Bioethanol is made by fermentation of renewable feedstocks, followed by distillation and dehydration processes. Typical feedstock materials are:

- **starches and cereals** -- wheat, corn, rye, cassava, potatoes, rice
- **sugars** -- cane molasses, beet molasses, sugar syrup, fructose, whey

Raw material for bioethanol is sugar derived in an enzymatic reaction from starch. The fermentation generates ethyl alcohol with the help of yeast. This ethyl alcohol (bioethanol) is then separated by distillation. For petrol-grade bioethanol, the alcohol must be dehydrated, raising the concentration of bioethanol to more than 99%.

The by-product of the ethanol process is stillage. It can be used to fuel biogas plants for energy generation, or it can be converted into DDGS, a protein-rich food for animals.
Bioethanol Production Process

Process steps

A Slurrification
After milling, the mash is liquified with water and steam, and starch is enzymatically transformed into sugars.

B Fermentation
The mash is mixed with yeast. The yeast ferments the sugar into alcohol and CO₂.

C Distillation
The mash is cooked and the alcohol evaporated in the column.

D Rectification
The rectifier concentrates the alcohol.

E Dehydration
The concentrated bioethanol is dehydrated to an ethanol content of more than 99.9 %.

F CO₂-recovery
The CO₂ from fermentation is collected, washed, liquified, and pumped to a storage tank.

G Stillage treatment
The remaining stillage is evaporated and then dried.
# Innovative Solutions from Sterling SIHI
## Process Pumps for Bioethanol

<table>
<thead>
<tr>
<th>Process Pumps for</th>
<th>Pump type</th>
<th>Pump execution</th>
</tr>
</thead>
</table>
| 1 Mash | Centrifugal pump Type CBT | Capacity: max. 2200 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron, stainless steel  
Ex-proof: yes |
| | Centrifugal pump Type DBS | Capacity: max. 800 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron, stainless steel  
Ex-proof: yes |
| | Centrifugal pump Type CBS | Capacity: max. 650 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron, stainless steel  
Ex-proof: yes |
| | Centrifugal pump Type SPL | Capacity: max. 3500 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron, stainless steel  
Ex-proof: yes |
| 2 Ethanol | Centrifugal pump Type CBS | Capacity: max. 650 m³/h  
Shaft sealing: double mechanical seal  
Material: stainless steel  
Ex-proof: yes |
| | Centrifugal pump Type CBE/CBM | Capacity: max. 650 m³/h  
Shaft sealing: mag drive  
Material: stainless steel  
Ex-proof: yes |
| 3 CO₂ | Side channel pump Type CEH | Capacity: max. 35 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron  
Ex-proof: no |
| | Side channel pump Type ASH | Capacity: max. 12 m³/h  
Shaft sealing: single mechanical seal  
Material: grey cast iron  
Ex-proof: no |
| 4 Distillation  
Rectification  
Dehydration | Liquid ring vacuum pump Type LPHX/LPH | Capacity: max. 3000 m³/h  
Shaft sealing: single mechanical seal  
Material: stainless steel  
Ex-proof: yes |
| | Liquid ring vacuum pump Type LEH | Capacity: max. 3000 m³/h  
Shaft sealing: single mechanical seal  
Material: stainless steel  
Ex-proof: yes |
| | Complete vacuum systems Type PL | Capacity: max. 3000 m³/h  
Shaft sealing: single mechanical seal  
Material: stainless steel  
Ex-proof: yes |

...Liquid pumps, vacuum pumps and complete vacuum systems ...from one source
# Innovative Solutions from Sterling SIHI

## Utility Pumps for Bioethanol

<table>
<thead>
<tr>
<th>Utility Pumps for</th>
<th>Pump type</th>
<th>Pump execution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling water</strong></td>
<td><strong>Centrifugal pump Type ZLN</strong></td>
<td>Capacity: max. 1800 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: grey cast iron&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td></td>
<td><strong>Centrifugal pump Type CBT</strong></td>
<td>Capacity: max. 2200 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: grey cast iron&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td></td>
<td><strong>Centrifugal pump Type SPL</strong></td>
<td>Capacity: max. 3500 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: grey cast iron&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td><strong>Cleaning liquid</strong></td>
<td><strong>Centrifugal pump Type CBS</strong></td>
<td>Capacity: max. 650 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td></td>
<td><strong>Centrifugal pump Type ZLN</strong></td>
<td>Capacity: max. 1800 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td></td>
<td><strong>Side channel Pump Type AKH</strong></td>
<td>Capacity: max. 35 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td><strong>Condensate from Steam generation</strong></td>
<td><strong>Side channel Pump Type CEH</strong></td>
<td>Capacity: max. 35 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: grey cast iron&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td></td>
<td><strong>Multi-Stage Pump Type MSL</strong></td>
<td>Capacity: max. 650 m³/h&lt;br&gt;Shaft sealing: single mechanical seal&lt;br&gt;Material: grey cast iron&lt;br&gt;Ex-proof: no</td>
</tr>
<tr>
<td><strong>Storage tank</strong></td>
<td><strong>Centrifugal pump Type CBS</strong></td>
<td>Capacity: max. 650 m³/h&lt;br&gt;Shaft sealing: double mechanical seal&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: yes</td>
</tr>
<tr>
<td></td>
<td><strong>Centrifugal pump Type CBE/CBM</strong></td>
<td>Capacity: max. 650 m³/h&lt;br&gt;Shaft sealing: mag drive&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: yes</td>
</tr>
<tr>
<td></td>
<td><strong>Side channel Pump Type CEH</strong></td>
<td>Capacity: max. 35 m³/h&lt;br&gt;Shaft sealing: mag drive&lt;br&gt;Material: stainless steel&lt;br&gt;Ex-proof: yes</td>
</tr>
</tbody>
</table>

...Liquid pumps, vacuum pumps and complete vacuum systems ...from one source
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