JRIFST

www.journals.rifst.ac.ir
Journal of Research and Innovation in Food Science and Technology

Research Institute of Food Science and Technology

Volume 8, Issue 2, Summer 2019, Pages 165-176
Document Type: Extended Abstract
DOI: 10.22101/JRIFST.2019.07.22.825

Effect the Ratio of an Emulsion Containing Sugar Alcohols and Particle Size on Thermal Resistance and Some Physical and Sensory Characteristics of Chocolate

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Received: 2018.09.04; **Accepted**: 2018.11.26

Abstract

In this study, the effect of emulsion containing sugar alcohols and particle size on increasing the melting point of the chocolate in semi-industrial conditions was investigated. Formulation containing PGPR emulsion, cocoa butter, water, isomalt and maltitol was added to a chocolate with a particle size of 20 and 30 μ. Texture, melting point and sensory properties (color, odor, taste, oral sensation and overall acceptance), moisture content and water activity were analyzed for chocolate formulated with PGPR emulsion, cocoa butter, water, isomalt and maltitol. The chocolate was compared with the control chocolate. The results showed that the use of maltitol and isomalt significantly increased the moisture content and water activity of the samples ($P<0.05$). Significant differences were observed between the treatments in terms of hardness of the tissues, which indicated a decrease in hardness by increasing the emulsion of sugar alcohols ($P<0.05$). Sensory properties showed that maltitol was similar to the control sample in terms of flavor and had a higher rate of oral melting compared to isomalt in all concentrations in color, all treated samples were brighter than control samples. There was no significant difference in the overall acceptance of the samples ($P>0.05$). In general, due to the insignificant effect of this emulsion formulated in the overall acceptance of sensory properties and its significant effect on increasing the melting point, these materials can be used in the production of heat -resistant chocolate in tropical areas.

Keywords: Chocolate, Isomalt, Maltitol, Melting Point, Particle Size

Introduction

Chocolate is a colloidal system in which the liquid phase consists of cocoa butter and a dispersed phase of cocoa powder particles and sugar. Chocolate cocoa butter is melting in the form of a stable form (DeMan, 1999). Earlier research suggests that heat-resistant chocolate can be produced by modifying the fat-cell structure, using oil-fat-bound polymers and increasing the melting point of the fat phase (Wan Aidah, Abdul Azis, Roselina, & Sabariah, 2014). Researchers believe that when liquid polyols are added to chocolate, it reacts with the fat found in chocolate, which increases the viscosity of the product. Today, polls are widely used in chocolate, including the use of isomalt, xylitol, and maltitol (Sokmen & Gunes, 2006), maltitol with or without polydextrose and inulin (Rapaille & Gonze, 1995). Despite numerous studies on the use of alcoholic sugars, as well as the role of particle size on the chocolate thermal resistance and limited research on the use of water in chocolate formulations, there has been a report on the simultaneous effect of the use of emulsion containing these compounds and the resizing of particles on the properties of chocolate Not published.

Material and methods

The materials used in this study were cocoa powder, maltitol, and iso-malt, lecithin, polyglycerol, PGPR polymerase), cocoa butter and sugar. First, in order to produce one kilogram of composite chocolate, the ingredients were prepared in the following proportions: 27% cocoa powder, 28% cocoa butter, 0.5% lecithin and 0.2% polyglycerol, polymer ricinoleate, 40% sugar. In a ball bearing machine that contains a stainless steel ball and abrasion resistance of 8 mm in diameter for grinding and mixing. In the first step, the withdrawal of the product from the wilter machine after 70 min to obtain particles of size (30 μ) called the mixture (A), and then, after 100 min, the particle size (20 μ), the mixture (B) was called. In the second step, a mixture of (A) and (B) isomalt and maltitol was added (Kiumarsi, Yeganehzad, Shahidi, Pahlevanloo, & Khoshkish, 2017).

Moisture content

The moisture content of the specimens was measured using the National Iranian Standard Method No. 2705 (Iranian National Standardization Organization [ISIRI], 2011).

Water activity

To measure the aquatic activity, a Swiss-made Lab Master Standard was used (Afoakwa, Paterson, Fowler, & Vieira, 2008).

Texture analysis

The tissue texture model (TA. XT plus, Stable Micro System) was used to analyze the tissue profile and measure the tissue properties of the samples.

Chocolate Melting Profile

To investigate the mold profile of chocolate samples, a differential scanning calorimeter (DSC-100/Spico Company) was used in China, equipped with a thermal analysis site.

Sensory evaluation

Sensory evaluation of samples was performed based on the analysis of a series of food characteristics. Sensory evaluation of the samples was done by 10 sensory evaluators who had seen the initial education using the Five Point Hedonic Test (Mahdavian Mehr & Mazaheri Tehrani, 2014).

Statistical Analysis

The results were analyzed in a factorial design with two particle size factors and emulsion ratio plus control sample. To compare the mean of treatments, Duncan method and 95% confidence level were used to evaluate the significance of the results. Data analysis was performed using SPSS software (version 18.0). Microsoft Excel (version 2016) charts were used to draw charts.

Results and discussion

Results of water activity

Increasing the amount of emulsion to a concentration of 30% increased the water activity of the product. All samples had a significant difference with the control sample ($P<0.05$). But there is no significant difference between treatments of 30 and 40%. The independent effect of emulsion concentrations on increasing the amount of water activity is much greater than the particle size variations in both formulations.

Moisture results

The results of moisture analysis showed that with increasing the amount of maltitol in treatments with larger particle size, the trend is increasing and there is no significant difference between treated samples, but there is a significant difference with the control sample ($P<0.05$). The highest moisture content in the smaller particle size is 30% for maltitol emulsion, and in a larger size, it is associated with 40% maltitol emulsion, and the least amount of moisture is related to the control samples in both sizes. In the study of the effect of isomalt emulsion on increasing moisture content, it was observed that increasing the percentage of isomalt in both sizes of the particles increaseed the moisture content of the samples.

Texture analysis

In the chocolate produced by increasing the amount of alcoholic beverage emulsion, the hardness of the treatments decreased, so that the least hardness in both particle sizes contained a 40% emulsion of maltitol and isomalt. The highest hardness was observed in the control sample. The reason for this decrease can be attributed to the high moisture content of polyols.

Melting profiles

By adding the maltol emulsion to the treatments at both times, the temperature of the initial melting of all samples increased. This increase in the particle size of 20 $\mu$to 30% of the maltitol emulsion had an increasing trend and almost linearly at a concentration of 40%.

Sensory analysis results

The general acceptance of chocolate samples produced by the use of maltitol and isomalt sweeteners did not show significant differences with sweeteners concentration ($P>0.05$). Sensory properties alone showed that the color of the treated samples with polyols was brighter than the control sample. The highest score was attributed to the darker color control sample, and comparing the concentrations of maltitol with similar concentrations in isomalt were observed. Which resulted in more maltitol samples.

Conclusion

Adding emulsion (isomalt and maltitol) to chocolate formulations increaseed the percentage of moisture content in all specimens, which can be attributed to the gravity and the presence of their hydrophilic groups. Both types of sweeteners have a higher moisture content when compared to sucrose, and isomalt had a higher moisture content. The use of emulsion had reduced the hardness of the tissue. The use of methyl ethyl and isomalt in chocolate formulations increased the melting temperature, which was the main reason for this resistance to melting temperature, which was the absorption of moisture. Chocolate samples produced with the use of maltitol and isomalt sweeteners showed that the presence of sweeteners and increasing the concentration of sweeteners did not have a significant effect on the overall acceptance of the consumer.

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Extended Abstract