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Short Communication

Investigation of Starch Modification Potential of 'Kanwa' – an Alkaline Salt

A.K. Oladele[a]*, U. I. Ibanga[a] and J.O. Aina[b]
[a]Department of Food Technology, FCFFT, New Bussa, Niger State, Nigeria
[b]Department of Food Technology, University of Ibadan, Nigeria

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Abstract. Cassava-starch-modification potential of 'Kanwa' at different concentrations was studied. Kanwa modified cassava-starches showed better swelling power, paste clarity, viscosity, peak viscosity, freeze-thaw stability and reduced gelatinization time over native starch. However, native starch had better water solubility and set back viscosity.

Keywords: kanwa, modified starches, starch modifiying property

Native starches are unsuitable for many industrial applications due to poor characteristics exhibited under processing conditions such as extreme temperature, high shear pressure and diverse pH (Wang *et al.*, 1993). Modified starches in comparison have generally better paste clarity, gel stability, increased resistance to retrogradation, increased solubility and improved freeze-thaw stability which increase their application as stabilizer, filler, binder and adhesive. Starches are modified by physical, enzymatic, biological and chemical methods in order to reduce their limitations in industrial uses. Chemical modification of cassava and other plant starches with improved qualities and applications have been reported by several workers (Ahmed *et al.*, 2005; Iyothi *et al.*, 2005; Nurulislam and Azemi, 1997). Use of naturally occurring food products as starch modifying agents has been advocated. Some natural products such as alum and ginger have been reported to improve the functional properties of cassava and rice starches (Daramola and Osanyinlusi, 2006; Lee *et al.*, 1995). 'Kanwa' also known as 'trona' or sodium sesquicarbonate is a naturally occurring alkaline rock salt with trace amounts of Ca, Mg, Fe, Zn, S, Cl, Si, P and K (Makanjuola and Beetlestone, 1975). It is used not only as a tenderizer but also as flavouring agent, food preservative and as a prophylactic (Uzogara *et al.*, 1988). It is relatively inexpensive, less hazardous and requires less safety precautions in use. Although its food uses have been established, information on its starch modification potential is not available in literature.

The present work aims at modifying cassava starch with low 'kanwa' concentrations and determines the pasting properties of the modified starches. For this prupose starch was extracted from an improved cassava variety 82/00058, aged 12 months at harvest, obtained from International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria. Subsequently, cassava roots were grated, water was added and the slurry was sieved. The filtrate was allowed to settle for 24 h before decantation. The starch was drained, dried and milled into powder. 'Kanwa' was purchased from a retail market in Ibadan and used without further treatment while other chemicals used were of analytical grade.

The slurry method described by Agboola *et al.* (1991) was employed for the preparation of the modified cassava starches. Whereas unmodified (native) starch was used as control.

The yield of the substituted starch on a dry matter basis, solubility at 60 °C, swelling power, ash and moisture content of native and substituted starches were determined (AOAC, 1980; Smith, 1967; Leach *et al.,* 1959).

Moreover, pH of the samples, paste clarity, pasting properties and freeze-thaw stability over four cycles were also determined. (Craig *et al.*, 1989; Knight, 1974; Smith, 1967). Analysis was carried out in triplicate except pasting properties which were determined only twice.

The values obtained for some of the physical and functional properties of 'kanwa'-modified starches are shown in Table 1. Yield of the modified starches was high and varied with kanwa concentrations ranging between 90.5-95.7%. This shows that leaching of the starch constituents is reduced at alkaline conditions unlike acidic conditions which reduced yield through thinning of the starch (Ahmed *et al.*, 2005; Lawal *et al.*, 2004). Increase in 'kanwa' concentration from 0.1 to 1.0% increased the yield. The swelling power of the modified starches (4.9 - 5.3) was higher than that of the native (unmodified) starch (3.5). This could be attributed to weakening of the starch

*Author for correspondence; E-mail:dekanmiscientist@yahoo.com

Table 1. Physical and functional characteristics of native and 'kanwa' modified starches*

Sample	Yield (%)	Swelling power (%)	Solubility (%)	M.C. (%)	Paste clarity (%T)
Cassava starch + 0% kanwa	NA	3.5±0.01	7.7±0.01	11.0±0.03	78.3±0.09
Cassava starch + 0.1% kanwa	90.5±0.12	5.2±0.02	4.2±0.01	10.3±0.04	80.6±0.06
Cassava starch + 0.5% kanwa	95.7±0.16	5.3±0.01	5.0±0.02	11.3±0.01	80.6±0.07
Cassava starch + 1.0% kanwa	94.2±0.09	4.9±0.03	7.0±0.02	11.6±0.04	82.4±0.09

*= values are means of triplicate determinations; NA = not applicable

Table 2. Brabender amylograph reading for native and 'kanwa' modified cassava starches*

Sample	Pasting temperature (°C)	Peak viscosity (BU)	Viscosity at 95 °C (BU)	Viscosity at 50 °C (BU)	Setback viscosity (BU)	Time (min)
Cassava starch + 0% kanwa	68	195	165	110	85	24
Cassava starch + 0.1% kanwa	67	370	220	200	170	23
Cassava starch + 0.5% kanwa	68	395	160	290	105	22
Cassava starch + 1.0% kanwa	68	335	180	200	135	23

*= values are means of duplicate determinations

granules by the substituent ions which allow penetration of water molecules into the granules. The solubility of the modified starch samples was lower (4.2 -7.0%) compared to the native starch (7.7%). The lower solubility recorded for 'kanwa'-modified starches may be attributed to the non-thinning effect of the alkaline salt used. Acids and acidic materials have been reported to create thinning effect which results in a greater fluidity and introduction of the hydrophilic substituent group which allows water molecule retention because of their ability to form hydrogen bonds which increase solubility (Lawal *et al.*, 2004; Betancur *et al.*, 1997; Khalil *et al.*, 1995). The paste clarity of the modified starches was higher (80.6 - 82.4%T) than the native starch (78.3%T). This is a reflection of higher swelling power exhibited by the modified starches. The paste clarity increased as the 'kanwa' concentration was increased from 0.1-1.0%. The pH of the modified starches (10.1 -10.3) was higher than that of the native starch (8.0), which is an indication of the alkaline nature of the modifying agent.

The pasting properties of the modified starches and the native starch are shown in Table 2. Pasting temperature range of 67-68°C was obtained for the modified starches while the native starch had pasting temperature of 68 °C. Addition of kanwa had no effect on the pasting temperature of the starch. The gelatinization time was 22-23 min and 24 min for modified starches and native starch, respectively. Cooking time has energy-cost implication during starch application in the industry. The setback viscosity of modified starches (105-170 BU) was higher as compared to 85 BU recorded for native starch with cassava starch, treated with 1.0% kanwa, having the highest (170 BU). This reflects the instability of the cooked paste of the modified starches against retrogradation. The modified starches exhibited increase in viscosity when cooled from 95 °C to 50 °C and higher peak viscosity compared to the native starch. This indicates that the modified starches could be used as pie filling where thickening and stability are required.

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