

Investigation of Illegal Additives in Commercial Alkaline Tsong-tsu and Effects of Bio-gum on the Textural Characteristi

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ABSTRACT

The first part of this thesis is the investigation of illegal additives used in commercial alkaline tsong-tsu. From the satisfaction investigation of the users of sodium trimetaphosphate in making alkaline tsong-tsu, it was found that 58 % of common family users and 38 % of business users give negative appraisal. Incorrect use of sodium trimetaphosphate is found to be the main reason to trace it to its cause. In this thesis, we also found out that it still have 29.1 % of commercial alkaline tsong-tsu adds the borax illegally. In the second part of this thesis, several biological gums were added individually to alkaline tsong-tsu with or without the addition of 0.3 % sodium trimetaphosphate. These biological gums include guar gum, carboxymethyl cellulose , xanthan gum, and sodium alginate. The characteristic of the biological gum is to mend strong towards the deficiency of sodium trimetaphosphate, and adding the biological gum had a big impact on alkaline tsong-tsu ' s texture and flavor. The characteristics of the biological gum are different. The biological gum of different kinds each has different results that appear to use in making alkaline tsong-tsu. After a lot of tests, we found out that 0.3 % xanthan gum and locust bean gum in 1:1 ratio added with 0.3 % of sodium trimetaphosphate to glutinous rice can give alkaline tsong-tsu products better appearance, texture, and flavor than those made using 0.3 % of sodium trimetaphosphate alone or 0.3 % borax along.

Keywords : Alkaline Tsong-Tsu, Biological Gum, Textur Borax, Xanthan Gum, Locust Bean Gum, Sodium Trimetaphosphate.

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REFERENCES

- 中文部份 1.王進昆、柯文慶、洪端良、陳重文、盧榮錦、賴滋漢。2002。食品 營養儀器分析。富林出版社。台中。台灣。2.日本藥學會。1973。衛生試驗法注解。金原出版株式會社，p 221。東京。日本。3.江伯源。1991。磷酸鹽類改進許多食品品質。食品工業23 (12) :43 - 47。4.吳宗沛。1991。澱粉的凝膠 (gelation)、回凝 (retrogradation) 之原理及應用。烘培工業9:49 - 53。烘培工業11:46 - 48。5.吳淑靜、柯文慶、賴滋漢。食品添加物。1997。富林出版社。台中。台灣。6.杜至善。2001。顆粒特性對澱粉凝膠過程黏彈性質之影響。靜宜學食品營養學系碩士論文。台中。台灣。7.杜易學。1999。交鏈化糯性米澱粉在湯圓產品應用上之研究。國立中興大學食品科學系碩士論文。台中。台灣。8.柯文慶、賴滋漢。2004。食物學原理。富林出版社。台中。台灣。9.高鈺鳳。2002。添加物對鹼粽質感特性的影響。國立台灣海洋大學食品科學研究所碩士論文。基隆。台灣。10.區少梅。2003。食品感官品評學。富林出版社。台中。台灣。11.許振耀。食品添加物使用法。振源食品化工原料股份有限公司。台北。台灣。12.康美智。1994。鹼對中式傳統米食製品之影響 - 影響鹼粽質地因素探討。食品科學21 (1):21 - 33。21 (4) :235 - 346。21 (5) :369 - 382。13.張永兆。1990。鹼粽加工及硼砂代用品之研究。中華穀類食品工業技術研究所研究報告第十四輯。台北。台灣。14.陳仁偉。1995。碳酸鈉對米澱粉糊化的影響。中國農業化會誌33 (4) :482 - 493。15.陳季洲。1998。梗糯品種稻米澱粉理化特性分析。中國農業化學會誌36 (3) :311 - 322。16.陳俊成。2003。三仙膠的製造、性質與應用。食品資訊，193: 51-5。17.游美淑。1990。影響鹼粽質地因素探討。食品科學17 (3) :235 - 251。英文部分 1.Asaoka M., Okuno K, Sugimoto Y, Kawakami K, and Fuwa H,1984.Effect of environmental temperature during development on rice plants and on some properties of endosperm starch : Starch/Starke,36:189-206 . 2.Bahnassey YA, Breene WM, 1994. Rapid visco-analyzer(RVA)pasting profiles of wheat, corn, waxy corn, tapioca and amaranth starches(A.hypochondriacus and A. cruentus) in the presence of Konjac flour, Gellan,Guar,Xanthan and Locust Bean Gums. Starch. 46:134-141. 3.Baird JK, Talashek TA, Chang H. 1992. Gellan gum: effect of composition on gel properties. In: Phillips Go, Williams PA, Wedlock DJ, editors. Gums and stabilizers for the food industry. 6th ed. p 479-487. Oxford, U.K. 4.Barbara K, 1998. Properties and applications of xanthan gum. Polymer Degrade Stab 59:81-94. 5.Bourne MC, 1978. Texture profile analysis. Food Technol 32(7):62-72. 6.Cary, N, 2004. SAS/STAT 9.1 User's Guide. p. 731-906. SAS Publishing.New York, USA. 7.Clark AH, 1992. Gels and gelling. In: Schwartzberg HG, Hartel RW, editors Physical chemistry of food. New York : Marcel Dekker, Inc. p 263-305. 8.Fox JE, 1997. Seed gums. In: Imeson A, editor. Thickening and gelling agents for food. London, UK: Blackie Academic & Professional. p 262-283. 9.Howling D,1980. The influence of the structure of starch on its rheological properties. Food Chem ., 6:51-62 . 10.Kulicke WM, Eidam D, Kath F, Kix M, Kull AH, 1996. Hydrocolloids and rheology: regulation of viscoelastic characteristics of waxy rice starch in mixtures with galactomannans. Starch/Starke 48(3):105-114. 11.Launay B, Cuvelier G, Martinez-Reyes S, 1997. Viscosity of locust bean, guar and xanthan gum solutions in the Newtonian domain: a critical examination of the log(η) - logC[η] master curves. Carbohydrate Polymers. 34:385-395. 12.Lacher B, Noble O, 1997. Xanthan gum. In: Imeson A, editor. Thickening and gelling agents for food. London, UK: Blackie Academic & Professional. P284-311. 13.Llams PA, Phillips Go, 2000. Introduction to food hydrocolloids. In:Phillips Go, Williams PA, editors. Handbook of hydrocolloids. Boca Raton, FL: Woodhead Publishing Limited and CRC Press LLC.p119. 14.Lundin L, Hermansson AM, 1995. Supermolecular aspects of xanthan-locust bean gum gels based on rheology and electron microscopy. Carbohydr Polym 26: 129-140. 15.Mauro, D. J, 1996. An update on starch, American Association of Cereal Chemists 41, 10, 776-780. 16.Morris ER, 1982. Rheology of hydrocolloids.In: Phillip Go,Wedlock DJ,Williams PA editors. Gums and stabilizers for food industry. 2nd ed, Oxford UK : Oxford Univ. Press. p 57-77. 17.Sudhakar V, Singhal RS, Kulkarni PR, 1994. Effect salts on interactions of starch with guar gum. Food Hydrocolloids 10:329-334. 18.Tester and Morrison, 1990. Swelling and gelatinization of cereal starches.Cereal chemistry 67:558-563. 19.Villareal et al.,1993. Structure and properties of endosperm starches from cultivated rice of Asia and other countries.70:567 - 571. 20.Wing J. 1999. Hydrocolloids.In: Rosenthal AJ,editor. Food texture measurement and perception. Gaithersburg, MD.: Aspen Publishers, Inc.p 282-304. 21.Whistler, R. L, 1954. Guar gum, locust bean gum and others. In ' Nature Plant Hydrocolloids ' , p. 45~50. American Chemical Society, Washington, D. C. 22.Xiaohung shi, James N.B, 2002 Effects of food gums on viscosities of starch Suspension. Carbohydrate polymers 50:7-18.