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Extended Abstract

The Effect of Various Levels of Xanthan/Guar Gum and Chubak Extract on Rheological, Thermal, Sensory and Microstructure of Gelatin Free Marshmallow

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Abstract

The aim of this study was to replace gelatin and albumin with three levels of xanthan gum and guar gum (1, 1.5 and 2%) and three levels of chubak extract (0.2, 0.4 and 0.6%) in marshmallow and evaluate physicochemical and organoleptic properties of new formulations. The results of physicochemical experiments showed that in all samples containing 0.6% of Chubak extract, density and overrun significantly decreased and increased, respectively. The moisture content and water activity in samples containing different levels of gum and chubak extract significantly increased in comparison to control (P<0.05). The results of DSC showed that the melting point and enthalpy of the samples increased with increasing hydrocolloid content. Also, texture evaluation revealed that samples containing 1.5% gum, 0.4% and 0.6% of extract were not significantly different from the control (P<0.05). Investigation on microstructure of bubbles in 1.5% of hydrocolloid and three levels of chubak extract showed that sample containing 0.2% chubak had large bubbles and samples containing 0.4 and 0.6% had smaller and more bubbles. Finally, sensory evaluation showed that samples with 1.5% hydrocolloid and 0.4% of chubak extract received the highest scores after control. This product owning to its suitable sensory and rheological properties has potential to be used as replacement for commercial products containing gelatin and albumin.

Keyword: Chubak extract, Dynamic rheological properties, Electron microscope, Marshmallow, Xanthan/guar

Introduction

Marshmallow as an aerated confectionery product is formulated using gelatin, albumin and syrup. Gelatin is widely used to improve elasticity, aeration, gel formation and stability of products such as marshmallow, but there are some limitation for using gelatin in food industry. Albumin is a protein in egg white that provides relatively stable foam (Greweling, 2015). High cost and risk of salmonella infection has limited the use of albumin (Ayoubi, Habibi Najafi, & Karimi, 2008). Xanthan gum is an extracellular heteropolysaccharide (Pinheiro *et al.*, 2011). Guar gum is a nonionic polysaccharide with high molecular weight and hydrogen bands (Saha & Bhattacharya, 2010). According to (Mardani *et al.*, 2019), the

ratio of 25/75 for xanthan/guar gums is appropriate for application in gelatin free marshmallow. Chubak is a plant of the Acanthophyllum genus and rich in amphiphilic saponins (Aghel, Moghimipour, & Raies Dana, 2010). The aim of the present study was to investigate the physico-chemical characteristics of gelatin free marshmallow in the presence of sweetening agents, chubak extract, xanthan and guar gums.

Materials and methods

Marshmallow was prepared using different percentages of gums and chubak extract. ^{0}Brix, pH (Periche, Heredia, Escriche, Andrés, & Castelló, 2015), moisture, aw (Tan & Lim, 2008), melting point, enthalpy (Yu & Christie, 2001), texture (Periche, Castelló, Heredia, & Escriche, 2016), color, microscopic image (Wretfors *et al*., 2010), rheology (Farahnaky, Askari, Majzoobi, & Mesbahi, 2010) were measured. Density, overrun and sensory analysis were also determined Tan & Lim (2008), Dabestani & Yeganehzad (2019) and Ayadi, Abdelmaksoud, Ennouri, & Attia (2009) methods.

Results and discussion

According to the results, with increasing gum content, the samples became thicker, density increased and overrun decreased. With increasing foaming agent, density decreased significantly as a result of the chubak saponins and their structure. In samples, there was no significant difference in density, except samples of 0.4% chubak extract and 1% gum, 0.6% chubak extract and 1% gum, 0.6% chubak extract and 1.5% gum, and 0.2% chubak extract and 2% gum. Also, with increasing gums and chubak extract in samples, moisture and aw increased. The lowest moisture and aw were observed in the control sample followed by sample of 1% gum and 0.2% chubak extract. The increase in moisture content is related to the surfactant properties of chubak extract and hydrophilic nature of the gums. The highest moisture content and water activity of the sample were obtained in sample of 2% gum and 0.6% chubak extract. The melting temperature of the control sample was 59.42±0.66. The melting point and enthalpy decreased with increasing chubak extract. Also, with increasing gum, the texture was heavier due to the hydrogen bonds between the xanthan and guar gum (Mardani et al., 2019). Hardness of the samples increased significantly with increasing gum. Also, increasing chubak extract had a negative effect on the texture parameters. Control sample had no significant difference in hardness with 1.5% gum and 0.4 and 0.6% chubak extract and 1% gum and 0.4% chubak extract. The highest consistency was observed in control sample which was significantly different with all of samples. Using higher concentrations of chubak extract increased L* parameter and decreased a* and b* parameters. The control sample containing gelatin and albumin formed a foam-like structure with a large number of small bubbles. At low concentration of chubak extract, the bubbles were large and unbalanced (Fig. 1).

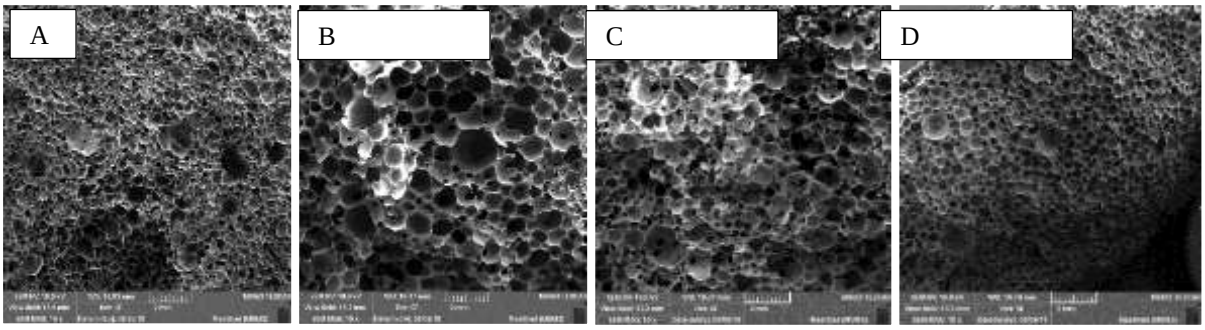

Fig. 1. A. Control sample, B. Sample of containing 1.5% gum and 0.2% chubak, C. Sample of containing 1.5% gum and 04% chubak, D. Sample of containing 1.5% gum and 0.6% chubak

Elastic properties of samples increased with increasing concentration of chubak extract. In all samples, G' was higher than G" indicating a gel-like system. In samples, complex viscosity (η^*) decreased linearly with increasing frequency indicating pseudoplastic behavior.

Conclusions

The results of this study showed that the samples containing 1.5% gum and 0.4% chubak extract were the closest to the control sample containing gelatin and albumin, regarding appropriate texture and sensory properties.

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