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PREPARATION OF CORN SHORT AMYLOSE STARCH

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ABSTRACT

This paper mainly studies the preparation of corn short amylose starch. In this paper, corn starch was used to treat corn starch, and the film-forming properties of starch were improved. The cornstarch was heated and the gelatinized and centrifuged. In this paper, the preparation method of green, green and safe amylose was explored, and the content of the high content of high content amylose was 8.91%, and the high content of short-chain starch was 49.15%, and the high-content branched starch was 27.5%. The molecular weight of adhesive is tested and the different composition of starch (DSC), differential scanning calorimeter test, shows that the combination of amylose and amylopectin limits the structural integrity of starch, amylose crystallization inhibition of pullulan, make ordinary corn starch granules for semi crystalline state, limits the material aspects of the application of starch, starch components separation as the basis of starch materials processing steps.

KEYWORDS

Short amylose; Corn starch; Preparation.

1. INTRODUCTION

The invention relates to the technical field of natural polymers, in particular to a starch composition. At present, a lot of researches have been made on the modification of starch at home and abroad, and the commonly used modification methods are physical methods (such as ultrasonic, ionizing radiation, microwave, hydro thermal solution, extrusion and ball milling treatment, etc.), chemical methods (such as oxidation, esterification, etherification and crosslinking, etc.) and biological enzyme methods [1].The prior art also discloses many methods for improving the performance of starch materials, mainly including reducing the molecular weight of amylopectin, modifying starch, compounding starch with high-performance resin and the like. For example, the prior art has disclosed the preparation of a highly amylose-based film which can be completely biodegraded. High amylose-based films were obtained by blending high amylose with polyvinyl alcohol, plasticizing with glycerol, and crosslinking with glyoxal. However, this high amylose-based film uses high amylose as raw material and does not consider the influence of different molecular weights of amylose on the film properties. High amylose can improve the film performance by crosslinking with polyvinyl alcohol and glyoxal, which wastes resources and increases the cost. In addition, the invention can only prepare crosslinked products into films by the method of casting films.

Starch is the most widely used natural polysaccharide polymer which can be completely biodegraded at present. It has the advantages of wide source of raw materials, low price and easy biodegradation, and occupies an important position in the field of biodegradable materials. The mechanical properties of various grades of starch plastics published at home and abroad can generally be compared with those of traditional plastics with similar applications, but their performance is often not satisfactory. one of their main disadvantages is that degradable plastics containing starch have poor water resistance and wet strength, and their mechanical properties are severely reduced when exposed to water, while water resistance is precisely the advantage of traditional plastics in the process of use. Compared with ordinary starch, high amylose has better water resistance, shear resistance and film forming property, so it has great development potential in plastic industry.

Starch is insoluble in cold water, poor in shear resistance, poor in water resistance and lack of melt fluidity, which makes it difficult to be used as a high molecular material alone. Based on a research, it needs to be chemically or physically modified to enhance some functions or form new physicochemical properties [2-4].

2. MATERIALS AND METHODS

2.1 Materials and equipment

Pullulan enzymes: novozymes new Novozym 26062 (EC 3.2.1.41), enzyme preparation for non-gmo, edible, suitable temperature 63℃, holding time, 30-90 minutes. PH value 3~6.5, best 3.5~5.5. Enzyme activity 400PUN/g, a transparent brown liquid (L), with a density of about 1.20g/ml. The degradation dosage reference provides 0.9-1.2kg/ ton, equivalent to 1 microliter/gram starch [5-7].

Starch: 1. Corn starch changchun dacheng group, moisture 13.8%.

Processing method: (1) the corn starch heated to 96℃, pasting 50 minutes, centrifugal separation: 4000 RPM (2791g), 10 minutes, take the upper fluid, 1.5 times of ethanol elution, the polypropylene membrane suction filter, 40℃ drying, yield 9%. (2) the centrifugal leftovers, adding deionized water, heated to 63℃ add pullulan enzyme, heat preservation, 90 minutes, centrifugal separation: 4000 turn, 10 minutes, take the upper fluid, 1.5 times of ethanol elution, polypropylene membrane suction filter, 40℃ drying, the rate of 50%.

Table 1

Sample number	The sample name	Amylose content	Production manufacturers
2.1#	Waxy starch	0.7%	Changchun dacheng group.
2.2#	Ordinary starch	28%	Changchun dacheng group.
2.3#	High amylose	55%	National starch
2.4#	Centrifuge lower enzyme solution, centrifuge upper layer.		On the basis of preparation 2.2#

2.2 The test of viscous molecular weight

Different starch hot water extraction and starch were selected, and the starch DMSO solution of 0.4% (w/w) was prepared. With 0.8 mm ubbelohde viscometer (shenyang xin hundred petrochemical glass instrument plant) in 25±0.1℃ under different concentrations (c) were determined under the flow of time (t), has gone out of the time (t0) and DMSO solvent. Then the increase ratio viscosity (η sp), relative viscosity （η r ）[8]. Using the formula of single point method to obtain (η)

$$(\eta)=\left[2\left(\eta_{\mathrm{sp}}\text{-}\ln\eta_{\mathrm{r}}\right)^{1/2}\right./c$$

c=0.0004,

The empirical equation to substitute the obtained (s) into Mark Houwink

$$(\eta)=KM^{\alpha}$$

That is, the molecular weight M, in the formula, K=1.0*10^{-4}, and alpha =0.7 [9,10].

2.3 Different component starch differential scanning calorimeter (DSC) test

The thermal analysis test was performed on perkin-elmer Diamond DSC type instrument (US) with Pyris data analysis software, and the temperature was calibrated with metal In. The sample dosage is 5~10mg. Before use, it is in the vacuum oven to dry 24 small test, sealed in the aluminum dry pan. Temperature scanner is set to: from room temperature to heat up to 210℃, 210℃ for 5 min to eliminate thermal history, and then cooled to room temperature at a rate 10/min℃; Then at the same rate up to 210℃, temperature curve; Isothermal crystallization process analysis, samples at 210℃ temperature 3 min, with 500℃/min quickly down to room temperature, cooling speed record in the process of isothermal crystallization enthalpy change over time function, the experiment is carried out under N2 gas protection [11-13].

3. RESULTS AND ANALYSIS

3.1 Test results of viscosity of different starch compositions

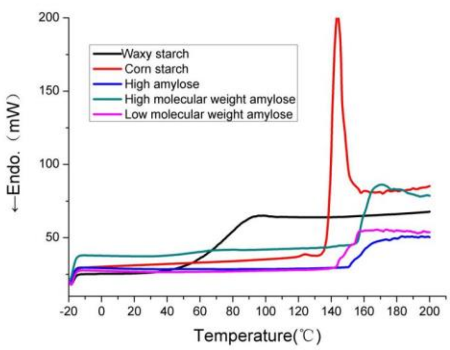
Table 3.1 the test results of the viscosity of different starch compositions are basically equivalent to the universal recognition of molecular weight.

Table 2: Different components of starch molecular weight

Sample number	The sample name	Product yield	Wood viscosity meter time (s)	Incremental viscosity	Relative molecular weight.
contrast	dimethylsulfoxide		42.76		
2.2#	Ordinary starch	49.15%	69.24	0.63	6.3*10^{8}
2.4.#	Centrifuge lower enzyme solution, centrifuge upper layer.		46.03	0.08	3.57*10^{7}

3.2 Analysis of crystallization properties of materials.

FIG. 3.1 is the DSC curve of starch in different components. It can be seen from the figure that with the increase of amylose content in the amylose, the crystalline peak moves to the high temperature, from the lowest branch of starch to the highest amylose. The results show that the combination of amylose and amylopectin limits the structural integrity of starch, amylose crystallization inhibition of pullulan, make ordinary corn starch granules for semi crystalline state, limits the material aspects of the application of starch, starch components separation shall be as the basis of starch materials processing steps.



4. CONCLUSION

Explores the green, environmental protection, safety of amylose preparation method, the preliminary separation of the high content of amylose content to 8.91%, high short amylose content was 49.15%, the high content of starch 27.5%. The viscosity method can be used to determine the difference of the molecular weight of different components by an order of magnitude, which proves that this method is feasible. The DSC analysis shows that the amylose temperature increases with the amylose content, indicating that the amylose has better thermal stability. After separation, the spray drying can obtain the amylose granules of an order of magnitude smaller than the original starch granules. In this chapter, the purity of the separation of corn starch components has yet to be improved, and the separation of starch can expand the application of starch, and the efficient separation method needs further study. The amylose content of common corn starch is 21% and amylopectin content is 78%. the mixing of amylose and amylopectin in this ratio reduces the performance of starch-based materials, and the reasonable control of the ratio and polymerization degree of amylose and amylopectin will greatly improve the performance of starch materials. Amylose is easy to regenerate in food processing, and amylose can keep good soft characteristics. Using amylose to prepare bio-based materials and amylopectin to process food may be a reasonable application direction of starch. Compared with the prior art, this paper directly uses high-purity amylose as raw material, reducing the adverse effects caused by the mixing of amylopectin and amylose, and improving the performance of starch materials. At the same time, the invention combines high-molecular-weight amylose and low-molecular-weight amylose with different properties, improves the processing fluidity of the starch composition, and makes it suitable for different processing modes, thereby obtaining different starch materials and expanding the application of starch in the field of high-molecular materials.

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