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The Effects of Quince Seed Mucilage and Carboxymethyl Cellulose Coating on the Chemical Properties of French Fries

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ABSTRACT: Potato variety Satina after slicing (6 × 1 × 1 dimensions) was coated by dipping in 0.5, 1 and 1.5 percent of quince seed mucilage and carboxymethyl cellulose (CMC). These samples with a control group, which was not covered, were fried in oil, then acid and peroxide values of samples were measured. Use of hydrocolloid coating caused a significant decrease (P<0.05) in the peroxide and acid values due to the heating. The control sample revealed the highest acid value and mucilage 1.5% had the lowest acid value. In general the value of acidity was decreased as the result of increasing the concentration of hydrocolloids. Results showed that the use of the selected hydrocolloid coatings significantly reduced the peroxide value in comparison with the control group. Mean comparison of coating factor effect on peroxide value showed that peroxide value in control group had the highest amount in the entire testing process.

Keywords: Quince seed, potato, carboxymethyl cellulose, coating.

INTRODUCTION

Deep frying is one of the old cooking methods and it is widely used for production of crisp and tasty foods (Daraie Garmakhani *et al*., 2011). During frying, water vapor and other constituents of the food material will be transferred to fat. High temperatures for a long time leads to the destruction of the frying oil (De Meulenaer *et al*., 2007). On the other hand, during frying, complex changes, including physical (increasing viscosity and density, increasing turbidity and the desire to create foam in oil, reducing the smoke point, reducing the surface tension), chemical (increasing peroxide and free fatty acids, increasing high molecular weight compounds, decreasing stability, reducing the amount of unsaturated fatty acids) and organoleptic (including reduced taste) changes occur in oil that have a direct impact on quality and safety of food material (MacKay, 2000).

Peroxide value is such quantity that oil quality is studied based on it during the production, storage and sale of the product frequently. Peroxide value shows that the degree of oxidation of lipid system is based on produced hydroperoxide (Farhoosh *et al*., 2006). Using hydrocolloid coating significantly decreases the oxygen permeation rate and the rate of peroxide compounds in fried slices. Using hydrocolloid coating effectively delays fat oxidation and the emergence of a strong taste due to the formation of peroxide compounds (Wanstedt *et al*., 1981).

Previous studies on the frying oils have shown the amount of free fatty acids increases during frying. On the other hand, the use of hydrocolloid coatings delays oil hydrolysis rate and increasing acidity. This can be attributed to inhibitory coating property against on moisture transferring (Aminlari *et al*., 2004).

MATERIALS AND METHODS

This research was carried out as two-factor factorial experiment based on completely randomized design (CRD) with three replications. The first factor was the type of coating in 7 levels as follow: control or uncoated, mucilage with, 0.5, 1, 1.5 percent, CMC with, 0.5, 1 and 1.5 percent and the second factor was temperature at two levels of 170 and 185°C.

Slices of potato were blanched for 4 minutes in the water 80-85°C and were washed immediately with cold water. After cooling slices of potato at room temperature, they were immersed in quince seed mucilage and CMC solutions 0.5, 1, 1.5% for 3 minutes. Then, its surface was dried for 5 minutes in an oven at 105°C. The samples were fried in 3 liters of frying oil at temperatures of 170 and 185°C for 12 minutes. Fried potato slices were cut smithereens and were dipped in a 250 ml container containing 200 ml of n-hexane solvent at room temperature for 45 minutes (per 100g of sample, 200 ml n-hexane was used.). The samples were filtered content within the Wattman's paper No.50, and then hexane was removed by evaporation at 45°C in the rotary device (Tabib Loghmani *et al*., 2013). The extracted oil which remained in the distillation flask, for the next steps of the experiment (peroxide and acidity tests), was kept in falcon tubes at the temperature 4°C. The collected data were subjected to analysis of variance using Minitab 16 software and means comparison was done by Tukey test at the probability level of 0.05.

RESULTS AND DISCUSSION

Application of hydrocolloid coatings delayed hydrolysis rate of oil and the increase of acid value (Fig. 1). As the control sample had the highest acid value and mucilage 1.5% had the lowest acid value. The acidity was increased with increasing the temperature, in other words the total mean of acidity recorded at 185°C was higher than that recorded at 170°C. According to Fig. 1, it can be found that acidity was decreased by increasing the concentration of hydrocolloids. The effects of quince seed mucilage and CMC used in three concentrations, although are different numerically, they are not significant statistically. Use of various coatings of selected hydrocolloids in comparison with the control group was significantly reduced acid value.

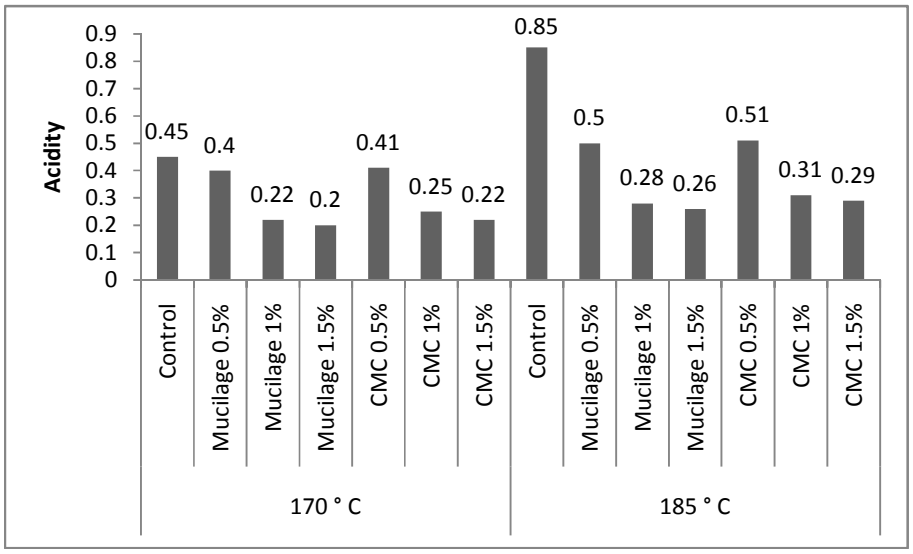

Fig. 1. The interaction of temperature and coating type on average of acidity of fried potato slices.

Results of the data variance analysis related to peroxide value showed that the interaction of two factors: coating and temperature, was not significant on the peroxide value parameter, but the main effects of two factors were significant on the parameter. Study of means of the main effects of two factors on coating and temperature shows that the use of the selected hydrocolloid coatings in comparison with the control group reduced the peroxide value significantly. The comparison of the averages of coating factor effect on peroxide value indicated that in the whole process of testing, peroxide value of the control treatment showed the highest amount (Table 1). Mucilage 1.5% had the greatest effect in reducing the rate of peroxide compounds. There was no significant difference between the concentrations of 1% and 1.5% mucilage. The effect of temperature factor on peroxide value shows that peroxide value was increased with increasing temperature. The highest and lowest peroxide values were observed at 185°C and 170°C, respectively. The results obtained in this study were consistent with the research results of Wanstedt *et al.* (1981) and Aminlari *et al.* (2004).

Table 1: The comparison of the averages of the main effects of the coating and the temperature on the peroxide index of potato*.

	Treatments	Peroxide index
Coating type		
	Control	1.2 abc
	Mucilage 0.5%	1.2 abc
	Mucilage 1%	0.8 bc
	Mucilage 1.5%	0.7 c
	CMC 0.5%	1.5 a
	CMC 1%	1.4 ab
	CMC 1.5%	0.9 abc
Temperature		
	170°C	0.9 b
	185°C	1.3 a

*The numbers of each group in each column with the same letters according to Tukey test at 5% probability level are not significant.

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