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Bacterial Content of Desecated Egg

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BACTERIAL CONTENT OF DESICCATED EGG.

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The value of eggs as an article of food for human consumption has been recognized for a long period of time. The relative value, as compared to other available food products, may be subject to further investigation, even though much work has already been done. But whatever may be the variance in conclusions, yet the fact of the great food value of eggs has been established by experiment and by practical experience. With the realization of the value of a food, is an attendant increased consumption and the necessity for increased production, and also the advisability of extending the period over which the given food is available. During the months of plenty, provision should be made for the "lean" months.

Many foods are of such a nature that they lend themselves readily to preservation by various means. On the other hand, the preservation of some is a problem that has been solved, in some degree of satisfaction at least, within recent years only. Because of economic reasons in the matter of transportation and storage, some plan of eliminating water from foods containing large percentages has been sought and in many instances has been readily found and practically applied. In other cases the problem was more difficult. But now we have desiccated milk, desiccated eggs and other dried foods that in their original condition contained large percentages of water.

No satisfactory method has yet been found whereby eggs in the shell can be preserved for any length of time. Even if such a method were known the economic problem of bulk and breakage would persist. The loss in transportation of eggs in the shell is very great. The frozen product may be kept indefinitely, but at considerable expense for refrigeration and storage. For a number of years experimenters have been trying various methods of desiccation, and are now preparing eggs by drying, for storing and for transportation, on a large scale. Various methods are used, as the tray method, disk method, belt method, and the instantaneous method by spraying the liquid into a chamber heated to about 160 degrees Fahrenheit. This method seems to be the best one devised. The per cent of water removed is so great that the solids from thousands of cases can be stored in containers in a relatively small space. Fresh eggs contain approximately seventy-four per cent water, while the powder prepared by the instantaneous method has only from

three to five per cent. Here, then, is a food material rich in nutrients but without sufficient water for ordinary bacterial growth, and one that may be preserved a long period of time.

One of the problems connected with the preparation of the desiccated product is to avoid contamination of the eggs in their preparation for the drying chamber. They must be broken and poured from the shells and sent through the beater and tanks. The sanitary problem connected with this part of the process is the most serious and the most difficult to solve on the part of the honest manufacturer. Many studies show that the bacterial content of the fresh, unbroken egg is either small or wanting. The ordinary conditions, however, under which eggs are produced and are gathered are such that the shell very generally carries large numbers of bacteria of various kinds; and it is a practical impossibility to break and pour the eggs without a degree of contamination closely correlated with the condition of the shell. Samples removed from the shell in the laboratory under aseptic conditions, by flaming the shell and using sterilized instruments, may be sterile, or may contain a very small number of bacteria, while samples of eggs of the same kind taken from the pans in the factory may show thousands per cubic centimeter. At present no practical method of preventing such contamination is known. At best, the product, whether frozen or desiccated, will contain many more bacteria than are normally present in the fresh, unbroken egg; this number being dependent largely upon the condition of the shell, whether clean or dirty, and upon care and conditions in the factory.

The eggs known as "spots" contain many bacteria, but under careless conditions in the factory the product prepared from good, "candled" eggs may show as many bacteria as the product prepared from the "spots." For this reason a bacterial count does not of necessity prove the condition of the original; neither does the gas production, for in the greater number of examinations of fresh eggs broken in the pans, gas is produced in the fermentation tubes. This is in accord with what might be expected when the wide distribution of the *Bacillus coli* group is taken into consideration.

Another question of importance arising is, with reference to the effect of storage upon the bacterial content of the prepared egg, whether frozen or desiccated. Results obtained at Washington after a series of examinations are given in Bulletin No. 158 of the Bureau of Chemistry, 1912. The investigation included both frozen and desiccated products, and a decrease in content after storage was noted. This fact gives rise to some questions of importance. How rapid and to what degree is the decrease? Does a corresponding decrease occur in the

product from "spots" and other inferior eggs? Can an inferior product be detected by count and fermentation tests after a lengthy period of storage? What conditions of storage will cause the most rapid diminution of bacteria? Is it possible that some desiccating plants may buy "spots" and then put the product on the market as high grade desiccated eggs?

Work extending over four seasons, beginning with 1910, leads me to the opinion, rather by inference, it is true, that dishonest manufacturers may find it possible to put a very inferior article on the market, one that may give satisfactory results when examined by the ordinary method of colony counting and the fermentation test after a period of storage. The dry powder contains food material for bacterial growth, but there is an insufficiency of water, and the vitality of the bacteria is gradually lost until, in time, the powder becomes practically sterile. The powder freshly prepared from "spots" and rotten eggs contains a great number of bacteria; but during the process of the instantaneous method, or upon the application of heat in baking, practically all bad odor is eliminated. Such a result was obtained in July, 1912, from an experiment performed relative to the preparation of powder from bad eggs for use in tanning. Several cases of eggs in all degrees of rottenness, some "spots," some "blood spots," some containing dead chicks, were broken and were run through the process of desiccation. The resulting powder was indistinguishable in its appearance by any one, unless it be by an expert, from the powder prepared from fresh eggs. Upon presentation of a small can of the powder and a can of the good product to one of my colleagues, for his inspection by the sense of smell, he found it impossible to determine which was good and which was bad. Knowing the two cans, I thought possibly I could detect a slight difference in the odor. Such a product stored for a considerable period of time will give a low bacterial count and will fail to produce gas in the fermentation tube.

During the four seasons of 1910, 1911, 1912, 1913, something like 550 examinations of liquid and powdered egg were made in the Drake bacteriological laboratory. At the beginning of the work there was no expectation of using the data for public presentation.

From April 8 to July 10, 1910, seventy-six samples of liquid white and sixty-six samples of liquid yolk were examined, a total of 142 tests. A summary of Table I shows a large percentage of both white and yolk producing from 100,000 to 500,000 colonies per cubic centimeter; in the case of the whites, 40.78 per cent, and of the yolks, 66.66 per cent. Of the white, 44.71 per cent produced less than 100,000 colonies, and

of the yolks, 30.29 per cent. Of the 142 samples, twenty, or 14.08 per cent, yielded no gas in dextrose broth, .01 of a cubic centimeter being used. A much smaller percentage of the yolk samples than of the whites produced gas; in the former, 27.27 per cent with no gas, and in the latter only 2.63 per cent. Stated positively, 72.73 per cent of the samples of yolks produced gas and 97.37 per cent of the whites. During this season also a few tests were made on liquid whole egg and on desiccated yolk; these were not of sufficient number to give data of any special value.

Beginning April 5, 1911, and continuing until July 6, ninety-four samples of desiccated whole egg and thirty-three samples of liquid were tested. Of the desiccated samples, sixty-three, or 67.02 per cent, showed from 100,000 to 500,000 colonies per gram; 23.35 per cent less than 100,000, and 9.57 per cent between 500,000 and 1,000,000. Gas-producing samples in dextrose broth numbered sixty-five, or 69.15 per cent. Of the tests with the liquid samples, thirty were counted. Seven, or 23.33 per cent, gave a count between 100,000 and 500,000; three, or 10 per cent, showed less than 100,000 colonies, and twenty, or 66.66 per cent, a count of 500,000 and above. Of the entire thirty-three samples every one yielded gas in the dextrose tube, the per cent of gas ranging from 20 per cent to 89 per cent. (Table 2.)

In 1912 fifty-six samples of desiccated product were examined between May 6 and July 3. Of these, forty, or 71.42 per cent, developed between 100,000 and 500,000 colonies per gram; 12.49 per cent showed less than 100,000, and 1.78 per cent 500,000 or more. Of the fifty-six samples, forty-two, or 75 per cent, developed gas in lactose tubes, ranging from 11 per cent to 60 per cent. Four liquid samples all produced gas in lactose broth ranging from 64 per cent to 80 per cent. (Table 3.)

Beginning May 7, 1913, and continuing until July 2, ninety-eight samples of powdered egg were examined. Of these, seventy, or 71.42 per cent, developed from 100,000 to 500,000 colonies per gram; 20.40 per cent developed less than 100,000 and only 8.16 per cent 500,000 or more. In lactose broth, seventy-two, or 73.47 per cent, produced gas ranging from 5 per cent to 80 per cent. (Table 4.)

Of the entire 248 samples of desiccated egg examined during the three seasons, 173, or 69.75 per cent, showed from 100,000 to 500,000 colonies per gram; fifty-seven, or 22.98 per cent, less than 100,000 colonies, and eighteen, or 7.25 per cent, 500,000 or more. Gas was produced in 180 samples, or in 72.59 per cent. Dextrose broth was used in 1911 until May 24, when lactose was substituted and was used in 1912 and 1913. The percentage of tubes producing gas in 1911 was slightly lower than

the percentage in 1912 and 1913, possibly because the incubation period was only twenty-four hours instead of forty-eight hours. Of the 142 samples of liquid tested in 1910, 122, or 85.91 per cent, produced gas in the dextrose tube. Seventy-six of the samples were whites, and of these, seventy-four, or 97.36 per cent, produced gas, while of the sixty-six samples of yolk, forty-eight, or 77.73 per cent, produced gas. This shows a difference in gas production decidedly in favor of the yolks over the whites. In breaking and pouring a greater degree of contamination of the whites is probable than of the yolks.

In order to get some data on the effect of storage upon bacterial content, some tests were made upon samples of powder that had been in the fluctuating temperature of the laboratory for varying periods of time. Also some samples were put into the incubator at a temperature near 35°C, but varying somewhat. At the time samples were put into the incubator others from the same lots were put into a cool room at a temperature of 17° to 19°C. The experiment with the samples in the cool room was soon checked by the fact that the mite, *Tyroglyphus siro,* developed in the cans, although they were presumably hermetically sealed with paraffin.

The specimens were examined at various dates after different periods of storage. The earliest time of examination of the samples in the laboratory was after a storage of seventy-four days, and the latest after storage of 575 days. The smallest per cent decrease in bacterial content was 36.67 in one specimen after a storage of eighty-one days. It seems that this result should be considered due to error, as it is so far below the average per cent decrease. Another test of the same sample after 240 days gave no results because of spreading colonies. In five instances the count after a longer period of storage showed a larger number of colonies than the count of the same samples after a shorter period. In three of the cases the difference is so slight that they may be left out of consideration. In all probability the other two may be explained as due to errors.

The average decrease in bacterial content in 113 tests upon fifty-six samples under laboratory conditions of temperature for periods of seventy-four to 575 days was 94.12 per cent, and of these only three, or 2.65 per cent, developed gas in the lactose broth in twenty-four hours, .01 gram being used in each tube. (Table 5.)

Beginning on August 22, 1913, and continuing at intervals until December 8, 1913, counts were made upon thirty-two samples of powdered whole egg that had been stored in the incubator for periods of 60, 100, 109, 112, 153, and 156 days. With the exception of five, the

samples were put into the incubator after six to twenty-eight days' storage in the laboratory. The decrease in bacterial content ranged from 99.38 per cent to 100 per cent, with an average of 99.95 per cent. Three samples in the incubator sixty days showed a decrease of 99.78 per cent; one, at 109 days, a decrease of 99.90 per cent; nine, at 112 days, a decrease of 99.96 per cent; one, at 153 days, a decrease of 100 per cent; and eight, at 156 days, a decrease of 99.99 per cent. One sample, in the incubator 112 days, produced 37 per cent gas in lactose broth. No gas was produced in any of the others. (Table 6.)

At the same time that samples were put into the incubator, other samples taken from the cans in the incubator were put in the cool room in order to compare the effect of storage under noticeably different degrees of temperature. Two samples were tested after a period of sixty days and one after sixty-seven days; these showed a decrease respectively of 99.22 per cent, 99.07 per cent, and 94.25 per cent. The other samples had been invaded by the *Tyroglyphus siro.*

A little comparison of the results obtained shows that decrease in bacterial content took place more rapidly at a higher temperature than at a lower fluctuating room temperature, a storage ranging from seventy-four to 575 days at laboratory temperature giving an average decrease of 94.12 per cent, and a storage ranging from sixty to 156 days in the incubator, following no storage to a storage of twenty-eight days at room temperature, giving an average decrease of 99.95 per cent.

In so far as these experiments indicate, it seems that the desiccated egg loses a large percentage of the bacteria originally present if stored for even a relatively short period. Also the experiment indicates a more rapid diminution if storage is at a higher temperature than at a lower. And it seems possible that a poor product, even one prepared from "spots," and worse, might satisfy the ordinary bacterial test of colony counting and gas determination after a period of a few months' storage.

TABLE I—BACTERIAL TESTS LIQUID EGG FROM APRIL 8 TO JULY 1, 1910.

Date	Lot No.	Egg	No. Colonies per c. c. 48 hrs. at 37° C.	Per Cent Gas, 24 hrs. .01 c. c. Dextrose Broth	Date	Lot No.	Egg	No. Colonies per c. c. 48 hrs. at 37° C.	Per Cent Gas, 24 hrs. .01 c. c. Dextrose Broth
Apr. 8	1	White	13,500	—	Apr. 27	17	White	360,000	+
Apr. 8	1	Yolk	3,800	—	Apr. 27	17	Yolk	500,000	—
Apr. 9	2	White	400	—	Apr. 28	18	White	79,000	+
Apr. 9	2	Yolk	900	—	Apr. 28	18	Yolk	90,000	+
Apr. 11	3	White	52,300	+	Apr. 29	19	White	318,000	+
Apr. 11	3	Yolk	3,400	+	Apr. 29	19	Yolk	55,400	—
Apr. 12	4	White	900	+	Apr. 30	20	White	79,000	+
Apr. 12	4	Yolk	700	—	Apr. 30	20	Yolk	49,000	+
Apr. 13	5	White	100,000	+	May 2	21	Whole Egg	108,000	+
Apr. 13	5	Yolk	42,000	—	May 3	21	White	300,000	+
Apr. 14	6	White	9,100	+	May 3	22	Yolk	29,000	+
Apr. 14	6	Yolk	6,500,000	+	May 4	22	White	60,000	+
Apr. 14	6	Pow'd Yolk (per gram)	50,000	+	May 4	23	Yolk	190,000	+
Apr. 15	7	White	650,000	+	May 5	23	White	110,000	+
Apr. 15	7	*Machine White	2,000	+	May 5	24	Yolk	72,000	8
Apr. 15	7	Pow'd Yolk (per gram)	74,300	+	May 6	24	White	35,000	40
Apr. 16	8	White	6,500	+	May 6	25	Yolk	15,000	31
Apr. 16	8	Yolk	7,400	—	May 7	25	White	225,000	43
Apr. 18	9	White (40 hrs.)	100,000	+	May 7	26	Yolk	180,000	4
Apr. 18	9	Machine White (40 hrs.)	100,000	+	May 9	27	Yolk	150,000	7
Apr. 18	9	Yolk	500,000	+	May 10	26	White	25,000	38
Apr. 19	10	White	55,000	+	May 10	27	White	71,000	50
Apr. 19	10	Machine White	6,000	+	May 10	28	Yolk	93,000	0
Apr. 19	10	Yolk	40,000	+	May 11	28	White	95,000	55
Apr. 20	11	White	17,800	+	May 11	29	Yolk	99,000	5
Apr. 20	11	Yolk	36,500	+	May 12	29	White	82,000	57
Apr. 21	12	White	1,400	+	May 12	30	Whole Egg	260,000	0
Apr. 21	12	Yolk	3,300	+	May 12	31	Whole Egg	260,000	6
Apr. 21	12	Pow'd Yolk (per gram)	21,700	—	May 13	30	White	450,000	50
Apr. 21	12	Feed Pump Yolk	2,000,000	+	May 13	32	Yolk	230,000	1
Apr. 22	13	White	1,100	+	May 14	31	White	7,000	50
Apr. 22	13	Machine White	3,000	+	May 14	33	Yolk	215,000	8
Apr. 23	14	White	11,600	+	May 16	32	White	8,000	68
Apr. 23	14	Feed Pump Yolk	250,000	+	May 16	34	Yolk	145,000	3
Apr. 23	14	Pow'd Yolk (per gram)	19,400	+	May 17	33	White	360,000	80
Apr. 25	15	White	50,000	+	May 17	35	Yolk	230,000	0
Apr. 25	15	Yolk	120,000	+	May 18	34	White	200,000	50
Apr. 26	16	White	1,000	+	May 18	36	Yolk	108,000	12
Apr. 26	16	Yolk	28,700	+	May 19	35	White	220,000	54

*Eggs broken with a machine.

TABLE I—CONTINUED—BACTERIAL TESTS LIQUID EGG FROM APRIL 8 TO JULY 1, 1910.

Date	Lot No.	Egg	No. Colonies per c. c. 48 hrs. at 37° C.	Per Cent Gas, 24 hrs. .01 c. c. Dextrose Broth	Date	Lot No.	Egg	No. Colonies per c. c. 48 hrs. at 37° C.	Per Cent Gas, 24 hrs. .01 c. c. Dextrose Broth
May 19	37	Yolk	240,000	24	June 13	53	White	38,000	26
May 20	36	White	370,000	50	June 13	57	Yolk	160,000	12
May 20	38	Yolk	215,000	22	June 14	54	White	240,000	26
May 21	37	White	30,000	55	June 14	58	Yolk	195,000	8
May 21	39	Yolk	234,000	15	June 15	55	White	15,000	23
May 23	38	White	168,000	17	June 15	59	Yolk	230,000	8
May 23	40	Yolk	262,000	31	June 16	56	White	85,000	50
May 24	39	White	950,000	60	June 16	60	Yolk	150,000	0
May 24	41	Yolk	210,000	25	June 17	7	White	30,000	53
May 25	40	White	450,000	60	June 17	39	White	80,000	64
May 25	42	Yolk	228,000	5	June 17	40	White	30,000	71
May 26	41	White	700,000	60	June 17	57	White	180,000	57
May 26	43	Yolk	270,000	1	June 17	61	Yolk	275,000	18
May 27	44	Whole Egg	160,000	40	June 18	58	White	70,000	64
May 28	45	Whole Egg	340,000	2	June 18	62	Yolk	220,000	29
May 31	42	White	102,000	41	June 20	59	White	350,000	52
May 31	46	Yolk	234,000	1	June 20	63	Yolk	210,000	31
June 1	43	White	375,000	52	June 21	60	White	290,000	64
June 1	47	Yolk	270,000	1	June 21	64	Yolk	230,000	21
June 2	44	White	160,000	47	June 22	61	White	600,000	60
June 2	48	Yolk	400,000	2	June 22	65	Yolk	310,000	50
June 3	45	White	370,000	47	June 23	62	White	260,000	60
June 3	49	Yolk	190,000	25	June 23	66	Yolk	395,000	0
June 4	46	White	440,000	50	June 24	63	White	275,000	35
June 4	50	Yolk	100,000	5	June 24	67	Yolk	335,000	0
June 6	47	White	785,000	44	June 25	64	White	490,000	60
June 6	51	Yolk	175,000	0	June 25	68	Yolk	260,000	0
June 7	48	White	325,000	53	June 27	65	White	900,000	73
June 7	52	Yolk	215,000	18	June 27	69	Yolk	300,000	8
June 8	49	White	815,000	63	June 28	66	White	1,200,000	60
June 8	53	Yolk	350,000	36	June 28	70	Yolk	300,000	10
June 9	50	White	100,000	50	June 29	67	White	1,650,000	88
June 9	54	Yolk	140,000	0	June 29	71	Yolk	340,000	5
June 10	51	White	750,000	53	June 30	68	White	600,000	60
June 10	55	Yolk	85,000	16	June 30	72	Yolk	240,000	0
June 11	52	White	300,000	75	July 1	69	White	244,000	65
June 11	56	Yolk	130,000	0	July 1	73	Yolk	200,000	0

TABLE II—BACTERIAL TESTS DESICCATED EGG FROM APRIL 5 TO JULY 6, 1911.

Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 24 hrs. .01 gram Dextrose Broth	Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 24 hrs. .01 gram Dextrose Broth
April 5	2	Pow'd	15,500	0	May 1	28 Cooler	Liquid	(1c.c.) 850,000	28
April 5	3	Pow'd	110,000	6	May 3	29	Pow'd	270,000	42
April 5	4	Pow'd	24,000	10	May 3	30	Pow'd	445,000	26
April 5	5	Pow'd	13,000	9	May 3	30 Beater	Liquid	(1c.c.) 2,190,000	30
April 5	6	Pow'd	64,000	0	May 3	30 Cooler	Liquid	(1c.c.) 1,600,000	24
April 6	7	Pow'd	100,000	5	May 5	31	Pow'd	150,000	25
April 7	8	Pow'd	50,500	25	May 6	32	Pow'd	250,000	0
April 8	9	Pow'd	28,500	0	May 6	33	Pow'd	450,000	56
April 11	10	Pow'd	36,500	14	May 8	34	Pow'd	168,000	51
April 11	11	Pow'd	139,000	18	May 8 a.m.	34 Beater	Liquid	(1c.c.) 130,000	50
April 12	12	Pow'd	165,000	7	May 8 a.m.	34 Cooler	Liquid	(1c.c.) 950,000	56
April 13	13	Pow'd	87,000	3	May 8 p.m.	34 Beater	Liquid	(1c.c.) 550,000	53
April 14	14	Pow'd	188,000	30	May 8 p.m.	34 Cooler	Liquid	(1c.c.) 275,000	53
April 15	15	Pow'd	53,500	30	May 8 p.m.	34 2d Tank	Liquid	(1c.c.) 1,000,000	50
April 17	15	Pow'd	353,000	30	May 9 a.m.	35 Beater	Liquid	(1c.c.) ?	57
April 17	16	Pow'd	112,000	16	May 9 a.m.	35 Cooler	Liquid	(1c.c.) ?	53
April 19	17	Pow'd	300,000	36	May 9	35	Pow'd	52,000	73
April 19	18	Pow'd	215,000	26	May 10	36	Pow'd	165,000	60
April 21	19	Pow'd	180,000	36	May 10 p.m.	36 Beater	Liquid	(1c.c.) 340,000	76
April 21	20	Pow'd	320,000	33	May 10 p.m.	36 Cooler	Liquid	(1c.c.) 230,000	87
April 24	15	Pow'd	280,000	10	May 11 a.m.	37 Beater	Liquid	(1c.c.) 680,000	77
April 24	21	Pow'd	1,000,000	26	May 11 a.m.	37 Cooler	Liquid	(1c.c.) 2,000,000	20
April 25	22	Pow'd	140,000	5	May 11 p.m.	37 Beater	Liquid	(1c.c.) 3,950,000	89
April 25	Checks	Pow'd	150,000	10	May 11 p.m.	37 Cooler	Liquid	(1c.c.) 2,000,000	68
April 25	1st Tank	Liquid	(1c.c.) 615,000	60	May 11 a.m.	37	Pow'd	125,000	61
April 25	2d Tank	Liquid	(1c.c.) 840,000	43	May 11 p.m.	37	Pow'd	125,000	0
April 25	Pan	Liquid	(1c.c.) 8,500	46	May 12 a.m.	38	Pow'd	750,000	50
April 25	1st Tank 5 p.m.	Liquid	(1c.c.) 530,000	50	May 12 p.m.	38	Pow'd	425,000	60
April 25	1st Tank 9 p.m.	Liquid	(1c.c.) 1,200,000	40	May 12 a.m.	38 Beater	Liquid	(1c.c.) 3,000,000	26
April 25	23	Pow'd	200,000	40	May 12 a.m.	38 Cooler	Liquid	(1c.c.) 600,000	55
April 26	21	Pow'd	570,000	30	May 12 p.m.	38 Beater	Liquid	(1c.c.) 120,000	80
April 26	23	Pow'd	390,000	36	May 12 p.m.	38 Cooler	Liquid	(1c.c.) 2,200,000	58
April 26	24	Pow'd	360,000	33	May 12 p.m.	38 Pan	Liquid	(1c.c.) 13,500	86
April 27	25	Pow'd	650,000	36	May 15	39	Pow'd	290,000	53
April 27	Beater	Liquid	(1c.c.) 2,550,000	55	May 15	40	Pow'd	310,000	50
April 27	Cooler	Liquid	(1c.c.) 8,250,000	47	May 17	41	Pow'd	330,000	66
April 29	26	Pow'd	74,000	26	May 17	42	Pow'd	300,000	70
April 29	27	Pow'd	250,000	33	May 20	43	Pow'd	270,000	63
May 1	28	Pow'd	340,000	33	May 20	44	Pow'd	455,000	70
May 1	28 Beater	Liquid	(1c.c.) 1,000,000	66	May 20	45	Pow'd	300,000	60

TABLE II—CONTINUED—BACTERIAL TESTS DESICCATED EGG FROM APRIL 5 TO JULY 6, 1911.

Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 24 hrs .01 gram Dextrose Broth	Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 24 hrs. .01 gram Lactose Broth
May 24	48 Pan	Liquid	(1c.c.) 3,000	80 lactose bal. of season	June 19	65	Pow'd	215,000	0
					June 19	66	Pow'd	800,000	0
					June 19	67	Pow'd	215,000	0
May 24	48 Beater	Liquid	(1c.c.) ?	82	June 19	68	Pow'd	255,000	20
May 24	48 Cooler	Liquid	(1c.c.) 205,000	80	June 23	69	Pow'd	425,000	0
May 24	48 2d Tank	Liquid	(1c.c.) 275,000	66	June 23	70	Pow'd	145,000	0
May 24	46	Pow'd	300,000	13	June 23	71	Pow'd	185,000	0
May 24	47	Pow'd	300,000	0	June 23	72	Pow'd	70,000	30
May 26	48	Pow'd	130,000	33	June 23	73	Pow'd	265,000	26
May 26	49	Pow'd	500,000	80	June 23	74	Pow'd	900,000	0
May 26	50	Pow'd	445,000	13	June 28	75	Pow'd	300,000	0
May 31	51	Pow'd	425,000	16	June 28	76	Pow'd	230,000	0
May 31	52	Pow'd	390,000	30	June 28	77	Pow'd	130,000	0
May 31	53	Pow'd	800,000	26	June 28	78	Pow'd	250,000	10
June 3	54	Pow'd	400,000	43	June 28	79	Pow'd	75,000	23
June 3	55	Pow'd	445,000	0	June 28	80	Pow'd	510,000	5
June 3	56	Pow'd	800,000	36	July 6	81	Pow'd	20,000	0
June 12	57	Pow'd	60,000	26	July 6	82	Pow'd	285,000	0
June 12	58	Pow'd	150,000	0	July 6	83	Pow'd	60,000	0
June 12	59	Pow'd	37,000	0	July 6	84	Pow'd	75,000	0
June 12	60	Pow'd	65,000	0	July 6	85	Pow'd	50,000	10
June 12	61	Pow'd	93,000	0	July 6	86	Pow'd	85,000	0
June 12	62	Pow'd	350,000	0	July 6	87	Pow'd	255,000	0
June 12	63	Pow'd	260,000	0	July 6	88	Pow'd	390,000	46
June 19	64	Pow'd	275,000	30					

TABLE III—BACTERIAL TESTS DESICCATED EGG FROM MAY 6 TO JULY 3, 1912.

Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per cent gas 48 hrs. .01 gm. lactose broth	Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per cent gas 48 hrs. .01 gm. lactose broth
May 6	90	Pow'd	2,200	0	June 12	34	Pow'd	190,000	50
May 6	91	Pow'd	46,700	22	June 12	35	Pow'd	341,000	49
May 9	92	Pow'd	12,000	52	June 15	36	Pow'd	86,000	44
May 9	93	Pow'd	85,000	15	June 15	37	Pow'd	180,000	0
May 11	94	Pow'd	200,000	46	June 15	38	Pow'd	204,000	47
May 11	94 (sugar)	Pow'd	173,000	40	June 15	39	Pow'd	144,000	47
May 11	95	Pow'd	54,000	0	June 15	Beater	Liquid (1c.c.)	3,000,000	80
May 15	8	Pow'd	35,000	52	June 15	Pipe	Liquid (1c.c.)	3,600,000	77
May 15	9	Pow'd	162,000	59	June 15	1st Tank	Liquid (1c.c.)	2,500,000	64
May 15	10	Pow'd	115,000	58	June 15	2d Tank	Liquid (1c.c.)	2,000,000	77
May 18	11 (sugar)	Pow'd	59,000	20	June 21	40	Pow'd	120,000	0
May 18	12	Pow'd	63,000	54	June 21	41	Pow'd	500,000	50
May 22	13	Pow'd	43,000	53	June 21	42	Pow'd	373,000	50
May 22	14	Pow'd	170,000	58	June 21	43	Pow'd	45,000	60
May 22	15	Pow'd	157,000	27	June 21	44	Pow'd	338,000	45
May 22	16	Pow'd	198,000	45	June 27	45	Pow'd	400,000	0
May 25	17 (sugar)	Pow'd	87,000	11	June 27	46	Pow'd	160,000	22
May 25	18	Pow'd	140,000	37	June 27	47	Pow'd	141,000	22
May 25	19	Pow'd	113,000	35	June 27	48	Pow'd	468,000	0
May 29	20	Pow'd	140,000	31	June 27	49	Pow'd	154,000	0
May 29	21	Pow'd	255,000	43	July 3	50	Pow'd	129,000	0
May 29	22	Pow'd	332,000	48	July 3	51	Pow'd	252,000	0
June 3	23	Pow'd	495,000	36	July 3	52	Pow'd	530,000	0
June 3	24	Pow'd	132,000	44	July 3	53	Pow'd	200,000	0
June 3	25 Current Receipts	Pow'd	94,000	52	July 3	54	Pow'd	336,000	0
June 3	00 Spots	Pow'd	200,000	27	July 3	55	Pow'd	150,000	0
June 5	26 (sugar)	Pow'd	425,000	55	July 3	56	Pow'd	390,000	0
June 5	27	Pow'd	200,000	34	July 3	Spots	Pow'd	1,560,000	15
June 5	28	Pow'd	300,000	47	July 3	Spots Beater	Liquid (1c.c.)	40 to 50,000,000	36
June 8	29	Pow'd	123,000	51	July 3	Spots Pipe	Liquid (1c.c.)	40 to 50,000,000	37
June 8	30	Pow'd	344,000	20	July 3	Spots 1st Tank	Liquid (1c.c.)	40 to 50,000,000	37
June 8	31	Pow'd	39,000	37	July 3	Spots 2d Tank	Liquid (1c.c.)	40 to 50,000,000	36
June 8	32	Pow'd	82,000	20	July 3	Spots (Broken in) Beater	Liquid (1c.c.)	40 to 50,000,000	36
June 12	33	Pow'd	300,000	50					

TABLE IV—BACTERIAL TESTS DESICCATED EGG FROM MAY 7 TO JULY 2, 1913.

Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 48 hrs. .01 gram Lactose Broth (Record of two tubes)		Date	Lot No.	Egg	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 48 hrs. .01 gram Lactose Broth (Record of two tubes)	
May 7	125 first	Pow'd	6,000	45	50	May 29	147 last	Pow'd	255,000	0	48
May 7	125 last	Pow'd	6,700	0	20	May 29	148 first	Pow'd	102,000	0	45
May 7	126 first	Pow'd	5,100	50	60	May 29	148 last	Pow'd	201,000	0	35
May 7	126 last	Pow'd	2,000	0	30	June 2	149 first	Pow'd	130,000	0	0
May 10	127 first	Pow'd	6,000	0	0	June 2	149 last	Pow'd	246,000	30	64
May 10	127 last	Pow'd	12,100	0	0	June 4	153 first	Pow'd	252,000	50	55
May 10	128 first	Pow'd	13,300	50	50	June 4	153 last	Pow'd	552,000	57	66
May 10	128 last	Pow'd	230,500	50	60	June 4	154 first	Pow'd	(24 hrs.) 105,000	50	68
May 10	129 first	Pow'd	95,600	50	50	June 4	154 last	Pow'd	495,000	43	52
May 10	129 last	Pow'd	270,000	0	0	June 6	155 first	Pow'd	410,000	0	54
May 14	130 first	Pow'd	62,000	41	45	June 6	155 last	Pow'd	440,000	41	50
May 14	130 last	Pow'd	185,000	0	20	June 6	156 first	Pow'd	87,000	60	62
May 14	132 first	Pow'd	168,000	40	50	June 6	156 last	Pow'd	250,000	0	35
May 14	132 last	Pow'd	209,000	0	0	June 9	157 first	Pow'd	(24 hrs.) 165,000	0	0
May 16	133 first	Pow'd	284,000	30	30	June 9	157 last	Pow'd	345,000	0	80
May 16	133 last	Pow'd	284,000	32	36	June 9	158 first	Pow'd	445,000	0	0
May 16	134 first	Pow'd	166,000	40	66	June 9	158 last	Pow'd	780,000	0	20
May 16	134 last	Pow'd	290,000	0	25	June 11	160 first	Pow'd	565,000	0	44
May 16	135 first	Pow'd	193,000	0	20	June 11	160 last	Pow'd	655,000	0	0
May 16	135 last	Pow'd	269,000	0	50	June 11	161 first	Pow'd	380,000	0	5
May 21	139 first	Pow'd	27,000	58	58	June 11	161 last	Pow'd	405,000	0	9
May 21	139 last	Pow'd	210,000	40	43	June 13	162 first	Pow'd	390,000	0	0
May 21	140 first	Pow'd	210,000	46	56	June 13	162 last	Pow'd	312,000	0	0
May 21	140 last	Pow'd	337,000	54	56	June 13	163 first	Pow'd	360,000	15	21
May 23	141 first	Pow'd	140,000	50	54	June 13	163 last	Pow'd	450,000	0	17
May 23	141 last	Pow'd	525,000	50	54	June 16	164 first	Pow'd	162,000	0	10
May 23	142 first	Pow'd	252,000	46	46	June 16	164 last	Pow'd	192,000	0	0
May 23	142 last	Pow'd	655,000	50	50	June 16	165 first	Pow'd	126,000	0	8
May 24	136 first	Pow'd	120,000	62	64	June 16	165 last	Pow'd	192,000	9	15
May 24	136 last	Pow'd	130,000	0	0	June 18	167 first	Pow'd	260,000	0	0
May 24	137 first	Pow'd	183,000	69	72	June 18	167 last	Pow'd	275,000	0	23
May 24	137 last	Pow'd	95,000	0	0	June 18	168 first	Pow'd	75,000	0	32
May 24	143 first	Pow'd	182,000	76	76	June 18	168 last	Pow'd	70,000	0	0
May 24	143 last	Pow'd	312,000	54	76	June 21	169 first	Pow'd	180,000	0	30
May 27	144 first	Pow'd	180,000	75	80	June 21	169 last	Pow'd	242,000	0	0
May 27	144 last	Pow'd	360,000	0	60	June 21	170 first	Pow'd	56,000	33	40
May 27	146 first	Pow'd	261,000	70	75	June 21	170 last	Pow'd	50,000	0	0
May 27	146 last	Pow'd	445,000	46	50	June 21	171 first	Pow'd	45,000	0	0
May 29	147 first	Pow'd	153,000	48	62	June 21	171 last	Pow'd	250,000	0	0

June	23	172	first	Pow'd	395,000	6	26	June	28	178	first	Pow'd	260,000	0	30
June	23	172	last	Pow'd	365,000	15	24	June	28	178	last	Pow'd	170,000	0	15
June	25	174	first	Pow'd	125,000	0	0	June	28	179	first	Pow'd	125,000	9	30
June	25	174	last	Pow'd	330,000	0	0	June	28	179	last	Pow'd	200,000	0	0
June	25	175	first	Pow'd	230,000	16	28	July	2	181	first	Pow'd	55,000	0	0
June	25	175	last	Pow'd	395,000	0	0	July	2	181	last	Pow'd	70,000	0	0
June	28	176	first	Pow'd	200,000	0	28	July	2	182	first	Pow'd	485,000	0	15
June	28	176	last	Pow'd	295,000	0	13	July	2	182	last	Pow'd	540,000	40	40
June	28	177	first	Pow'd	55,000	0	0	July	2	183	first	Pow'd	265,000	30	44
June	28	177	last	Pow'd	120,000	0	5	July	2	183	last	Pow'd	560,000	12	12

TABLE V—BACTERIAL TESTS DESICCATED EGG AT INTERVALS; 1912 PRODUCT.

Date of Test	Lot No.	Days Storage	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 48 hrs. .01 gm Lactose Broth	Per Cent Decrease in No. Colonies	Date of Test	Lot No.	Days Storage	No. Colonies per gram 48 hrs. at 37° C.	Per Cent Gas 48 hrs. .01 gm Lactose Broth	Per cent Decrease in No. Colonies
Aug. 7, '12	90	90	300	0	86.36	Feb. 18, '13	19	264	1,800	0	98.40
Jan. 15, '13	90	249	200	0	90.91	Aug. 13, '12	20	74	11,200	0	92.00
Dec. 8, '13	90	575	50	0	97.72	Jan. 21, '13	20	235	2,600	0	98.14
Aug. 7, '12	91	90	2,800	0	94.02	Aug. 13, '12	21	74	6,600	0	93.49
Jan. 15, '13	91	249	1,600	0	96.57	Feb. 18, '13	21	263	1,400	0	99.51
Aug. 7, '12	92	87	650	0	94.58	Aug. 13, '12	22	74	17,400	0	94.75
Jan. 15, '13	92	246	500	0	95.83	Feb. 18, '13	22	263	3,200	0	99.03
Aug. 7, '12	93	87	17,200	0	79.76	Sept. 14, '12	23	102	42,600	0	91.39
Jan. 15, '13	93	246	2,700	0	96.82	Mar. 7, '13	23	276	26,500	0	94.64
Aug. 7, '12	94	85	30,200	0	84.90	Sept. 14, '12	24	102	14,200	0	89.24
Jan. 15, '13	94	244	?	0	?	Mar. 7, '13	24	276	8,200	0	93.78
Dec. 8, '13	94	570	0	0	100.	Sept. 14, '12	25	102	2,000	0	97.86
Aug. 7, '12	94 (sugar)	85	21,800	0	87.97	Mar. 7, '13	25	276	700	0	99.24
Jan. 15, '13	94	244	5,200	0	97.	Sept. 14, '12	26	99	37,800	0	91.10
Aug. 7, '12	95	85	11,400	0	78.88	Mar. 7, '13	26	274	12,000	0	97.17
Jan. 15, '13	95	244	2,300	0	95.14	Sept. 14, '12	27	99	11,600	0	94.20
Aug. 7, '12	8	81	5,200	0	85.14	Mar. 7, '13	27	274	8,500	0	95.75
Jan. 15, '13	8	240	800	0	97.71	Sept. 14, '12	28	90	48,000	0	84.00
Aug. 7, '12	9	81	102,600	44	36.67	Mar. 7, '13	28	274	17,000	0	94.33
Jan. 15, '13	9	240	?	0	?	Sept. 14, '12	29	96	42,000	0	65.85
Aug. 7, '12	10	81	21,000	0	81.73	Mar. 7, '13	29	271	15,000	0	87.80
Feb. 18, '13	10	275	6,000	0	94.78	Sept. 14, '12	30	96	7,800	0	97.73
Aug. 13, '12	11	86	7,000	0	88.13	Mar. 7, '13	30	271	3,000	0	99.12
Feb. 18, '13	11	272	5,000	0	91.61	Sept. 14, '12	31	96	1,200	0	96.92
Aug. 13, '12	12	86	4,600	0	92.70	Mar. 7, '13	31	271	450	0	98.84
Jan. 21, '13	12	244	2,000	0	96.82	Dec. 8, '13	31	557	0	0	100.
Aug. 13, '12	13	81	11,200	0	73.95	Sept. 14, '12	32	96	7,000	0	91.46
Jan. 21, '13	13	240	4,500	0	87.20	Mar. 7, '13	32	271	2,200	0	97.31
Aug. 13, '12	14	81	26,800	0	81.23	Sept. 14, '12	00	102	9,000	0	95.50
Jan. 21, '13	14	240	1,400	0	99.17	Jan. 15, '13	00	280	?	0	?
Aug. 13, '12	15	81	5,600	0	96.43	June 30, '13	00	396	3,850	0	98.75
Feb. 18, '13	15	267	900	0	99.42	Sept. 23, '12	33	102	12,400	0	95.56
Aug. 13, '12	16	81	28,600	0	85.55	Apr. 14, '13	33	304	8,800	0	97.06
Feb. 18, '13	16	267	2,800	0	98.57	Sept. 13, '12	34	102	11,600	0	93.89
Aug. 13, '12	17	78	8,600	0	89.90	Apr. 14, '13	34	304	9,500	0	95.00
Jan. 21, '13	17	238	2,500	0	97.12	Sept. 23, '12	35	102	5,400	0	98.41
Aug. 13, '12	18	78	800	0	99.42	Apr. 14, '13	35	304	5,100	0	98.50
Feb. 18, '13	18	264	500	0	99.64	Sept. 23, '12	36	99	2,400	0	97.21
Aug. 13, '12	19	78	5,400	0	95.22	Apr. 14, '13	36	301	6,200	0	69.53

Sept. 23, '12	37	99	100	0	99.94	June 30, '13	46	368	3,000	0	98.12
Apr. 14, '13	37	301	100	0	99.94	Jan. 13, '13	47	197	14,200	0	89.92
Sept. 23, '12	38	99	5,000	0	97.54	June 30, '13	47	368	3,700	0	97.20
Apr. 14, '13	38	301	1,650	0	99.15	Jan. 13, '13	48	197	12,600	0	97.30
Sept. 23, '12	39	99	14,200	0	90.13	June 30, '13	48	368	11,000	0	97.67
Apr. 14, '13	39	301	13,100	0	90.90	Jan. 13, '13	49	197	700	0	99.54
Sept. 23, '12	40	93	800	0	99.83	June 30, '13	49	368	300	0	99.80
Apr. 14, '13	40	295	2,100	0	98.25	Jan. 13, '13	50	190	6,300	0	95.11
Sept. 23, '12	41	93	60,000	0	88.00	Jan. 13, '13	51	190	8,200	0	96.74
Apr. 14, '13	41	295	43,200	0	91.36	Jan. 13, '13	52	190	11,600	44	97.81
Sept. 23, '12	42	93	27,600	0	92.76	June 30, '13	52	361	5,300	0	99.00
Apr. 14, '13	42	295	23,300	0	93.91	Jan. 13, '13	53	190	6,800	0	96.60
Sept. 23, '12	43	93	400	0	99.11	June 30, '13	53	361	4,700	12	97.65
Apr. 14, '13	43	295	1,400	0	96.87	Jan. 13, '13	54	190	4,900	0	98.54
Sept. 23, '12	44	93	49,200	0	85.45	June 30, '13	54	361	3,800	0	98.86
Apr. 14, '13	44	295	5,300	0	98.43	Jan. 13, '13	55	190	5,100	0	96.60
June 30, '13	44	374	10,000	0	97.04	June 30, '13	55	361	2,000	10	98.66
Jan. 13, '13	45	197	2,400	0	99.40	Jan. 13, '13	56	190	11,200	0	97.12
June 30, '13	45	368	4,000	0	99.00	June 30, '13	56	361	9,400	0	97.59
Jan. 13, '13	46	197	6,500	0	95.93						

TABLE VI—BACTERIAL TESTS DESICCATED EGG AT INTERVALS; 1913 PRODUCT.

Date 1913	Lot No.	Days Storage			No. Col. per gram 48 hrs. at 37° C.	Per Cent Decrease No. Col.	Per Ct. Gas 48 hrs. .01 gram Lact'se Broth	Date 1913	Lot No.	Days Storage			No. Col. per gram 48 hrs. at 37° C.	Per Cent Decrease No. Col.	Per Ct. Gas 48 hrs. .01 gram Lact'se Broth
		Lab. Temp.	19° C.	35° C.						Lab. Temp.	19° C.	35° C.			
Aug. 22	137 last---	28	60	0	600	99.07	0	Oct. 22	164 first--	9	0	112	0	100.00	0
Aug. 22	137 last---	28	0	60	0	100.00	0	Oct. 22	164 last---	9	0	112	0	100.00	0
Aug. 22	144 last---	25	60	0	2,800	99.22	0	Oct. 22	165 first--	6	0	112	0	100.00	0
Aug. 22	144 last---	25	0	60	50	99.98	0	Oct. 22	169 first--	0	0	112	0	100.00	0
Aug. 22	146 first--	25	67	0	15,000	94.25	0	Oct. 22	170 last---	0	0	112	50	99.90	0
Aug. 22	146 first--	25	0	60	1,700	99.38	0	Oct. 22	171 last---	0	0	112	50	99.98	0
Oct. 10	147 last---	23	0	100	0	100.00	0	Oct. 22	172 last---	0	0	112	400	99.89	37
Oct. 10	148 last---	23	0	100	0	100.00	0	Oct. 22	175 first--	0	0	109	50	99.90	0
Oct. 10	153 last---	18	0	100	0	100.00	0	Dec. 8	137 last---	28	0	156	0	100.00	0
Oct. 10	155 first--	16	0	100	100	99.97	0	Dec. 8	144 first--	25	0	156	0	100.00	0
Oct. 10	156 first--	16	0	100	100	99.88	0	Dec. 8	146 first--	25	0	156	0	100.00	0
Oct. 10	156 last---	13	0	100	200	99.92	0	Dec. 8	147 last---	23	0	156	50	99.98	0
Oct. 10	157 first--	13	0	100	100	99.93	0	Dec. 8	153 last---	18	0	156	0	100.00	0
Oct. 10	157 last---	13	0	100	50	99.98	0	Dec. 8	155 first--	16	0	156	100	99.97	0
Oct. 10	158 last---	13	0	100	100	99.98	0	Dec. 8	156 last---	13	0	156	0	100.00	0
Oct. 10	161 first--	11	0	100	200	99.94	0	Dec. 8	157 first--	13	0	156	0	100.00	0
Oct. 22	162 first--	9	0	112	100	99.97	0	Dec. 8	175 last---	0	0	153	0	100.00	0
Oct. 22	163 last---	9	0	112	200	99.95	0								

TABLE VII.

LIQUID WHITE 1910 PRODUCT.			LIQUID YOLK 1910 PRODUCT.		
No. Colonies Per c. c.	Number of Samples	Per Cent of Total	No. Colonies Per c. c.	Number of Samples	Per Cent of Total
To 10,000	12	15.78	To 10,000	6	9.09
10,000 to 50,000	10	13.15	10,000 to 50,000	7	10.60
50,000 to 100,000	12	15.78	50,000 to 100,000	7	10.60
100,000 to 500,000	31	40.78	100,000 to 500,000	44	66.66
500,000 to 1,000,000	9	11.84	500,000 to 1,000,000	0	0
1,000,000 to 7,000,000	2	2.63	1,000,000 to 7,000,000	2	3.03
	76	99.96		66	99.98

DESICCATED EGG PRODUCT OF

No. Colonies per gram	1911		1912		1913	
	Number of Samples	Per Cent of Total	Number of Samples	Per Cent of Total	Number of Samples	Per Cent of Total
To 10,000	0	0	1	1.78	5	5.10
10,000 to 50,000	7	7.44	6	10.71	5	5.10
50,000 to 100,000	15	15.91	8	14.28	10	10.20
100,000 to 500,000	63	67.02	40	71.42	70	71.42
500,000 to 1,000,000	9	9.57	1	1.78	8	8.16
	94	99.94	56	99.97	98	99.98

SUMMARY OF DESICCATED PRODUCT.

No. Colonies per gram	Number of Samples	Per Cent of Total
To 10,000	6	2.41
10,000 to 50,000	18	7.25
50,000 to 100,000	33	13.30
100,000 to 500,000	173	69.75
500,000 to 1,000,000	18	7.25
	248	99.96

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