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Influence of thermal treatment on the color of carrageenan gel

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Abstract

This paper presents the results obtained after experiments concerning on the influence of thermal treatment on color of carrageenan gels colored with carminic acid and colorant Ponceau 4R. Model systems analyzed were maintained on the thermostat for 15 minutes, respectively, 30 minutes, at a temperature of 40^0C, 55^0C and 70^0C. Transmittance of samples was measured before and after the heat treatment, with the spectrophotometer Spekol provided with re-emission accessory R 45/0. Was obtained a decrease of lightness of the carrageenan gels maintain in the thermostat at 40^0C and 55^0C, and an increase of lightness gels maintain in the thermostat at 70^0C

Keywords: carrageenan gels, carminic acid, lighness, redness

1. Introduction

Food color gels, is undoubtedly one of the main characteristics that define the quality of these products, which has a decisive influence on the acceptance or rejection by consumers [1].

The carrageenan reduce mobility of the water by restraint of them in the solid systems gel type. In these gels can be incorporated fats, flavorings and other ingredients of the product [2].

In recent years, many consumers have limited their dietary intakeof fat and colories due to diet and health concerns. Consumer interest in reducind dietary fat and calorie intake has encouraged meat technologists to develop low-fat meat product formulations having good economical value and desirable palatability [3].

The carrageenan gel has a texture that imitates very well the texture of the adipose tissue and therefore is used to obtain meat products with a low fat [4].Using different heat treatments (boiling, cold smoked, hot smoked) to obtain meat preparations affect the color of food produced. Experimental research is conducted to study changes in the color of the carrageenan gels colored with carmine acid maintained for 15, respectively, 30 minutes at different temperatures.

2. Materials and Method

Experiments were conducted using carrageenan derived from Eucheuma algae (KUK, Romania), carmine acid E-120 (Rollit, Romania) and color Ponceau 4R, E124 (Rollit, Romania).

The carrageenan gels, colored with carmine acid or Ponceau 4R colorat were obtained by the method proposed by Torres, etc. in 2003 [4].

The amount of dye is added 0.01% and was calculated so that the maximum dose allowed in meat products (100 mg dye/ kg product for acid carmine and 250mg/kg product color Ponceau 4R) according to Health Ministry Orders 438/295 in 2002. Color of the gels was measured before and after thermostation samples for 15 minutes and 30 minutes at a temperature of 40^0C, 55^0C or 70^0C.

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To measure the color used spectrophotometry Spekol 10 where was mounted accessory which R 45/0. Reading was compared with a standard sample represented an area of white magnesium oxide, which is characterized by the following values of the trichromatic coordinates: X = 98, Y = 100, Z = 118 and the following trichromatic coefficients: x = 0.3101 , y = 0.3164, z = 0.3734. The intensity of light reflected from the surface sample, measured after cooling the sample at room temperature, was expressed in units Hunter with relations: $L=100\sqrt{Y}$; $a=\frac{175}{\sqrt{Y}}(1{,}02X-Y)$, where L is the brightness (lightness), and represents the degree of red (rednness) of the carrageenan gels colored with acid carmine.

3. Results and Discussion

Differences in color expressed by the variation of the lightness and rednness obtained for the carrageenan gel colored with carmine acid are presented in Table 1 and the color differences obtained for the carrageenan gel colored with Ponceau 4R are presented in Table 2.

In the case of carrageenan gel colored with carmine acid and thermostation at 40°C or 55°C temperature was obtained a decrease in brightness and an increased of the rednness; the gels of carrageenan thermostated at a 70^0C temperature recorded an increase in brightness and a decreased in rednness.

Table 1. Differences in color of the carrageenan gels colored with carminic acid obtained at different thermostation temperatures

Colorant	Temp [°C]	Time [min]	ΔL	Δa
A.C.	40	15	-0,24	0,9
A.C.	40	30	-0,3	1,1
A.C.	55	15	-0,44	1,2
A.C.	55	30	-1,28	1,5
A.C.	70	15	0,95	-1,01
A.C.	70	30	2	-1,95

A.C. = carminic acid

Table 2. Differences in color of the carrageenan gels colored with Ponceau 4R obtained at different thermostation temperatures

Colorant	Temp [°C]	Time [min]	ΔL	Δa
P_4R	40	15	-0,15	0,88
P_4R	40	30	-0,32	1,12
P_4R	55	15	-0,45	1,22
P_4R	55	30	-1,3	1,48
P_4R	70	15	0,3	-0,22
P_4R	70	30	0,49	-0,32

P_4R= Ponceau 4R

In the case of the carrageenan gel colored with Ponceau 4R was obtained a decrease of the brightness in all thermostated samples at 40°C or 55°C temperature and an increased in rednness. The thermostated carrageenan gels at a temperature of 70^0C was obtained increase brightness and decrease of the rednness. The changes color values were lower compared with those obtained for the gel that was colored with carminic acid. Thus, the difference Δa in the case of the thermostated carrageenan gel at 70^0C and colored with carminic acid was by 6.09 times higher than the carrageenan gel colored with colorant Ponceau 4R, and ΔL was by 4.08 times higher. In the figure 1. was represented graphically the variation of the redness in relation to temperature of the carrageenan gel colored with carminic acid, and in figure 2. the variation of lightness in relation to temperature.

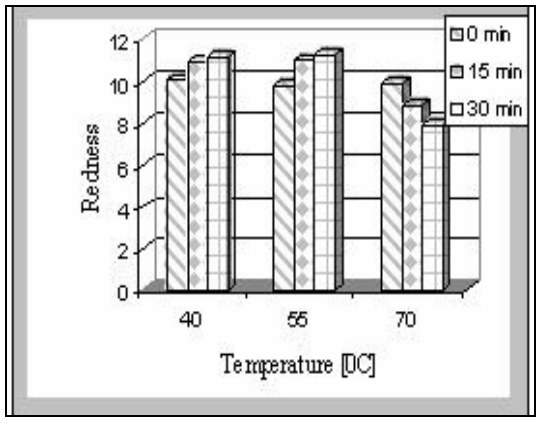

Figure 1. Changes in the of the redness colored carrageenan gel with carminic acid

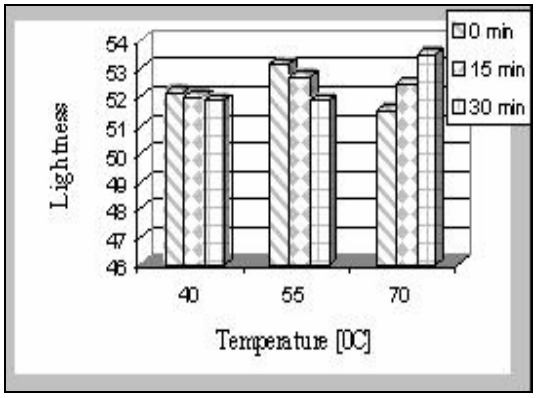

Figure 2. Changes in the of the lightness colored carrageenan gel with carminic acid

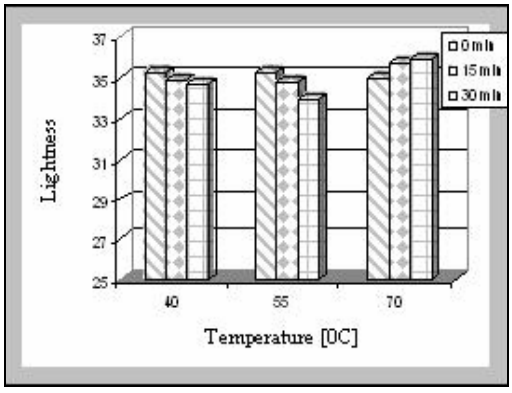

Figure 4. Changes in the of the lightness colored carrageenan gel with Ponceau 4R

To obtain a increase of 13.34% in the redness of the carrageenan gel colored with carmine acid after thermostation for 30 minutes at a temperature of 55^0C and a decrease of 19.81% after thermostation for 30 minutes at a temperature of 70^0C. Lightness of the thermostated carrageenan gels colored with carminic acid after 30 minutes at a temperature of 70^0C is 3.73% higher than the initial lightness of gel, and after a thermostation of 30 minutes at a 55^0C temperature is 2.40% less than the initial brightness of carrageenan gel. In figures 3, respectively 4 was represented the variation degree of redness and lightness in relation to temperature of carrageenan gel colored with Ponceau 4R

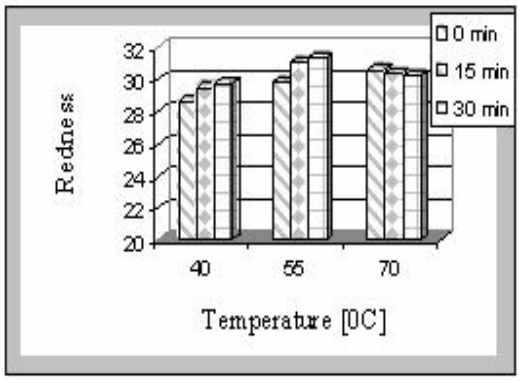

Figure 3. Changes in the of the redness colored carrageenan gel with Ponceau 4R

The degree of red of the carrageenan gel colored with Ponceau 4R increase by 4.96% after a termostation for 30 minutes at a of 55^0C temperature and decreases with 1.05% after a termostation for 30 minutes at a of 70^0C temperature.

Brightness of carrageenan gels colored with Poncesu 4R and thermostated for 30 minutes at a temperature of 70^0C increases by 1.36% compared to the initial value. If termostated temperature is 55^0C, and is the same length, by 30 minutes, lightness descrese with 3.83% towards the initial value.

4. Conclusion

The following conclusions are made evident according the made experiments:

- parameters that define the color (lightness and redness degree) of carrageenan gels colored with carminic acid or Ponceau 4R colorant varies during the heat treatments;
- the variation of these parameters depends on the temperature and the time of heat treatment, and also on the used colorant. Redness degree of samples varies in inverse proportion with lightness;
- the carrageenan gels colored with carminic acid or Ponceau 4R and thermostated at below 70^0C temperature, respectively 40^0C or by 55^0C for 30 minutes, recorded increase redness and decrease lightness. This behavior is due, mainly, to dehydration gels leading to

increasing concentration of the colorings in the samples;

- thermostating the gels at 70^0C temperature, influences differently the color parameters, in the terms of used colorant. Therefore, the gel's redness degree colored with carminic acid, thermostated for 30 minutes at 70^0C, decreases with 6,1 times more than de redness degree of Ponceau 4R colored gel.

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