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BIOCHEMICAL CHANGES IN SHELL COATED EGGS DURING STORAGE

Muhammad Afzal Malik, A.H.K. Niazi and Mahmood Islam Chaudhary

PCSIR Laboratories, Lahore16, Pakistan

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Egg shells were coated with chlorinated wax emulsion, liquid paraffin and carboxymethyl cellulose (CMC) and stored at 35° for 42 days for the determination of changes occuring in solid content, pH, volatile nitrogen and water soluble phosphorus. Minimum changes were observed in eggs coated with 9% chlorinated wax emulsion, a small portion of which migrated into the edible part of the egg.

INTRODUCTION

Eggs are high in nutritional value and are highly perishable too, especially in the summer. Deterioration occurs during storage due to loss of water, changes in albumin pH, basic volatile nitrogen, vitamins, hydrolysis of proteins, water soluble phosphorus etc.[1-2].

Efforts have been made to retard the deterioration of eggs by storing them at 29°F, and also preserving them by sealing the pores of the shell by various coating agents including emulsion, oils and synthetic plastics[3-8].

The formulation of coating agents and the method of their application to the egg shell and the physical changes occuring during storage have already been reported [9].

The present paper aims at arresting the deteriorative changes occuring during storage by coating the shell pores with coating agents and studying some of the chemical, biochemical and microbiological changes during the storage of coated eggs, which, when broken, appear to be related closely to the increase in hydrogen ion concentration and to the loss in weight of the whole egg.

MATERIALS AND MEHTODS

Eggs Collection and their Treatment: Fresh eggs collected from Poultry Farm were grouped and treated with coating agents reported by Alvi *et.al*[9].

Determination of Solid Content: Contents of eggs were well mixed and allowed to dry in oven at 100-105° to constant weight[10].

Determination of pH: The pH of albumin was determined by Walter and Anita method[11]. Egg was broken, albumin separated, weighed and diluted with distilled water. For each of egg, 1 ml of water was added. Contents were well mixed and pH measured.

Determination of Basic Volatile Nitrogen: The basic volatile nitrogen was determined by the distillation procedure[12]. Eggs contents from the same batch were well mixed and 50 g of the sample was taken in a distillation flask, 2 g of MgO and about 1 ml of liquid paraffin were added. The contents were distilled for 25 mints after boiling, and volatile nitrogen absorbed in 2% boric acid solution, which was then titrated against N/70 HCl using a mixture of bromocresol green and methyl red as an indicator. The amount of nitrogen was then calculated as:–

5 ml of N/70 HCl = 1 mg of N.

Estimation of Phosphorus: The solution for the estimation of phosphorus was prepared by dissolving well mixed egg content in water[13]. 20 ml of water was added for each g of egg. To 20 ml of this solution, 5 ml of N/100 acetic acid was added to obtain precipitable proteins and filtrate separately. 1 ml of clear solution was taken for the estimation of phosphorus which was determined colorimetrically[14].

Total Counts: The liquid portion was asceptically transferred into sterile flask containing glass beeds, and plugged with cotton wool and the contents shaken till a homogenous slurry was obtained. One g of homogenous egg slurry was diluted to 1000 ml. The total number of spores/100 ml (i.e. 1 g egg wt.) was determined with the help of haemocytometer[13].

$$\text{No of spores/g of egg} = \frac{n \times d}{K \times S}$$

n = No of spores counted

d = dilution

K = capacity of one small square of cytometer.

S = No of small squares counted.

Estimation of Chloride. Percentage of chloride in egg liquid was determined by A.O. A.C. method[16] and calculated on the basis of the volume of $AgNO_3$ used.

RESULTS AND DISCUSSION

There is increase in solid content of the egg during storage due to the evaporation of water through the pores of egg shell, not sealed with a coating agent[1]. In the present studies, the fresh egg contained 24.5% solids which increased to 29.1% in the control egg; in coated eggs it increased from 24.5 to 27.9%, minimum increase being in wax emulsion coated eggs and maximum in eggs coated with liquid paraffin and CMC (Table 1). The minimum loss of water in 9% chlorinated wax emulsion coated egg can be due to effective suitable concentration of emulsion.

Change in pH. The change of pH of the controlled and coated eggs increased from 8.4 to 9.9 and 8.4 to 9.1 after 42 days of storage. However, the change in pH of egg albumin was comparatively less in emulsion coated eggs than the eggs coated with other coating agents. The least change being in 9% chlorinated wax emulsion coated eggs (Table2).

Change in Basic Volatile Nitrogen. The basic volatile nitrogen was found to be about 5.5 mg/100 g in fresh egg, which increased to 15.6 mg/100 g in control after 42 days storage (Table 3). In the emulsion coated eggs the basic volatile nitrogen was comparatively less and it increased from 5.5 to 11.8 mg/100 g, the least change being in eggs coated with 9% chlorinated wax emulsion. The change was little higher in the eggs coated with liquid paraffin and CMC which may be due to hydrolysis of protein to ammonia and amino acids[17].

Change in Water Soluble Phosphorus. The phosphorus in egg is mainly present as lipid soluble phosphorus which in fresh egg is 17.5 mg/ 100 g and very small quantity is present as water soluble. There was a rapid change in the amount of water soluble phosphorus in the controlled eggs during storage (Table 4). It reached 42 mg/100 g after 21 days of storage, then the change was slow, and after 42 days of storage it reached the level of 46.2 mg/100 g. In the coated eggs the change in water soluble phosphorus was comparatively slow. Eggs coated with chlorinated wax emulsion showed less increase in water soluble phosphorus, the least change being in 9% chlorinated wax emulsion coated eggs, and reached the level of 33.8 mg/100 g after 42 days. The changes in water soluble phosphorus were

Table 1. Effects of coating agents on solid contents of eggs during storage (%)

	Days						
Samples	0	7	14	21	28	35	42
Control	24.5	25.0	26.2	26.9	27.5	28.2	29.1
3 % Chlorinated wax emulsion	24.5	24.8	26.1	26.5	26.8	27.2	27.6
6 % Chlorinated wax emulsion	24.5	24.6	25.0	25.3	25.7	26.1	26.3
9 % Chlorinated wax emulsion	24.5	24.6	24.7	25.0	26.2	25.5	25.9
Liquid paraffin	24.5	24.9	25.2	25.9	26.4	27.1	27.7
Corboxy methyl cellulose (CMC)	24.5	25.2	25.6	26.1	26.7	27.2	27.9

Table 2. Effect of coating agents on pH of eggs during storage

	Days						
Samples	0	7	14	21	28	35	42
Control	8.4	8.7	9.1	9.5	9.7	9.8	9.9
3 % Chlorinated wax emulsion	8.4	8.5	8.4	8.6	8.7	8.8	8.9
6 % Chlorinated wax emulsion	8.4	8.4	8.5	8.7	8.6	8.8	8.9
9 % Chlorinated wax emulsion	8.4	8.3	8.4	8.6	8.8	8.7	8.8
Liquid paraffin	8.4	8.5	8.6	8.6	8.2	8.8	9.1
Corboxy methyl cellulose (CMC)	8.4	8.3	8.5	8.4	8.6	8.7	9.0

Table 3. Effects of coating agents on volatile nitrogen of eggs during storage (mg/100 g)

	Days						
Samples	0	7	14	21	28	35	42
Control	5.5	6.2	6.8	9.0	11.9	13.4	15.6
3 % Chlorinated wax emulsion	5.5	6.0	6.7	7.6	8.1	9.2	10.8
6 % Chlorinated wax emulsion	5.5	5.9	6.4	7.2	8.0	8.8	10.4
9 % Chlorinated wax emulsion	5.5	5.7	6.2	7.0	8.2	8.7	10.0
Liquid paraffin	5.5	5.9	6.4	7.0	7.8	8.9	10.8
Corboxy methyl cellulose (CMC)	5.5	6.3	7.4	8.0	9.2	10.4	11.8

Table 4. Effects of coating agents on water soluble phosphorus of eggs during storage (mg/100 g)

	Days						
Samples	0	7	14	21	28	35	42
Control	17.5	26.3	35.0	42.0	43.8	44.5	46.2
3 % Chlorinated wax emulsion	17.5	23.2	25.5	27.2	30.4	33.2	38.4
6 % Chlorinated wax emulsion	17.5	22.5	27.5	30.0	31.2	32.2	35.0
9 % Chlorinated wax emulsion	17.5	20.0	26.2	27.5	30.0	32.5	33.8
Liquid paraffin	17.5	22.5	26.2	29.8	32.2	36.3	38.5
Corboxy methyl cellulose (CMC)	17.5	24.0	27.5	30.2	35.0	38.2	40.0

Table 5. Effects of coating agents on total counts of eggs during storage (millions/g)

	Days						
Samples	0	7	14	21	28	35	42
Control	2.0	3.8	7.5	10.0	13.4	15.2	17.0
3 % Chlorinated wax emulsion	2.0	3.6	6.1	6.9	9.6	11.7	13.9
6 % Chlorinated wax emulsion	2.0	3.2	5.4	6.5	8.7	10.8	13.0
9 % Chlorinated wax emulsion	2.0	3.0	5.0	5.9	7.4	9.6	11.4
Liquid paraffin	2.0	3.5	5.8	7.6	10.2	13.0	15.9
Corboxy methyl cellulose (CMC)	2.0	3.3	6.8	7.9	9.3	12.2	14.5

greater in liquid paraffin and CMC coated eggs than in emulsion coated eggs as vouchsafed by other workers[2] while decrease may be attributed to lipid phosphorus during storage.[18].

Total Counts. The microscopic bacterial count which include both living and dead cells is a reliable index of decomposition of egg. The effect of different coating agents on the keeping quality of eggs was studied at 35° (Table 5). The bacterial count of 2 millions in the control sample at zero hr might be due to contamination of egg shell because of unhygienic conditions prevailing in the poultry farm. The total count in liquid whole egg increased from 2.0 to 17.0 million/g at 35° by the end of 42 days, minimum being in 9% chlorinated wax emulsion followed by 6%

chlorinated wax emulsion coated eggs, which are in permissible range[19-20]. Thus it is concluded that the eggs coated with 9% chlorinated wax emulsion showed comparatively better keeping quality by the end of 42 days followed by 6% chlorinated wax emulsion. Our chemical, biochemical and micro-biological results are in confirmity with earlier physical results[8-9].

Residual Effect of Chlorinated Wax Emulsion. The residual effect of chlorinated wax examined in the wax coated eggs. Chloride content in fresh egg as well as in emulsion coated egg was determined after 42 days storage. The amount of chloride ions in fresh and emulsion coated egg was found to be 0.25 and 0.26 mg/100 g respectively. Therefore, it appears that very small quantity of chlorinated wax emulsion has migrated into the egg.

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