

# STARCH



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# INTRODUCTION



- ❑ Modified starches are normal starches that have been altered chemically or physically in some way.
- ❑ It is a food additive which is prepared by treating starch or starch granules, causing the starch to be partially degraded.
- ❑ ***Modified food starch*** is a chemically altered food ingredient made from starch. Because many starches may contain gluten or have been contaminated with gluten, be on the look out for this ingredient in many of the foods sold today if you are eliminating gluten from your diet.

# CONTD.



- ❑ MFS is corn starch that has been processed either chemically, or with enzymes to give it desired properties like withstanding heat & acidity, retaining water, or gelling in cold solutions.
- ❑ Useful to food manufacturers in adding bulk. It is used as a filler to increase the volume & mass of a product while reducing the use of more expensive ingredients like meat.
- ❑ When starch is modified, the molecules are chemically engineered into a new structure that gives the desired property.

# HOW IT'S MADE?

There are numerous ways that food starch can be modified; the method varies based on the starch itself & on what it will be used for. These are some methods of producing a modified starch:

- Treating it with acid
- Roasting it
- Treating it with sodium hydroxide
- Treating it with potassium hydroxide
- Adding a positive electrical charge
- Treating it with emulsifiers
- Treating it with starch ether

Sometimes a starch may undergo more than one treatment, depending on the desired outcome.



# Types



## 1. Physical modification

- ✓ Heat- moisture treatment
- ✓ Annealing
- ✓ Retrogradation
- ✓ Pregelatinization

## 2. Chemical modification

- ✓ Cross linking
- ✓ Esterification
- ✓ Acid treatment
- ✓ Oxidation

## 3. Enzymatic modification

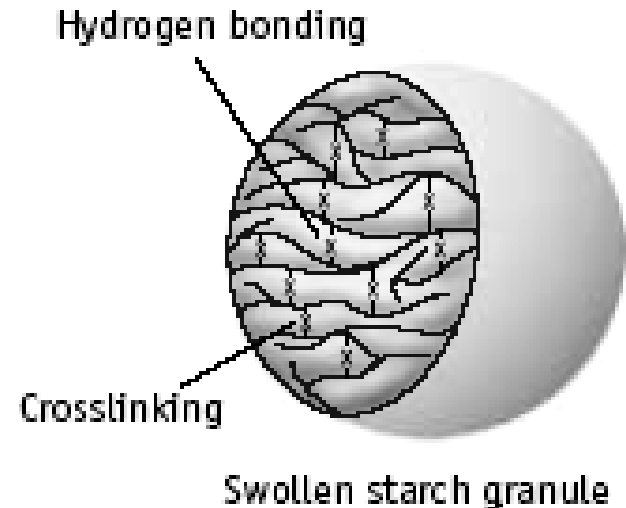
## 4. Genetic modification



# CROSS LINKING

- Cross linked starch, one of the more commonly used modified starches, has been treated chemically to link the starch molecules together with cross bridges.
- Cross linking makes a starch more heat resistant.

**FIGURE 20-7** Crosslinking within the starch granule of a modified starch.



Source: CERESTAR USA

# USES

Food starches are modified to make them easier to use in certain recipes. Modified starch has many uses in food products:

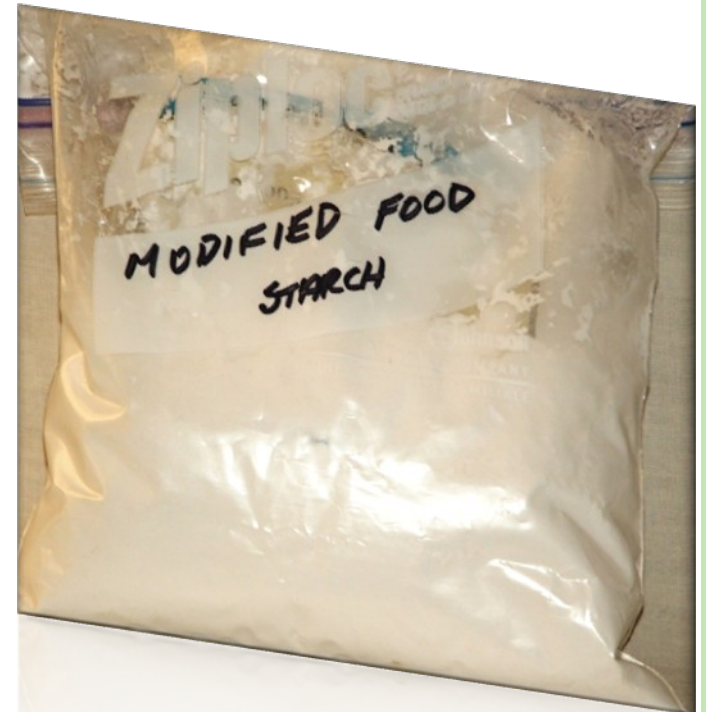
- Making a product easier to dissolve in cold water or milk for instant gelatinized recipes.
- To bind ingredients together & acting as a thickener for soups.
- Helping powdered foods, like powdered cheese sauce & gravy, have a less lumpy consistency when mixed.
- Serving as a fat substitute for low-fat foods.
- Acting as an emulsifier & stabilizer for salad dressings in order to keep oils from separating.
- Forming a hard shell on some candies like jelly beans.
- Producing foods with longer shelf lives.





# Reasons for modifying starches

- ❑ Provide functional attributes
- ❑ Abundant
- ❑ Readily available
- ❑ Provide an economic advantage




# Foods containing Modified Food Starch

- Chips
- Canned soups
- Instant pudding
- Low-fat ice cream
- Cheese sauces
- Mozzarella
- Powder coated foods such as cocoa-dusted almonds
- Candy
- Capsules that contain some medications



## CASE STUDY: Digestibility of Native and Modified Starches

- The effects of cooking & chemical modification of purified starches on the relative rates & extent of their hydrolysis were studied in vitro by using purified human & rabbit pancreatic amylases.
  - Comparison was made with an in vivo study of postprandial glucose & insulin response in adult rabbits.
  - Uncooked starches showed negligible hydrolysis in vitro, whereas cooking (10 min, 100°C) increased both the rate & extent of hydrolysis of all starches.
- 

# CONTD.

- In most cases chemical modification did not change the rate & extent of hydrolysis of the starches.
- Minor differences between human & rabbit pancreatic amylase exist, but there is a general resemblance between the two amylases in their starch-hydrolyzing properties.
- All the modified starches were hydrolyzed some what more slowly with the exception of the waxy corn distarch phosphate.



# RETROGRADATION OF STARCH




# INTRODUCTION

- ❑ ***Retrogradation*** is a reaction that takes place in gelatinized starch when the amylose & amylopectin chains realign themselves, causing the liquid to gel.
- ❑ The seepage of water out of an aging gel due to the contraction of the gel as the gel cools.
- ❑ Also known as *Syneresis* or *Weeping*.
- ❑ Amylose Molecules Tighten Bonds.
- ❑ Accelerated by Freezing
- ❑ **Prevention-** Use Foods Immediately



# CONTD.

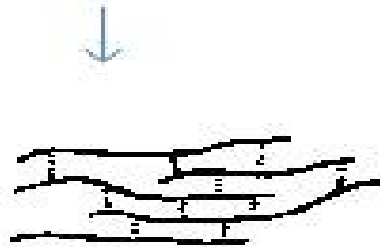
- ❑ Retrogradation can expel water from the polymer network. This is a process known as *syneresis*. A small amount of water can be seen on top of the gel.
  - ❑ Directly related to the *staling* or *aging of bread*.
  - ❑ Retrograded starch is linked to a reduction in colon cancer. It is less digestible.
  - ❑ Chemical modification of starches can reduce or enhance the retrogradation.
  - ❑ Additives such as fat, glucose, sodium nitrate & emulsifier can reduce retrogradation of starch.
- 



strarch + water



gelatinization



retrogradation

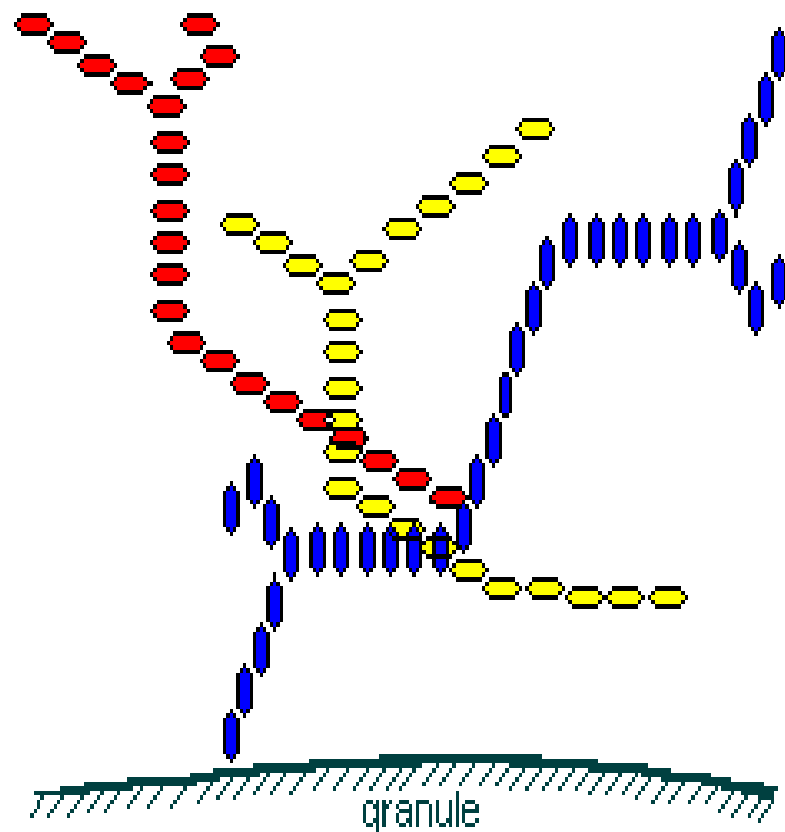
**How Play-Doh Works Retrogradation**

**Warm** **Cool**

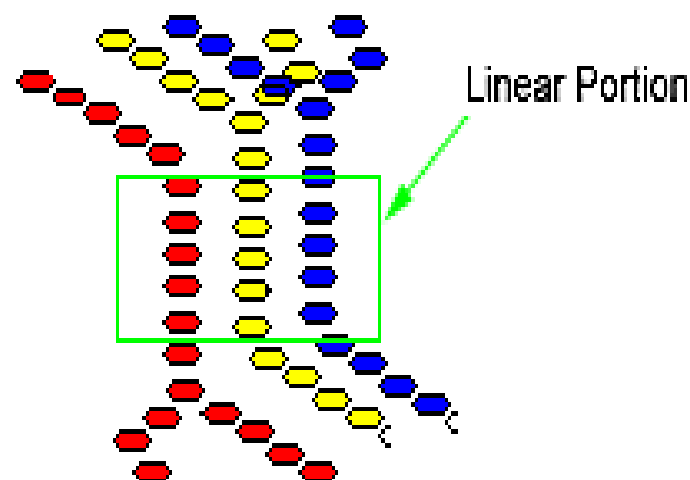
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## Retrogradation of Starch Molecules



Recall that after gelatinization the amylose is removed from the granule. Above is a diagram of amylose molecules.



Upon cooling the linear portion of these molecules line up. They remain together due to H-bonding. This process removes the water from in between them so they can crystallize together. This is called retrogradation.

# CONCLUSION

- ❖ Used as an emulsifier, stabilizer & thickening agent.
- ❖ Starches may be modified to increase their stability against excessive heat, acid & freezing; to change their texture; or to lengthen & shorten gelatinization time.
- ❖ MFS undergoes one or more chemical modifications.

A range of modified starches  
to meet diverse needs



# REFERENCES

- Food Chemistry by Belitz and Grosch, 2004
- [en.wikipedia.org](http://en.wikipedia.org)
- [www.google.com](http://www.google.com)



T H A N K

Y O U !

