED DISTILLERY
COMPARATIVE ENERGY REQUIREMENT WITH SPENT WASH CONCENTRATION

STAND ALONE EVAPORATION
• Distillation = 2.80 Kg/Lt
• Evaporation = 2.20 Kg/Lt
• Total = 5.0 Kg/Lt.

INTEGRATED EVAPORATION
• Distillation = 2.80 Kg/Lt
• Evaporation = 0.90 Kg/Lt
• Total = 3.70 Kg/Lt

Note: The above figures are for wash to ENA configuration.
Established in 1997.

KBK is wholly owned subsidiary of Shree Renuka Sugars Ltd. (SRSL)

SRSL is amongst the world’s leading companies in area of Sugar, Power and Bio-Ethanol

KBK has expertise in Distillery field for last 18 years.

Group turnover of company is $1.7 Bn.

KBK has executed about 50 projects across the Globe successfully
**GLOBAL GROUP BUSINESS OVERVIEW**

**KEY BUSINESS PROCESS**

- **Brazil**
  - Integrated Sugar Mills
  - Harvesting of owned cane in Brazil

- **India**
  - Imported / Local Raw Sugar
  - Indian sugarcane primarily converted to white sugar for domestic consumption
  - India-based sugar refineries can process imported raw sugar and re-export (tolling operation)

- **Power Co-Gen**

- **Sugar**

- **Ethanol**

- **Refined Sugar**

- **Integrated Sugar Mills**

- **Refineries**

- **Sugar / Ethanol Trading**

- **KBK Chem-Engineering**

- **Observations**
  - Brazilian raw sugar primarily exported
  - Indian sugarcane primarily converted to white sugar for domestic consumption
  - Physical trading of sugar and ethanol in Asian region enables better risk management

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EPC AND TURNKEY BUSINESS

- **Anhydrous Alcohol** - Fuel grade (Ethanol)

- **Hydrated Alcohol**
  - Rectified Spirit
  - Extra Neutral Alcohol
  - Export Quality Rectified Spirit
  - Industrial Grade Alcohol

- **Alcohol Allied Chemicals**
  - Ethyl Acetate
  - Acetic Acid

- **Process plants using feedstock as...**
  - **Sugar based Raw materials** – Molasses, Sugar Cane, Sweet sorghum
  - **Starch based Raw material** – Maize, Cassava, wheat, Sorghum & other grains.
Equipment Business :- **Design & Manufacturing as per ASME Standard**

- Critical Equipment – U Stamp
- Sugar Industry
- Food industries
- Chemical & Petrochemical Industry

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STRENGTHS...

- Workshop certified with

- ISO 9001:2008

- Total 100 Experienced Engineers adds strength to our organization

- Complete in-house Engineering & Design, Manufacturing, Erection – Commissioning & Services

- Professional and Experienced Team

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Process Engineering
We design build & maintain the plant with the help of high end process simulation software “CHEMCAD” which provide latest engineering techniques at our finger tips.
Static Equipment Design

Pressure Vessel and Distillation Column: Design as per ASME Standard

For static equipment analysis and its optimization we use High End PV Elite software.

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Static Equipment Design

Exchanger: Design as per ASME Standard and TEMA standard. For Heat exchanger analysis and its optimization, we use High End PV Elite software.
Design Optimization – Structural Optimization

Storage Tank: Design as per API Standard

Analysis & Optimization of Structure for API tank is done by High End STAAD Pro software.
Design Optimization – Structural Optimization

Storage Tank :- Design as per API Standard Analysis & Optimization of Structure for API tank is done by High End STAAD Pro software.
3D model of Distillery Plant Layout Optimization

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3D MODEL OF DISTILLERY PLANT
PIPING LAYOUT
MANUFACTURING STANDARDS

• **Certifications**
  ISO 9001: 2008

• **Third Party Approvals**
  “Bureau Veritas”
  “TUV”
  “SGS”
  “VSI”

• **Fabrication codes**
  ASME Section VIII Div. I.
  ASME Section V for NDE
  ASME Section IX for Welding

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MANUFACTURING INFRASTRUCTURE

- 51000 Sq. Ft. Work Area.
- Lifting Capacity of 25 MT.
- 40 ASME Qualified Welders
- Processing Cap. Per Month- 350 Tons

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MANUFACTURING INFRASTRUCTURE

- Pre Pinching Rolling Machine
  Capacity 25 Thk x 2000 mm Width

- Shearing Machine
  Capacity 10 Thk x 2500 mm Width

- Press Machine
  Capacity 10 Thk x 2500 mm Width
• Radial Drill Machine
  Capacity - Drill size up to 2” & thickness up to 100 mm

• Air Plasma Machine
  Capacity up to 70mm Thk.

• Lathe Machine
• **Certifications**
  - ISO 9001: 2008
  - “U” Stamping
  - “R” Stamping

• **Third Party Approvals**
  - “Bureau Veritas”
  - “TUV”
  - “SGS”
  - “VSI”

• **Fabrication codes**
  - ASME Section VIII Div. I.
  - ASME Section V for NDE
  - ASME Section IX for Welding

• **ASNT Qualified QC Team.**
  - Welding Inspectors.
  - DP Level II.
  - Radiography Level II.
  - Visual Testing Level II.
  - UT Level II.

• **Testing Facilities**
  - Radiography Room.
  - Instrument Calibration
  - PMI Testing
  - Ultrasonic Testing

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Health, Safety & Environment

- Health & Safety Policy
- Safety Manual
- Awareness Programs
- Training to Workmen Supervisors
- Regular Audits
Water Treatment Plant

Columns

Dryers

Condensate polishing Unit

Copper Pot Still

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KBK’S EXPERIENCE

International Project

- Renuka VDI, Brazil - 300 Klpd
- EPCL, Thailand - 200 Klpd
- San Carlos Bio energy Inc. Philippines - 120 Klpd
- Roxol Bio-Energy Corporation, Philippines - 100 Klpd
- Compagnie Sucriere, Senegalese - 60 Klpd
- Metahara Sugar Factory - 50 Klpd
- IBTC, Myanmar - 40 Klpd
- S.I.S industries, Bulgaria - 40 Klpd
- Nagarjuna Vietnam Ltd - 30 Klpd
- Kilimanjaro Biochem Ltd, Tanzania - 20 Klpd
KBK’S EXPERIENCE

Project In India

- Shree Renuka sugars, Athani- 210 KLPD
- Shree Renuka sugars, Khopoli- 210 KLPD
- NCS Distillaries Pvt. Ltd- 200 KLPD
- Khandoba Distillaries Ltd- 150 KLPD
- Gwalior Distilleries Ltd- 130 KLPD
- Sentini Bio-Products – 125 KLPD
- NSC Sugar Ltd- 120 KLPD
- S V Sugars Mills Ltd- 100 KLPD
- Jai Mahesh- 100KLPD
- The Dhampur Sugar Mills Ltd - 100 KLPD
- Esveeaar Distilleries Pvt. Ltd- 80 KLPD
- Uttam Sugars Ltd – 75 KLPD
- Empee Distilleries - 70 KLPD
Sanjivani SSK Ltd 60 KLPD
Natural Sugars & Allied Industries Ltd- 30 KLPD
Loknete Baburao patil, SSK Ltd- 30 KLPD
Pranav Agrotech Industries- 30 KLPD
Ghodganga Sahakari Sakhar Karkhana Ltd- 30 KLPD
GNFC- Ethyl Acetate Plant- 150 KLPD
Ganganagar Sugar Mills Ltd, Rajasthan 30 KLPD ENA Plant
Sanjeevani SSK. Ltd, Kopargaon 60 KLPD Ethanol plant
Hutatma SSK, Sangli, Spent wash Evaporation 350 Cu. M / Day
UP Cooperative Sugar, Kaimganj (Ethanol) 20 KLPD Ethanol plant
SRSL, Athani’- SW Evaporation 300 KLPD
SRSL, Havalga-SW Evaporation 180 KLPD
Bajaj Hindusthan (Kinauni)– SW Evaporation 160 KLPD
TECHNICAL ADVANTAGES

- 40% thin slop and 70% spent lees recycle
- Simultaneous saccharification and fermentation
- 14-15% v/v alcohol in fermented wash
- Optimised fermentation cycle
- Multi-feed plant configuration with wheat, rice, corn, sweet sorghum etc.
- Patented novel yeast strain
- DDGS dryer with LNG / Steam as heating source
- DDGS waste vapour recovery system
- Optimised consumption of additives and enzymes
Shamanur Sugars Ltd., Karnataka
60 KLPD - ENA & Ethanol
THE SANJIVANI SSK LTD, KOPARGAON MH.
60 KLPD Ethanol Plant
Rajasthan State Ganganagar Sugar Mills Ltd.
30 KLPD Duel Feed EQRS Plant
San Carlos Bio-energy Inc., Philippines
125,000 Liters per Day Cane Juice Ethanol Plant
KBL TANZANIA
20 KLPD Molasses
Renuka VDI, Sao Pedro, Brazil
300 KLPD Ethanol
Ekarata Pattana Company Ltd., Thailand
200,000 Liters per Day Ethanol Plant
**TECHNICAL ADVANTAGES**

- Maximum vinasse recycle to reduce effluent generation at source
- Achieved lowest vinasse generation of 1.5 lit / lit of ethanol
- Maximum productivity with optimum utility consumption and low cost of production
- Novel yeast strain suitable for high osmotic pressure
- Optimised fermentation cycle
- No requirement of performance boosters
- No use of Bio-cides

**Roxol Bio-energy Corporation, Philippines**

100,000 lit / day Molasses based Distillery (RS/ENA/Ethanol)

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Metahara Sugar Factory, Ethiopia

50 KLPD Ethanol Plant
Sugar Equipment

- Juice Heater up to 600 M Sq. HS
- Vacuum Pan up to 120 MT
- Robert Type Evaporator up to 4000 M Sq. HS
- SK Body Evaporator up to 3000 M Sq. HS
- Falling Film Evaporator up to 4750 M Sq. HS
- Direct Contact Heat Exchanger up to 530 M 3/Hrs Flow rate
- Crystallizer up to 130 MT
- Pug Mill
- Magma Minglers

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Equipment For Edible Oil Industry

- Tanks
  - Filling Tank
  - Charan Tank With heating Coil & Agitator
  - Citric Oil Reaction Tank With agitator
  - Citric Acid Tank With agitator
  - Caustic Tank With agitator
  - Caustic Lye Preparation Tank with agitator

- Heat Exchangers
  - Miscela heater
  - Heat Exchangers
 Charan Tank with Heating Coil & Agitator

 Client: Adani Wilmar Ltd, Mangalore

 Tank ID: 3 Mtr.
 Spot RT.
 Mirror Finish
- Filling Tank
- Client: Adani Wilmar Ltd, Mundra
- Tank ID: 2 Mtr.
Miscla Heater

Client :- Wilmar continental Ltd., South Africa
Design & Manufacturing As per ASME Code, Client - BBM Acoustic
MOC- SA 516 Gr70 Dia 3.6 Mtr. 100 % RT, Client- United Phosphorus Ltd.

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Reactor Vessel

MOC- SS 316,
Diameter  6.2 Mtr.
Height  11 Mtr.
100 % RT,

Client-GNFC Ltd
ESTEEMED CUSTOMERS

Kilimanjaro Biochem Ltd

GRAND ROYAL
SPECIAL RESERVE
WHISKY

PARRYS

CSS

Compagnie
Sucrerie
Sénégalaise

UNITED
BREWERIES
LIMITED

UB

EKAHAT

Dhampur Sugar Mills

SANJIVANI
SSK Limited

UPL Limited

METAHARA SUGAR FACTORY

Shree Renuka Sugars Limited

GAR

CIM

Baramati Agro Limited

EMPEE GROUP

SAN CARLOS BIOENERGY, INC.

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Thank You!