

Distilleries:

- After saccharification DE values of 70 are achieved.
- The resultant glucose can now be fermented by the yeast yielding 9-10 % alcohol.
- When further distilled , 95% rectified spirit can be obtained.



Starch industries:

- The durations of liquefaction, saccharification ,and degree of hydrolysis can be controlled depending on the end product required.
- Maltodextrins (DE 15-25) are commercially valuable for their rheological properties in the food industry. After liquefaction, the starch is directly sent for spray drying.
- Following Saccharification, conversion using Glucose isomerases, can achieve High fructose corn syrups containing 45-55% fructose , glucose and other by products. These are used in sweetners, confectioneries and other food industries.



## Research and Development Activities:

- DSIR approved R&D lab with state of the art Equipments & a team of experienced biotechnologists.
- Facilities for enzyme assay & performance analysis.
- Fermentation facility for enzyme production
- Continuous R & D work for modification & innovation of products.



We also offer enzymes for industries like textiles, Animal husbandry, leather, silk degumming, detergents, wool bioscouring.

For further information , our contact details are available below.

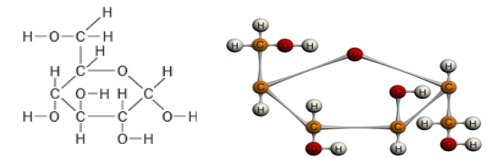


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## Enzymes for Starch and Distillery Industries



## Starch, As a raw Material

Distilleries, Starch Industries, Breweries all require one basic raw material for their end products : STARCH

Raw starch may be in the form of sugar crops — maize, sorghum, potatoes, wheat, sugar-cane, even cornstalks, fruit and vegetable waster.

Starch has to be hydrolysed to simpler forms and then used further.

**Amylases** are starch degrading enzymes and have become the popular replacement for acid hydrolysis since it has several advantages :

1) Small quantities of enzyme addition can replace large quantities of malt, resulting in easy handling and storage

2) Raw material costs are reduced by nearly 30% when switching to commercial enzymes

3) Acid hydrolysis gives rise to undesirably high colour and saltash content (after neutralisation) giving bitter degradation products.

4) Acid hydrolysis needs more energy for heating and is relatively difficult to control

5) Acid hydrolysis appears to be a totally random process which is not influenced by the presence of  $\alpha$ -1,6-glycosidic linkages

6)The biggest advantage being, the degree of hydrolysis and the required DE values can be achieved using enzymes.

Starch breakdown takes place in 3 stages:

1. Gelatinisation
2. Liquefaction
3. Saccharification

### Gelatinization

- Jet cooking of an aqueous starch solution.
- Starch swells and becomes highly viscous.
- This pretreatment makes starch highly penetrable for greater breakdown in subsequent steps.



### Liquefaction


- Involves breakdown of gelatinized starch to smaller maltodextrins and dextrins, maltotriose and few glucose units.
- An ALPHA AMYLASE is used as the Liquefying enzyme. It cleaves starch randomly at alpha 1,4 linkages.
- The breakdown of large particles drastically reduces the viscosity of gelatinized starch solution
- DE values upto 14– 17 can be achieved



### Saccharification:

- Saccharifying enzyme GLUCOAMYLASE is used as the final depolymerising enzyme.
- It cleaves the  $\alpha$  (1-4) as well as the  $\alpha$  (1-6) glycosidic linkages thus releasing glucose or maltose units,
- Depending on the extent of degradation and DE values required Saccharification is continued.
- DE values upto 90 can be achieved after saccharification.



 **CHEMBOND ENZYMES CO LTD** offers different amylases for :

### Liquefaction:

- **KEM LIQUIZYME 250**, is a High temperature bacterial alpha amylase we offer as our Liquefying enzyme.

### Saccharification

- **KEM SACCHARIZYME 1400**, is a fungal Glucoamylase we offer as our Saccharifying Enzyme.

Our enzymes can be used in Distilleries and Starch industries. Depending on the degree of starch degradation required the process can be customized.