Proceedings of the

IAB Women In Science International Symposium

on The Science of Health, Beauty & Ageing

7 May 2012
Concorde Hotel, Shah Alam, Malaysia

CHIEF EDITORS
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PREFACE

On the 21st of February 2012, Universiti Selangor (UNISEL), Malaysia, signed a Memorandum of Understanding (MOU) with the Institute of Technology Bandung (ITB), Indonesia in research and education. This was followed by a signing of a Memorandum of Agreement (MOA) between the School of Life Science and Technology (SITH), ITB and the International Islamic Academy for Life Sciences and Biotechnology (IAB), UNISEL. The focus of research agreed upon by the parties is on Enviromental Pollution and Conservation of Genetic Resources. Collaboration was also established in the Women in Science Programme. A Joint Seminar in Life Sciences & Technology: Partnership & Networking was also held at the Institut Teknologi Bandung, Bandung , Indonesia on the 22nd of February 2012 which involved speakers from SITH and IAB.

The present symposium 'IAB Women in Science International Symposium on The Science of Health, Beauty and Ageing' is the first among the many activities planned under the MOA. It is funded by the Selangor State Government and is jointly organised by IAB Women in Science, UNISEL and the School of Life Science and Technology, ITB. Speakers from Mauritius, Australia, Indonesia and Malaysia will cover various aspects of health, beauty and ageing particularly in relation to natural products, nutricosmetics, cosmetics and halal industry, SPA and others. These issues are usually associated mainly with women, but in reality, they are equally important for men as well.

This proceeding includes: the speakers' curriculum vitae and a summary of their oral presentations; abstracts for three special poster presentations; and 26 extended abstracts for poster presentations. Among the 26 extended abstracts, 11 are not related to the symposium theme 'The Science of Health, Beauty and Ageing' but were included here to show the involvement of the IAB Women in Science members in other research areas.

On behalf of the Organising Committee, we would like to take this opportunity to thank all the speakers and poster presenters for generously sharing their knowledge and research findings. We would also like to express our deepest gratitude to all participants and to all parties who have directly or indirectly contributed to the successful realization of the symposium and publication of the current proceedings.

Lastly, may this mark the beginning of a meaningful and fruitful partnership between ITB and UNISEL in particular and among all the symposium participants in general.

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Study of Functional Properties of Hydroxypropylated and Cross-linked Arrowroot (*Marantha arudinacea*) Starch as Ingredient for Food Industry

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ABSTRACT

Modified arrowroot starch produced by using propylene oxide and cross-link by using sodium trimetaphosphate (STMP) and sodium tripolyphosphate (STPP) was done to fix flaws that are owned by natural starches, so that they can have a broad application in the food industry. The use of arrowroot starch is meant to provide the food industry raw materials from new local sources of food, so that arrowroot starch may be an alternative that has characteristics comparable to or better than its origin. Dual modification of arrowroot starch result to changes on functional properties. The time to achieve gelatinization is faster at lower temperatures as compared to the native starch. Setback viscosity values shown in the lowest concentration level of 10% propylene oxide is in the range of 925 cP - 1073 cP, so that modifications at these levels showed a lower tendency for retrogradation. At acidic pH (3.5), there is a decrease in viscosity of starch pastes at different levels of temperature change as compared with the normal pH. Arrowroot starch modification in combination with 8% propylene oxide: STMP 2-3%: STPP 5-6% and 10% propylene oxide: STMP 1%: STPP 4% showed the best stability of the freeze-thaw. There is a tendency of decrease in the paste clarity (% T_{650}) with increasing concentration of phosphate salts STMP/STPP as reagents of cross-links at each level of concentration of propylene oxide. Sedimentation volume of modified starch gives a higher value compared to the native starch except for the treatment of phosphate salts STMP 1%: STPP 4% at concentration of propylene oxide 8% and 12%. Gel strength increased at a low concentration of propylene oxide (8%) as compared to the native starch, but decreased with higher concentrations of propylene oxide. Arrowroot starch that was modified using propylene oxide at concentration of 8% -10% and phosphate salt at concentration of 1% -2% STMP: 3% -5% STPP shows a change of functional properties better than other treatments, making it safe to be used as commercialized ingredients for food industry.

INTRODUCTION

The diversity of modern food industry and the variety of food products is very high requiring the tolerant starch raw materials in a broad range of processing techniques from the preparation, storage, and distribution. Modified starches using propylene oxide and cross-link using sodium trimetaphosphate (STMP) and sodium tripolyphosphate (STPP) is done to fix flaws that are owned by natural starches for a broad application in the food industry. The use of arrowroot starch in this study aims to provide the food industry raw materials from new sources of food that is local, so that arrowroot starch may be an alternative that have characteristics comparable to or better than it actually is. The aim of this research is to improve the functional properties of arrowroot starch to obtain a modified version that has the characteristics that can be used in the food industry.

MATERIALS AND METHODS

Arrowroot starch as main materials were derived from the tuber (harvest age 10 months), sodium sulfate, STMP, STPP, and propylene oxide from Sigma Aldrich, and all chemicals used in this experiment were analytical grade.

Dual modification process of arrowroot starch used a combination of hydroxypropylated concentration levels (8%, 10% and 12% propylene oxide) and cross-link reagent concentrations using STMP and STPP with a ratio of 1%: 4%, 2%: 5%, and 3%: 6%. Functional properties are studied, namely: pasting properties using the Rapid Visco Analyzer (RVA) (Deetae *et al.*, 2008); freeze-thaw stability (Deetae *et al.*, 2008; Lee and Yoo, 2011); stability to acidic conditions (Wattanachant *et al.*, 2002); paste clarity (Craig *et al*, 1989 in Lee and Yoo, 2011); sedimentation volume (Tessler, 1978), and gel strength (Lee and Yoo, 2011). The data was analyzed using analysis of variance ($\alpha = 0.05$) and difference test using Duncan Multiple Range Test ($\alpha = 0.05$) using SPSS 16.0 for Windows.

RESULTS AND DISCUSSION

Pasting properties and acid stability

The time to achieve gelatinization is faster at lower temperatures as compared to the native starch. Native starch peak viscosity value in 4029 cP is lower than the value of viscosity modified starches (> 6000 cP). Setback viscosity values shown in the lowest concentration level of 10% propylene oxide is in the range of 925 cP - 1073 cP, so that modifications at these levels showed a lower tendency for the retrogradation. At acidic pH (3.5) a decrease in viscosity of starch pastes at different levels of temperature change as compared with the normal pH (Table 1).

Table 1: Pasting properties of dual modified arrowroot starch using *Rapid Visco Analyzer* (RVA) on pH 6.5 and 3.5.

Treatment	Pasting time (minute)		Pasting temperature (°C)		Peak viscosity (cP)		Final viscosity 95°C (cP)		*Breakdown* (cP)		Final viscosity (cP)		*Setback* (cP)	
	6.5	3.5	6.5	3.5	6.5	3.5	6.5	3.5	6.5	3.5	6.5	3.5	6.5	3.5
Native	8.53	7.60	72.85	70.00	4209	5357	3106	3203	1103	2154	5414	5121	2308	1918
PO 8%; STMP 1%:STPP 4%	7.80	7.40	68.85	68.80	6203	5330	4489	3454	1714	1876	6930	5799	2441	2345
PO 8%; STMP 2%:STPP 5%	7.33	7.27	68.85	68.85	6534	5689	4522	3779	2012	1919	6919	5879	2397	2100
PO 8%; STMP 3%:STPP 6%	7.33	7.47	68.85	68.45	7066	6400	4931	4390	2135	2010	7284	6326	2353	1936
PO 10%; STMP 1%:STPP 4%	6.87	7.07	67.45	67.30	7533	6581	5091	4186	2442	2395	6016	5895	925	1709
PO 10%; STMP 2%:STPP 5%	7.07	7.00	66.90	66.90	7689	6916	5224	4641	2465	2275	6297	5959	1073	1318
PO 10%; STMP 3%:STPP 6%	7.00	7.20	67.65	67.65	7446	6786	5388	4670	2058	2116	6355	6657	967	1987
PO 12%; STMP 1%:STPP 4%	7.73	7.53	68.45	68.40	7089	6396	5024	4572	2065	1824	7807	6783	2783	2211
PO 12%; STMP 2%:STPP 5%	7.67	7.60	68.75	68.40	7324	6673	5584	4652	1740	2021	8182	7526	2598	2874
PO 12%; STMP 3%:STPP 6%	7.67	7.67	68.00	68.00	7636	7215	5671	5562	1965	1653	8165	8207	2494	2645

Keterangan : PO = propilen oksida; STMP = *sodium tri meta phosphate*; STPP = *sodium tri poly phosphate*

Freeze-thaw

Arrowroot starch modification in combination with 8% propylene oxide: STMP 2-3%: STPP 5-6% and 10% propylene oxide: STMP 1%: STPP 4% showed the best stability of the freeze-thaw, because at the end of the fourth cycle syneresis only have <50% (Figure 1).

Paste clarity, sedimentation volume and gel strength

There is a tendency of decrease in the paste clarity (% T_{650}) with increasing concentration of phosphate salts STMP/STPP as reagents of cross-links at each level of concentration of propylene oxide. Sedimentation volume of modified starch hydroxypropylated and cross link gave a higher value as compared to the native starch except for the treatment of phosphate salts STMP 1%: STPP 4% at concentration of propylene oxide 8% and 12%. Gel strength of hydroxypropylated and cross link starch increased at a low concentration of propylene oxide (8%) as compared to the native starch, but decreased with higher concentrations of propylene oxide (Table 2).

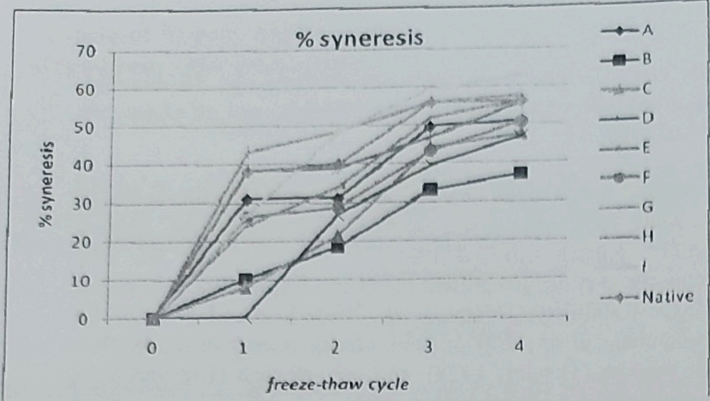

Figure 1: Freeze-thaw cycle of dual modified arrowroot starch (**A** = PO 8% ; STMP 1% : STPP 4%; **B** = PO 8% ; STMP 2% : STPP 5%; **C** = PO 8% ; STMP 3% : STPP 6%; **D** = PO 10% ; STMP 1% : STPP 4%; **E** = PO 10% ; STMP 2% : STPP 5%; **F** = PO 10% ; STMP 3% : STPP 6%; **G** = PO 12% ; STMP 1% : STPP 4%; **H** = PO 12% ; STMP 2% : STPP 5%; **I** = PO 12% ; STMP 3% : STPP 6%

Table 2: Paste clarity, sedimentation volume and gel strength of dual modified arrowroot starches.

Treatments	Paste clarity (%T_{650})	Sedimentation volume (%)	Gel strength (g)
Native	27.800 ± 0.800 f	28.083 ± 0.520 c	57.667±1.501 c
A = PO 8%; STMP 1%:STPP 4%	20.300 ± 0.265 c	24.500 ± 0.500 b	61.767±2,950 d
B = PO 8%; STMP 2%:STPP 5%	15.600 ± 0.100 c	31.833 ± 0.289 c	74.700±3.051 f
C = PO 8%; STMP 3%:STPP 6%	14.533 ± 0.306 ab	35.833 ± 0.289 g	78.967±1.102 g
D = PO 10%; STMP 1%:STPP 4%	16.233 ± 0.473 d	32.500 ± 0.500 c	66.500±2.751 c
E = PO 10%; STMP 2%:STPP 5%	16.467 ± 0.058 d	34.500 ± 0.500 f	56.967±0.961 c
F = PO 10%; STMP 3%:STPP 6%	14.067 ± 0.252 a	35.167 ± 0.289 fg	63.833±1.258 dc
G = PO 12%; STMP 1%:STPP 4%	15.433 ± 0.058 c	20.333 ± 0.289 a	62.567±1.450 d
H = PO 12%; STMP 2%:STPP 5%	14.767 ± 0.058 b	29.167 ± 0.764 d	51.000±0.458 b
I = PO 12%; STMP 3%:STPP 6%	14.333 ± 0.153 ab	29.333 ± 0.289 d	47.767±0.306 c

Notes: The same letter is not significantly according to Duncan's Multiple Range Test ($\alpha = 0.05$); PO = propylene oxyde; STMP = *sodium tri meta phosphate*; STPP = *sodium tri poly phosphate*

CONCLUSION

Arrowroot starch that was modified using propylene oxide at a concentration of 8% -10% and phosphate salt concentration of 1% -2% STMP: 3% -5% STPP showed the change of functional properties better than other treatments, making it safe to be used as commercialized raw materials for the food industry.

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