Sugarcane and Sugar Industry in Vietnam: Overview and Research and Development Prospects

Son Chu-Ky

Email: son.chuky@hust.edu.vn

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Outline

• Overview on sugar industry in Vietnam
• Major challenges for sugarcane cultivation and sugar industry in Vietnam
• Future prospects
• Conclusion
Overview on sugar industry in Vietnam

Current

Total
41 Factories
Total Capacity
140,000 TCD
Increased 1.5 times as against 2005 and increased 12.7 times as against 1995

1994

Total
9 Factories
Total Capacity
11,000 TCD

1990

Vietnam sugar industry started to develop

(Pham Quoc Doanh, 2017)
In 2017/18 season:

- only 36 mills and 1 refinery are operating
- Total installation capacity of 62,300 tons cane/day

- North and North of center: 11 mills.
- Center and highland: 14 mills.
- Mekong Delta: 11 mills and 1 refinery

- Cane stand areas: 238,000 ha
- Crushing cane output: 15,430,000 tons
- Sugar production: 1,476,500 tons

(VSSA, 2018)
Sugarcane varieties composition

- Thailand: 41%
- Taiwan: 22%
- France: 13%
- China: 12%
- Cuba: 9%
- Vietnam: 2%

(Cao Anh Duong, 2017)
Sugar cane and sugar production in Vietnam during 2013-2018

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<tbody>
<tr>
<td>Cane area (ha)</td>
<td>310,400</td>
<td>305,000</td>
<td>284,300</td>
<td>268,300</td>
<td>238,300</td>
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<tr>
<td>Cane production (ton)</td>
<td>20,128,500</td>
<td>19,821,600</td>
<td>18,335,800</td>
<td>17,171,300</td>
<td>15,430,000</td>
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<td>Cane yield (ton/ha)</td>
<td>64.80</td>
<td>65.30</td>
<td>64.40</td>
<td>64.80</td>
<td>64.80</td>
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<tr>
<td>Sugar yield (ton/ha)</td>
<td>5.96</td>
<td>5.54</td>
<td>5.77</td>
<td>5.66</td>
<td>5.66</td>
</tr>
<tr>
<td>No. of sugar factories</td>
<td>41</td>
<td>41</td>
<td>41</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>Total capacity designed (ton/day)</td>
<td>133,950</td>
<td>139,350</td>
<td>150,500</td>
<td>153,335</td>
<td>-</td>
</tr>
<tr>
<td>RE production (ton)</td>
<td>663,998</td>
<td>700,000</td>
<td>700,000</td>
<td>411,000</td>
<td>-</td>
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</tbody>
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(VSSA, 2018)
Challenges of sugarcane cultivation in Vietnam

- Most of sugarcane varieties (98%) are imported but no major one (occupied over 30% area)
- Few production system of disease-free cane seed (farmers mainly use raw material cane as seed cane for planting)
- Over 70% sugarcane area is non-irrigated
- 60% sugarcane area in hill soil
- Fertilizer application does not meet the requirements on quantity and balance
- Low rate of mechanization application, especially on harvesting
- High losses due to pests, disease and post-harvest
- High production cost, lower competitiveness

(Cao Anh Duong, 2017)
Challenges for sugar industry in Vietnam

• High production costs of cane production
• Low productivity of small sugar mills
• Regulatory strategies
• Workforce
• High competition in prices and quality with other alternatives

(VSSA, 2018)
• Sugarcane yield limiting factors: unfavorable weather, water stress, poor rainfall distribution, low soil fertility, improper land use and poor land management
• Very few professional training and education system for sugarcane and sugar industry in Vietnam
• **Limited linkage and cooperation** between farmers, sugar mills and R&D institutes and universities

(VSSA, 2018)
Future prospects for sugarcane and sugar industry

• Building long-term development strategy for sugarcane industry to 2025, vision to 2030
• Developing and strengthening cooperation with regional and international association and federations
• Improving capacity of utilization of sugar mills
• Focusing on planning and sugarcane field investment, lowering production cost and increasing farmers’ profits
• Profit sharing system between mills and farmers
• Providing more funding for RD programs on variety, co- and by-products from sugar industry (sweeteners, bio-ethanol and electric cogeneration...)

(VSSA, 2018)
Invert sugar process

- **Lab scale**: <1000 ml
  - NOSUCO’s sugar
  - Sugar concentration: 70, 75, 80%
  - Enzyme concentration: 0.63%; 1.26%; 0.31%
- **Pilot scale**: 15 – 30 L
  - NOSUCO’s sugar (70 Bx)/syrup (62Bx)
  - Enzyme: 0.3%

1. **Sugar, syrup**
2. **Dissolution (Bx 70, 75%)**
3. **Heating (50-55°C)**
4. **Hydrolysis 6-12h, 50-55°C**
5. **Stir**
6. **Enzyme inactivation 100°C, 5 min**
7. **Invertase**
8. **Buffer solution pH 4.5**
9. **Citric acid**
10. **Invert sugar**
Invert sugar process at pilot scale
Adding more values to molasses by-products

Yeast biomass

INOCULUM DEVELOPMENT

Stock culture ➔ Shake flask ➔ Seed fermenter ➔ Production fermenter ➔ Culture fluid ➔ CELL SEPARATION ➔ Biomass

Medium sterilization ➔ MEDIUM FORMULATION ➔ Medium raw materials ➔ PRODUCT EXTRATION ➔ Cell-free supernatant

PRODUCT PURIFICATION ➔ EFFLUENT TREATMENT ➔ PRODUCT PACKAGING

Manufacturing of dry yeast

Laboratory ➔ Fermentation ➔ Centrifugation ➔ Yeast cream storage ➔ Rotating vacuum filter ➔ Instant yeast drying
Exploring traditional fermented foods and their microflora for probiotic microorganisms

Research axes:
+ Tropical fermented foods
+ Tropical bioactive products
+ Specific network in bioencapsulation:

Modified raw material composition to increase the nutritional value

Starter
Modified recipes
New fermented products
Biocatalyst
Producer of antagonistic compounds (bacteriocin)
Technology transfer
New technology of fermentation

Quality & safety improvement
Traditional fermented foods
Fermented product microflora
Probiotic strains

Tropical Bioresources & Biotechnology
International Joint Laboratory

Exploring traditional fermented foods and their microflora for probiotic microorganisms
Virtual collection of microbial strains for biotechnological interests
Pre-adaptation approach

Appropriate dryings and carriers

Pre-adaptations (acid, temp, cross protection)

Optimized dryings + Pre-adaptations

Increase in microbial viability and functionality after drying

(Chu-Ky et al. 2013)
Conclusion

• Significant achievements for Vietnam sugar industry over 25 year with “one million ton of sugar” program
• Various existing challenges for sugar cane and sugar industry in Vietnam
• Enforcing research and development for sugarcane breeding and planting and for diversifying high added-value products from co- and by-products of sugar industry
Contact

School of Biotechnology and Food Technology (SBFT)
Hanoi University of Science and Technology (HUST)

Office: 202 - building C4
1, Dai Co Viet, Hai Ba Trung, Hanoi 100000, Vietnam
Phone/Fax: +84 24 3868 2470
Email: sbft@hust.edu.vn
Website: http://sbft.hust.edu.vn

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Thank you for your attention!