Preparation of Granular Cold Water-Soluble Sago Starch: A Preliminary Study

Kaur BHUPINDER, Alias Abdul KARIM, Mohd Hani NORZIAH, Chee Choon SEOW

Food Biomaterials Science Research Group, School of Industrial Technology, University Science Malaysia, 11800 Minden, Penang, Malaysia

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Abstract

Granular cold water-soluble (GCWS) sago starches were prepared by treating native sago starch with mixtures of aqueous solutions of ethanol and NaOH at different temperatures. These three factors — temperature, ethanol concentration and NaOH concentration, were studied in a random 2^3 experimental design. All three factors were found to significantly ($P<0.05$) affect the cold water-solubility of the starch. The maximum cold water-solubility achieved was 69.4 ± 4.0% using a combination 4M NaOH and 40% ethanol at 35°C. Higher temperature and higher NaOH concentration enhanced swelling whereas a higher percentage of ethanol inhibited it. Paste clarity increased with increased cold-water solubility.

1. Introduction

Sago starch is isolated from the trunk of the sago palm (*Metroxylon spp.*), locally known as 'rumbia', which is found throughout South East Asia. Besides being cheap, sago starch has several useful characteristics — it gelatinizes easily, has a relatively high viscosity, is mouldable, and undergoes little syneresis (Takahashi, 1986). Sago starch is used in various traditional confectionery and bakery products, in desserts and noodles, and in the production of sago pearls.

Granular cold water-soluble (GCWS) starches are currently produced using corn, waxy corn and tapioca starches. GCWS starches are of commercial interest for use in instant foods such as puddings, microwaveable foods, instant fillings, sauces and dry mixtures that can be reconstituted with cold or ambient temperature liquids.

The present work to develop GCWS sago starch was undertaken because of the need to widen the use of sago starch in food products.

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2. Materials and Method

Sago starch with a moisture content of 13.6%, was procured from Nitsei Sago Industries Sdn. Bhd. All chemicals used were of analytical reagent grade.

The method of Chen and Jane (1994a) for producing GCWS sago starch was followed with minor modifications. The three factors studied were temperature (25 and 35°C), ethanol concentration (40 and 60%, w/w) and NaOH concentration (3M and 4M) using a random 2^3 experimental design.

50 g (dry substance) of sago starch was suspended in 200 g of ethanol solution maintained at the desired temperature and mechanically stirred. 75 g NaOH solution was added at a rate of 4 g min^{-1}. The mixture was held for 15 min with gentle stirring. 200 (additional) g of ethanol solution was added slowly and stirred for another 10 minutes. The slurry was then left at room temperature to allow the starch granules to settle. The supernatant was decanted and the starch was washed with fresh ethanol solution. The starch was then re-suspended in aqueous ethanol solution and neutralized with 3M HCl in absolute ethanol. The starch was then washed with 60% and 95% ethanol solutions, dehydrated with absolute ethanol, and oven-dried at 80°C for 3 h. The dried starch was hammer-milled, sieved through a 220 μm sieve and stored in an airtight container.

The cold water-solubility (CWS), determined following the method of Eastman and Moore (1984), was calculated as follows:

$$\text{CWS}(\%) = \text{wt of solid in supernatant} \times 4 \times 100/\text{wt of sample}$$

The clarity, measured as transmittance (%T), was determined spectrophotometrically at 650 nm using the method described by Bello-Pérez *et al.* (2000).

All samples were analysed in duplicate and the results averaged. The data were statistically analyzed by a variance test procedure and Fisher's pair-wise comparisons test, using MINITAB for Windows, Release 10.1 software (1994).

3. Results and Discussion

All the three factors were found to significantly ($P<0.05$) affect CWS and clarity properties of the modified sago starch. The results are shown in Table 1.

The highest CWS obtained with sago starch was 69.4 ± 0.4% with 4M NaOH and 40% ethanol at 35°C. When the strength of the NaOH was reduced to 3M and concentration of ethanol increased to 60%, there was a significant decrease in CWS. The minimum CWS (8.0 ± 0.8%) was obtained with 3 M NaOH and 60% ethanol at 25°C. A high concentration of ethanol was found to inhibit granule swelling and retard dissociation of the double-helical structure (Chen

Table 1. % CWS and %T of GCWS Sago Starch[a,b]

Treatment			Results	
Temp(°C)	NaOH (M)	EtOH (%)	CWS (%)	T(%)
25	3	40	55.6 ± 3.6^{b}	69.4 ± 3.1^{cd}
35	3	40	64.0 ± 4.7^{a}	77.2 ± 4.3^{b}
25	4	40	64.6 ± 2.8^{a}	76.8 ± 4.5^{b}
35	4	40	69.4 ± 4.0^{a}	85.5 ± 6.3^{a}
25	3	60	8.0 ± 0.8^{c}	55.5 ± 4.2^{e}
35	3	60	57.6 ± 4.6^{b}	65.0 ± 5.7^{d}
25	4	60	65.6 ± 4.4^{a}	67.0 ± 3.3^{d}
35	4	60	66.8 ± 4.6^{a}	73.7 ± 4.1^{bc}

[a] Average ± standard deviation, n = 2

[b] Averages in the same column with the same letters are not significantly different ($P > 0.05$)

and Jane, 1994b, Bello-Perez *et al.*, 2000). Raising the concentration of NaOH and increasing the temperature increased the granule swelling. Paste clarity was found to increase with the increase in CWS. All the GCWS starches appeared to have intact granules when viewed at 200x magnification under a visible light microscope.

References

Bello-Pérez, L.A., Romero-Manilla, R. and Paredes-López, O. 2000, Starch/Stärke 52, 154.

Chen, J. and Jane, J. 1994a, Cereal Chem. 71, 618.

Chen, J. and Jane, J. 1994b, Cereal Chem. 71, 622.

Eastman, J.E. and Moore, C.O. 1984, U.S. Patent 4, 465, 702.

Takahashi, S. 1986, in Yamada N. and K. Kainuma (eds), Proc. 3rd Int. Sago Symp., 20–23 May 1985, Tokyo, Japan, 208–216.