RECP Demonstration and Assessment of China’s Cassava Starch Processing

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Contents

1. Current situation of cassava starch processing in China
2. RECP demonstration and assessment
3. Future trends and plan
Current situation of cassava starch processing in China
Cassava is a woody shrub, belongs to perennial crop. Cassava has edible roots. Its roots can make cassava powders and breads, produce cassava starch and cassava alcohol.
Global cassava distribution

Cassava originates from tropical America, and is widely cultivated in tropical and subtropical regions, mainly in Brazil, Bolivia, Mexico, Nigeria and so on.
### Global cassava output

Output of the largest five cassava planting countries in 2013 (FAO)

<table>
<thead>
<tr>
<th>Country</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>53 million tons</td>
</tr>
<tr>
<td>Thailand</td>
<td>30.23 million tons</td>
</tr>
<tr>
<td>Indonesia</td>
<td>23.94 million tons</td>
</tr>
<tr>
<td>Brazil</td>
<td>21.48 million tons</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>16.5 million tons</td>
</tr>
</tbody>
</table>
Cassava starch is extracted from cassava, widely used in food and non-food industries, such as drinking, candy, papermaking industries etc.

Cassava starch are divided into two categories: native cassava starch and modified cassava starch.

Specific modified cassava starch can be customized according to the requirements of users for meeting the special application.
In China, cassava has been introduced and cultivated since 1820s, now widely distributes in south China (Guangxi, Guangdong etc).

In recent years, cassava planting area in China is about 1.07 million acres. And the total output of cassava roots is 8.5-8.8 million tons. **Guangxi** accounts for about 60% of the planting area and cassava output in China.
China was by far the largest global buyer of cassava and cassava starch.

<table>
<thead>
<tr>
<th>Year</th>
<th>Dried cassava</th>
<th>Cassava starch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight (million ton)</td>
<td>Trade value (billion US$)</td>
</tr>
<tr>
<td>2010</td>
<td>5.76</td>
<td>1.20</td>
</tr>
<tr>
<td>2011</td>
<td>5.03</td>
<td>1.39</td>
</tr>
<tr>
<td>2012</td>
<td>7.14</td>
<td>1.78</td>
</tr>
<tr>
<td>2013</td>
<td>7.39</td>
<td>1.83</td>
</tr>
<tr>
<td>2014</td>
<td>8.65</td>
<td>2.11</td>
</tr>
</tbody>
</table>

http://comtrade.un.org/data/
Cassava starch industry

1. China has great domestic demand
Import of cassava starch grows at 14% per annum.
China is the largest global buyer of cassava and cassava starch.

2. Characteristic and pillar industry of Guangxi
Guangxi: the largest production base of native starch in China
76 enterprises

3. Pressure from South Asia
Starch from South Asia: low price

China’s cassava starch industry is facing with reform and modernization.
Mostly SMEs: using backward techniques and equipments

- Low starch recovery rate: ≤80%
- High COD generation: 350,000 t/a
- Huge consumption of fresh water: 14,000,000 m³/a
Main problems in cassava starch industry

RECP demonstration and assessment
Learn from the advanced potato production experience of Europe, and according to the technical characteristics of cassava production, a new production process was established.
Cassava

Simply washing

hammer crushing

Vertical screen

Disc centrifuge

Dewatering

Drying

Product

Cassava

Countercurrent washing

hammer crushing + rasper

Horizontal centrifugal screen

12-stage hydrocyclone

Dewatering

Biogas

Residue

Wastewater treatment

Residue

Product

Feed, Fuel

RECP process

Traditional production process
The RECP demonstration plant with an annual production capacity of 20,000t native starch has been established in 2013.
Demonstration plant

Plant after RECP transformation
Increase the release of the free starch
Effect

Vertical centrifugal screen

Horizontal centrifugal screen

Reduce water consumption & starch losses
Disc centrifuge
Hydrocyclone

Effect

Reduce water consumption & starch losses
Improve starch quality
The RECP plant has drawn great attention:《China Environment News》(Feb. 13, 2014) reported the RECP demonstration and its experience in Guangxi.
Assessment

Supported by a Resource Efficiency and Cleaner Production (RECP) project of UNIDO/UNEP, CNCPC and Swiss SOFIES jointly implemented cleaner production evaluation in the cassava starch industry in Nanning, Guangxi in 2015.
Assessment result

Business model: **financial leasing**

<table>
<thead>
<tr>
<th>Important RECP indicators</th>
<th>Traditional technology</th>
<th>RECP demonstration</th>
<th>Degree of change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicators of resource and energy utilization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Water consumption (/t starch)</td>
<td>20m$^3$</td>
<td>$\leq$9m$^3$</td>
<td>$-11m^3$</td>
</tr>
<tr>
<td>2. Power consumption (/t starch)</td>
<td>235kwh</td>
<td>170kwh</td>
<td>$-65kwh$</td>
</tr>
<tr>
<td>3. Recovery of starch</td>
<td>$\leq$80%</td>
<td>90%</td>
<td>$+10%$</td>
</tr>
<tr>
<td><strong>Indicators of pollution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Waste water generation (/t starch)</td>
<td>$\geq$20m$^3$</td>
<td>$\leq$9m$^3$</td>
<td>$-11t$</td>
</tr>
<tr>
<td>2. COD generation (/t starch)</td>
<td>0.3t</td>
<td>$\leq$0.2t</td>
<td>$-0.1t$</td>
</tr>
</tbody>
</table>
## Key starch quality indicators

<table>
<thead>
<tr>
<th></th>
<th>RECP demonstration</th>
<th>Traditional technology</th>
<th>Superior-class product (GB/T 29343-2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water content (%)</td>
<td>10.85</td>
<td>12.57</td>
<td>≤13.5</td>
</tr>
<tr>
<td>Whiteness (%) 457nm</td>
<td>95.2</td>
<td>89.7</td>
<td>≥92</td>
</tr>
<tr>
<td>Spots (number/cm³)</td>
<td>0.5</td>
<td>3.3</td>
<td>≤3.0</td>
</tr>
<tr>
<td>Ash content (DW, %)</td>
<td>0.18</td>
<td>0.25</td>
<td>≤0.2</td>
</tr>
<tr>
<td>Viscosity (BU)</td>
<td>1238</td>
<td>800-1000</td>
<td>≥600</td>
</tr>
</tbody>
</table>

**Assessment result**

- Resource and energy saving
- Product quality improvement

**Economic benefits:**

+95 USD/t starch
Most of cassava starch producers in China use backward technologies and equipments to produce native starch.

The RECP technologies can greatly improve the resource efficiency and product quality.

The RECP process in this project can be copied and disseminated to companies in China as well as other countries.

There are still big potential of energy saving, low carbon production and environmental protection for the producers.
Future trends and plan
Recently China government has issued several plans and programs, focusing on “green” or “clean” upgrading of traditional industries.

- **2013** Action Plan for Prevention and Control of Air Pollution
- **2015** Action Plan for the Prevention and Control of Water Pollution
- **2015** Made in China 2025

Requiring:
- New process
- New idea
- New model
Impacts of RECP demonstration

- Setting up RECP process
- Establishing new idea
- Creating business model

A good case for green and clean upgrading of traditional industries in China

Especially SMEs
Based on the RECP demonstration, a plan is settled to further improve RECP performance focusing on low carbon production (*Laibin city*).

**Future plan**

**Low carbon production:** Steam from the power plant (CHP)

**Valorization of waste water:** Organic fertilizer
Conclusion and recommendation

For China

China is one of the largest consumer of natural resources in the world, and has discharged a great amount of pollutants due to low resource efficiency. China is facing great challenges on **greening** the traditional industries. The RECP demonstration exhibits a new **model** for such efforts. We hope international practices can also provide experience and support to speed up the China’s green transformation.

For the world

Cassava industry is quite important in the world, especially in **Africa and Asia**. China’s RECP demonstration is also of great value to the global **cassava industries**.

<table>
<thead>
<tr>
<th>Area</th>
<th>Cassava output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>157,718,952 t</td>
</tr>
<tr>
<td>Americas</td>
<td>30,496,273 t</td>
</tr>
<tr>
<td>Asia</td>
<td>88,283,261 t</td>
</tr>
<tr>
<td>Oceania</td>
<td>263,572 t</td>
</tr>
</tbody>
</table>

2013, FAO
CNCPC hope to integrate the resources of breeding, planting, processing, product, equipment manufacturing and financial service of cassava industry, to provide technical and financial support for the development of global cassava industry.