V Semester

Paper: Nano biotechnology

Topic: NANO STARCH

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Name of the instructor: P. Aswini Devi

MSc, B.Ed

Lec. In Biotechnology

NANO STARCH

Starch as a natural polymer is abundant and widely used in various industries around the world.

In general, the preparation methods for starch nanoparticles (SNPs) can be classified into ‘top-down’ and ‘bottom-up’ methods.

SNPs can be produced in smaller sizes and used to improve the functional properties of starch.

Starch granules are a source of carbohydrates.

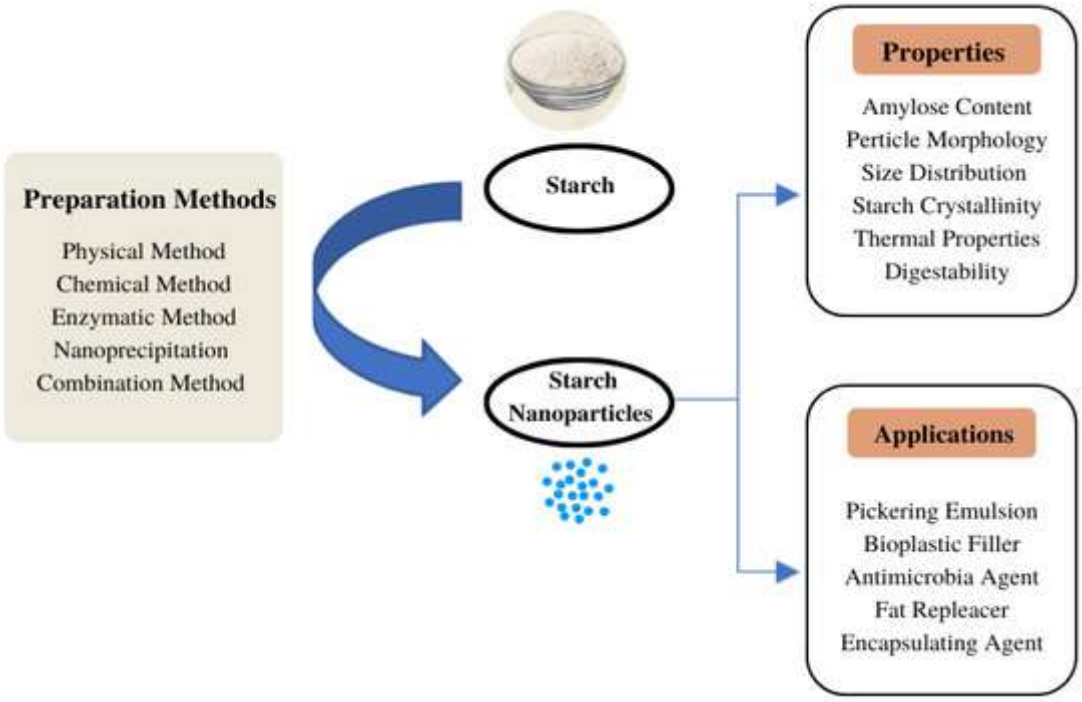
starch production is mainly based on four raw materials, namely, corn, cassava, wheat and potatoes, with >75% of starch produced from corn.

Starch is a mixture of two macro molecules namely:

AMYLOSE-linear chain of glucose molecule connected by (α-1,4 glycosidic linkage)

AMYLOPECTINE-with branched chains consisting of short amylose groups connected by (α-1,6 glycosidic linkage).

Starch generally: 20-30% Amylose and 70-80% Amylopectin depends on source.



Preparation Method of Starch Nanoparticles

The preparation of nanoparticles can be classified based on the preparation method: physical, chemical, enzymatic methods or their combination.

Physical Methods:

Various SNP preparations, such as gamma irradiation, high-pressure homogenisation (HPH) and ultrasonication, have been carried out.

Physical preparation using gamma irradiation as an immediate modification technique that causes depolymerization by breaking glycosidic bonds and hydrolysing chemical bonds, and it results in the production of small starch fragments

conducted HPH at a pressure of 250 MPa and reported that the repeated homogenisation process can result in significant size reduction.

Ultrasonic treatment is promising due to its high yield, being rapid and relatively simple without any purification steps. In the ultrasound modification, sound waves with frequencies higher than the threshold of the human hearing range (>16 kHz) are used. The sound waves generated by ultrasound generate mechanical energy disrupt the starch molecules, causing them to break apart into smaller particles.

Chemical Methods*:*

The preparation of SNPs using chemical hydrolysis has been used. Hydrolysis of SNPs generally uses optimal conditions, including 3.16 M H_2SO_4 or 2.2 M HCl and a 35–40 °C temperature for 12 h to several days

Enzymatic Methods*:*

The enzymatic preparation of SNPs involves hydrolysis using enzymes. The commonly used enzymes include α-amylase, glucoamylase and pullunase.

α -amylase, which causes random cleavage of α-1,4 -glycosidic bonds in amylose and amylopectin chains.

pullunase enzyme can rapidly hydrolyze α-1,6-glycosidic bonds

This enzymatic hydrolysis results in cracks and erosion of the starch granules, resulting in a reduction in the size of the starch particles with the right degree of enzymatic hydrolysis.

Nanoprecipitation:

SNPs are usually prepared by the precipitation of a starch paste solution using ethanol, propanol, isopropanol or butanol.

observed that the amylose–amylopectin ratio affects the characteristics of the resulting SNPs. Butanol can only form a complex and precipitate with amylose, but not with amylopectin.