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CLASSIFICATION OF GRADING EGGS ON PRODUCTION PROCESSES USING SHEWHART CONTROL CHARTS

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Abstract- Classification of post production objects are most preferable measure in the market while purchasing products and it helps consumers to get a right value for right product based on their acceptance. Product grading into different sizes is one of the safety measures of the products in transporting, marketing, handling and storing objects. The economic value of a post harvesting depends on the safety measures of handling the production processes. They are packed and transporting from one place to another place for marketing lead to heavy losses. In these situations grading the sizes of the products help to reduces the losses of the products and also keeps the quality of the products. In this paper, illustrates the production process of eggs based on quality and its sizes in an effective methodology through the use quality control charts into different grade sizes of post harvesting .

Keywords: Process shits, control charts, outliers, six sigma.

I. INTRODUCTION

Even heavily affected country Japan in the Second World War led to produce more reliable products than those of USA and Western group. From then to till now Japan has utilized the scientific quality control can through more light on an issue than a committee of experts for making decisions on production processes. Montgomery(2009) has illustrates that quality control chart method for designing production process to increase the product usually in the range of 10% to 100% without further investigation. This is an important methodology in the modern world to build the global industrialization changes for reducing the losses in the post harvesting products.

Product grading into different sizes is one of the safety measures of products in transporting, making as well as reduction of losses. Classification of grade sizes are most preferable measure in the market while purchasing products and it helps consumers to get a right value for right product based on their acceptance.

Quality is one of the most important consumer acceptance factor in the selection among the competing products. Understanding and improving quality is a key factor leading to business success, growth and an empowerment enhanced position. Hence grading products lead to quality improvement which is an integral part of the overall business strategy. The appropriate way to save the equality of the product is sorting the product into homogenous sizes.

Statistical process control is widely accepted for analyzing quality problems and improving the performance of the production processes. It has been developed by Dr. Walter A. Shewhart (1924) of the Bell laboratories. The control charts have found favor with practitioners to monitoring the large process shift. These charts are still popular because they are easier and simpler techniques. The control chart is an online process monitoring techniques widely used for the occurrence of assignable causes of process shifts. The chart contains a center line that represents the average value of the quality characteristics corresponding to in control state. Two other horizontal lines are called upper control limit and lower control limits. These control limits are chosen so that if the process is in control, all of the sample points will fall between them. Any one sample point falls outside the limits, then the production process is an out of control.

Several new control charts have been proposed by many researchers. They are a good alternative when the production process have different types of process shifts. Some of them are CUSUM , EWMA control charts , Semi - circle control chart for variable data, Multivariate semi-control chart for multivariate data and so on. Patel (1954) has studied CUSUM control charts for variable data. CUSUM has included the cumulative effective of monitoring the processes. Cox (2010) has constructed a numerical method for modeling the parameters λ and δ of a EWMA control charts. Sivasamy et.al (2000) have developed control chart for markov dependent sample sizes in which an optimum way is to detect all types processes shifts (large, moderate and small) by taking both the small and large samples under a switching rule of markov dependent sample method. Chao et.al (2008) have presented on 2D (two-dimension) control charts. The control charts are constructed using location and variability methods simultaneously. Patel (1993) have proposed a multivariate semi circle control charts for variable data deals an alternative single variable control chart for multivariate date.

II. SORTING PROCEDURE OF POST HARVESTING PRODUCTS

Shewhart control chart performs well for normal numerical data. The production processes are under normal, and then there is approximately 0.0027 likelihood of an observation exceeding 3σ control limits. This 3σ control chart limits indicate that false alarm occurs on average once every 1/0.0027 or 370.4 observations. Thus production process is incontrol, the average run length of the Shewhart control chart is 370.4 observations. If chance causes were present in the production processes, the probability of a observation falling either above or below would be out of a thousand. It means that the expectation of risk of looking for assignable causes is positive variation. But the risk of searching for an assignable cause of negative variation will be reduced additive and homogenous conditions.

In quality control chart 2σ specification limits and 3σ upper control limits are,

$$\text{Upper control limit (UCL)} = \overline{\overline{X}} + A_2 \overline{R}$$

$$\text{Lower control limit(LCL)} = \overline{\overline{X}} - A_2 \overline{R}$$

where $\overline{\overline{X}} = \frac{\sum \overline{X}_i}{n}$, where $\overline{X}_i$ is the average of i[th]sample with subgroup size n. Subgroup size can be n=2,3,4,..

$$\text{Upper Specification Limit (USL)} = \overline{\overline{X}} + 2\frac{\sigma}{\sqrt{n}}$$

$$\text{Lower Specification Limit (LSL)} = \overline{\overline{X}} - 2\frac{\sigma}{\sqrt{n}}$$

Eggs are sorted into three groups such as small, medium and large based on 0 to CL($\overline{\overline{X}}$), CL to USL, and USL to UCL respectively. After predicting the small, medium and large grading size ranges,

For the construction of control charts, 100 eggs have been considered. The control charts present graphic display of process stability or instability over time. The important reason for using control chart is to get the process stability. Process stability is the state on which a process has displayed a certain degree of consistency in the past and is expected to continue to do so in the future.

The grading sizes on the production processes are based on the reduced risk of Shewhart Control charts. They are small, medium and large. Small grade size of the object is chosen as small chance of observations falling in the interval LCL to LSL with low risk probability 99.73 %. Medium grade size is selected with probability of an observation falling in the interval LSL to USL is slightly high risk probability 95.45% as compared to extreme tails of small grade size and large grade size . Large grade is sorted as the interval USL to UCL of low risk of probability 99.73% . Table 1 shows the sorted governing principles of Shewhart control charts .

Table 1. Sorted governing principles of Shewhart control chart

Grade size Under Normal Assumption	**Range**	**Number of Items**
Small (In extreme left an observation falls out side 2σ limit)	LCL to LSL	N_1
Medium (In middle part an observation falls out side either above or below 2σ limits)	LSL to USL	N_2
Large (In extreme right an observation falls out side 2σ limit)	USL to UCL	N_3
Total	-	N

III. ENGINEERING PROPERTY OF EGG

The grading sizes of eggs are illustrated for considering eggs procured from open market of Salem. The geometry of the eggs are taken manually using Vernier Caliper. The geometry of the egg major and minor axes, weight, surface area and volume are measured.

Two dimensional shape of an egg is drawn by joining two ellipses at their minor axes. The eggs equatorial radius (a cm) short polar radius (b cm) and long polar radius (c cm) are known, then the surface area and volume of the eggs are calculated based on the formula.

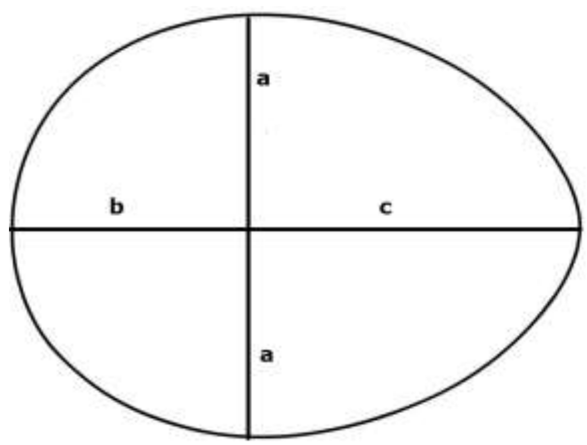

Figure .1 Specimen Egg showing major and minor axes

i.e., Surface Area = $2\pi a^2 + \pi a\left(\frac{b^2}{\sqrt{b^2-a^2}}\cos^{-1}\left(\frac{a}{b}\right)+\frac{c^2}{\sqrt{c^2-a^2}}\cos^{-1}\left(\frac{a}{c}\right)\right)$ Squared Units

Similarly, the volume of the eggs are found by the formula,

i.e., Volume of the Egg = $\frac{2\pi}{3}a^2(b+c)$ Cubic Units.

The weight, surface area and volume of the eggs are given in Table 2

Table. 2 Engineering properties weight, surface area and volume of the Eggs

S. No	a	b	C	Weight (gms)	Surface Area (cm^2)	Volume (cm^3)
1	2.20	2.5	3.3	63.14	74.17	58.79
2	2.60	2.7	3.6	58.42	97.30	89.20
3	2.30	2.7	3.2	59.54	79.36	65.37
4	2.15	2.4	3.7	60.77	75.06	59.06
5	2.15	2.6	3.1	57.25	71.09	55.18
6	2.10	2.5	3.4	57.29	70.97	54.49
7	2.15	2.4	3.4	58.25	72.13	56.15
8	2.15	2.6	3.4	61.37	73.98	58.09
9	2.25	2.6	3.5	62.11	79.26	64.68
10	2.15	2,7	3.2	58.74	72.99	57.12
11	2.05	2.5	3.2	54.22	67.06	50.17
12	2.10	2.2	3.1	52.48	65.44	48.95
13	2.25	2.5	3.5	66.62	78.30	63.62
14	2.10	2.3	3.2	54.24	67.28	50.80
15	2.20	2.4	3.3	59.54	73.23	57.78
16	2.05	2.2	3.5	53.33	67.20	50.17
17	2.25	2.6	3.8	64.54	82.31	67.86
18	2.20	2.5	3.4	61.74	75.16	59.81
19	2.25	2.4	3.5	56.51	77.34	62.56
20	2.15	2.3	3.7	61.89	74.14	58.09
21	2.10	2.5	3.4	56.52	70.97	54.49
22	2.10	2.4	3.1	51.72	67.23	50.80
23	2.30	2.4	3.4	67.24	78.46	64.26
24	2.25	2.3	3.3	62.11	74.37	59.38
25	2.25	2.3	3.6	62.13	77.40	62.56
26	2.25	2.6	3.5	55.65	79.26	64.68
27	2.10	2.4	3.1	52.33	67.23	50.80
28	2.25	2.6	3.2	60.85	76.24	61.50
29	2.20	2.5	3.3	60.39	74.17	58.79
30	2.15	2.5	3.6	62.12	75.00	59.06
31	2.15	2.6	3.2	58.54	72.05	56.15
32	2.10	2.4	3.4	56.47	70.07	53.57
33	2.25	2.7	3.3	66.76	78.21	63.62
34	2.10	2.4	3.4	54.54	70.07	53.57
35	2.15	2.3	3.4	56.44	71.21	55.18
36	2.20	2.3	3.4	61.57	73.28	57.78
37	2.10	2.2	3.4	51.55	68.28	51.72
38	2.15	2.4	3.3	56.28	71.16	55.18
39	2.10	2.2	3.5	53.84	69.23	52.65
40	2.35	2.5	3.6	62.24	83.71	70.55
41	2.20	2.4	3.2	59.56	72.25	56.77
42	2.10	2.5	3.1	62.36	68.14	51.72
43	2.05	2.5	3.2	52.67	67.06	50.17
44	2.15	2.6	3.2	58.17	72.05	56.15
45	2.25	2.6	3.2	62.08	76.24	61.50

46	2.20	2.7	3.2	62.11	75.09	59.81
47	2.15	2.7	3.2	57.07	72.99	57.12
48	2.15	2.5	3.0	55.72	69.21	53.25
49	2.20	2.3	3.2	58.76	71.31	55.75
50	2.15	2.7	3.4	62.12	74.92	59.06
51	2.15	2.6	3.3	57.97	73.02	57.12
52	2.15	2.6	3.1	57.45	71.09	55.18
53	2.10	2.4	3.1	55.84	67.23	50.80
54	2.15	2.7	3.6	61.12	76.87	60.99
55	2.10	2.3	3.2	56.24	67.28	50.80
56	2.10	2.4	3.0	53.14	66.30	49.88
57	2.30	2.7	3.1	62.12	78.34	64.26
58	2.20	2.6	3.2	60.14	74.13	58.79
59	2.15	2.7	3.1	58.52	72.03	56.15
60	2.15	2.5	3.5	62.11	74.03	58.09
61	2.25	2.3	3.4	62.09	75.37	60.44
62	2.20	2.7	3.0	58.45	73.13	57.78
63	2.20	2.9	3.4	65.21	78.98	63.86
64	2.10	2.7	3.2	55.64	70.91	54.49
65	2.20	2.3	3.6	61.99	75.27	59.81
66	2.25	2.5	3.1	61.47	74.28	59.38
67	2.25	2.6	3.5	65.50	79.26	64.68
68	2.05	2.2	3.3	50.50	65.34	48.41
69	2.20	2.6	3.4	62.12	76.11	60.82
70	2.00	2.2	3.1	56.48	61.57	44.40
71	2.20	2.5	3.5	63.70	76.15	60.82
72	2.05	2.2	3.1	55.62	63.50	46.65
73	2.25	2.6	3.5	65.43	79.26	44.68
74	2.15	2.5	2.9	56.37	68.25	52.28
75	2.15	2.5	3.3	58.13	72.09	55.15
76	2.35	2.6	3.2	68.07	80.52	67.08
77	2.15	2.6	3.1	56.46	71.09	55.18
78	2.15	2.8	3.4	60.87	75.86	60.02
79	2.00	2.4	2.9	54.12	61.50	44.40
80	2.20	2.7	3.1	56.45	74.11	58.79
81	2.10	2.5	3.1	54.17	68.14	51.72
82	2.20	2.7	3.1	59.32	74.14	58.79
83	2.10	2.6	3.2	57.30	69.99	53.57
84	2.15	2.7	3.3	62.12	73.95	58.09
85	2.15	2.6	3.5	62.11	74.96	59.06
86	2.05	2.5	3.3	52.76	67.99	51.05
87	2.10	2.4	3.2	55.62	68.17	51.72
88	2.20	2.8	3.3	62.11	77.03	61.83
89	2.25	2.8	3.3	64.00	79.19	64.68
90	2.10	2.5	3.1	55.92	68.14	51.72
91	2.10	2.7	3.1	59.15	69.97	53.57
92	2.30	2.8	3.6	64.34	84.47	70.91
93	2.25	2.7	3.3	63.58	78.21	63.62

94	2.20	2.6	3.5	65.69	77.10	61.83
95	2.30	2.6	3.2	65.60	78.37	64.26
96	2.10	2.5	3.1	55.62	68.14	51.72
97	2.20	3.0	3.2	62.48	77.98	62.85
98	2.15	2.4	3.2	56.29	70.20	54.22
99	2.05	2.4	3.2	50.86	66.17	49.25
100	2.00	2.5	3.1	55.84	64.16	46.91

IV. CONSTRUCTION OF CONTROL CHARTS

Table 3. Upper and Lower control limits of Average Egg weight

Sample No	X1	X2	X3	X4	X-bar	CL	UCL	USL	LSL	LCL	Range
1	61.34	58.42	59.54	60.77	60.02	59.04	65.54	62.52	55.56	52.55	2.92
2	57.25	57.29	58.25	61.37	58.54	59.04	65.54	62.52	55.56	52.55	4.12
3	62.11	58.74	54.22	52.48	56.89	59.04	65.54	62.52	55.56	52.55	9.63
4	66.62	54.24	59.54	53.33	58.43	59.04	65.54	62.52	55.56	52.55	13.29
5	64.54	61.74	56.51	61.89	61.17	59.04	65.54	62.52	55.56	52.55	8.03
6	56.52	51.72	67.24	62.11	59.40	59.04	65.54	62.52	55.56	52.55	15.52
7	62.13	55.65	52.33	60.85	57.74	59.04	65.54	62.52	55.56	52.55	9.80
8	60.39	62.12	58.54	56.47	59.38	59.04	65.54	62.52	55.56	52.55	5.65
9	66.76	54.54	56.44	61.57	59.83	59.04	65.54	62.52	55.56	52.55	12.22
10	51.55	56.28	53.84	62.24	55.98	59.04	65.54	62.52	55.56	52.55	10.69
11	59.56	62.36	52.67	58.17	58.19	59.04	65.54	62.52	55.56	52.55	9.69
12	62.08	62.11	57.07	55.72	59.25	59.04	65.54	62.52	55.56	52.55	6.39
13	58.76	62.12	57.97	57.45	59.08	59.04	65.54	62.52	55.56	52.55	4.67
14	55.84	61.12	56.24	53.14	56.59	59.04	65.54	62.52	55.56	52.55	7.98
15	62.12	60.14	58.52	62.11	60.72	59.04	65.54	62.52	55.56	52.55	3.60
16	62.09	58.45	65.21	55.64	60.35	59.04	65.54	62.52	55.56	52.55	9.57
17	61.99	61.47	65.50	50.50	59.87	59.04	65.54	62.52	55.56	52.55	15.00
18	62.12	56.48	63.70	55.62	59.48	59.04	65.54	62.52	55.56	52.55	8.08
19	65.43	56.37	58.13	68.07	62.00	59.04	65.54	62.52	55.56	52.55	11.70
20	56.46	60.87	54.12	56.45	56.98	59.04	65.54	62.52	55.56	52.55	6.75
21	54.17	59.32	57.30	62.12	58.23	59.04	65.54	62.52	55.56	52.55	7.95
22	62.11	52.76	55.62	62.11	58.15	59.04	65.54	62.52	55.56	52.55	9.35
23	64.00	55.92	59.15	64.34	60.85	59.04	65.54	62.52	55.56	52.55	8.42
24	63.58	65.69	65.60	55.62	62.62	59.04	65.54	62.52	55.56	52.55	10.07
25	62.48	56.29	50.86	55.84	56.37	59.04	65.54	62.52	55.56	52.55	11.62
					SD =	1.74				R bar	8.91

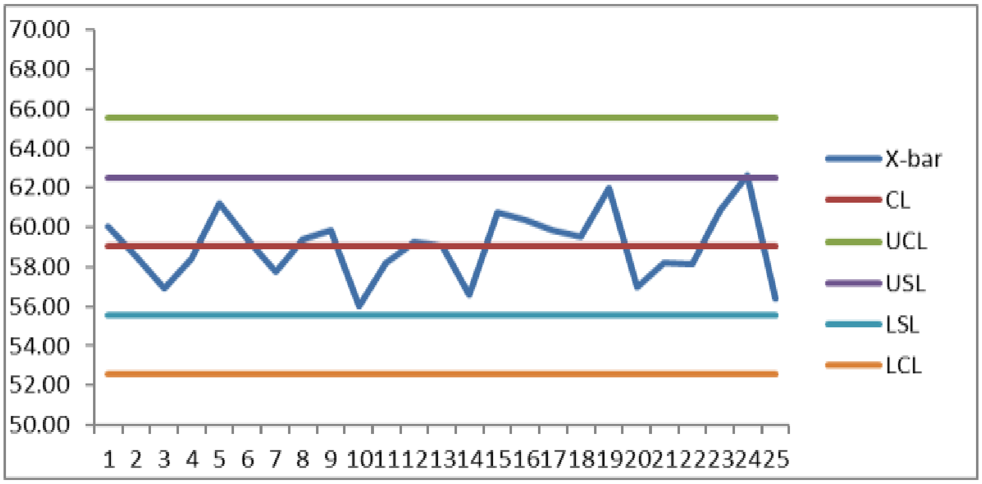

Figure 2. Average Egg Weight control chart

Table 4. Upper and Lower control limits of Average Egg Surface

Sample No	X1	X2	X3	X4	X-bar	CL	UCL	USL	LSL	LCL	Range
1	74.17	97.30	79.36	75.06	81.47	73.10	80.76	78.55	67.65	65.44	23.13
2	71.09	70.97	72.13	73.98	72.04	73.10	80.76	78.55	67.65	65.44	3.01
3	79.26	72.99	67.06	65.44	71.19	73.10	80.76	78.55	67.65	65.44	13.82
4	78.30	67.28	73.23	67.20	71.50	73.10	80.76	78.55	67.65	65.44	11.10
5	82.31	75.16	77.34	74.14	77.24	73.10	80.76	78.55	67.65	65.44	8.17
6	70.97	67.23	78.46	74.37	72.76	73.10	80.76	78.55	67.65	65.44	11.23
7	77.40	79.26	67.23	76.24	75.03	73.10	80.76	78.55	67.65	65.44	12.03
8	74.17	75.00	72.05	70.07	72.82	73.10	80.76	78.55	67.65	65.44	4.93
9	78.21	70.07	71.21	73.28	73.19	73.10	80.76	78.55	67.65	65.44	8.14
10	68.28	71.16	69.23	83.71	73.10	73.10	80.76	78.55	67.65	65.44	15.43
11	72.25	68.14	67.06	72.05	69.88	73.10	80.76	78.55	67.65	65.44	5.19
12	76.24	75.09	72.99	69.21	73.38	73.10	80.76	78.55	67.65	65.44	7.03
13	71.31	74.92	73.02	71.09	72.59	73.10	80.76	78.55	67.65	65.44	3.83
14	67.23	76.87	67.28	66.30	69.42	73.10	80.76	78.55	67.65	65.44	10.57
15	78.34	74.13	72.03	74.03	74.63	73.10	80.76	78.55	67.65	65.44	6.31
16	75.37	73.13	78.98	70.91	74.60	73.10	80.76	78.55	67.65	65.44	8.07
17	75.27	74.28	79.26	65.34	73.54	73.10	80.76	78.55	67.65	65.44	13.92
18	76.11	61.57	76.15	63.50	69.33	73.10	80.76	78.55	67.65	65.44	14.58
19	79.26	68.25	72.09	80.52	75.03	73.10	80.76	78.55	67.65	65.44	12.27
20	71.09	75.86	61.50	74.11	70.64	73.10	80.76	78.55	67.65	65.44	14.36
21	68.14	74.14	69.99	73.95	71.56	73.10	80.76	78.55	67.65	65.44	6.00
22	74.96	67.99	68.17	77.03	72.04	73.10	80.76	78.55	67.65	65.44	9.04
23	79.19	68.14	69.97	84.47	75.44	73.10	80.76	78.55	67.65	65.44	16.33
24	78.21	77.10	78.37	68.14	75.46	73.10	80.76	78.55	67.65	65.44	10.23
25	77.98	70.20	66.17	64.16	69.63	73.10	80.76	78.55	67.65	65.44	13.82
				SD =	2.72					R bar	10.50

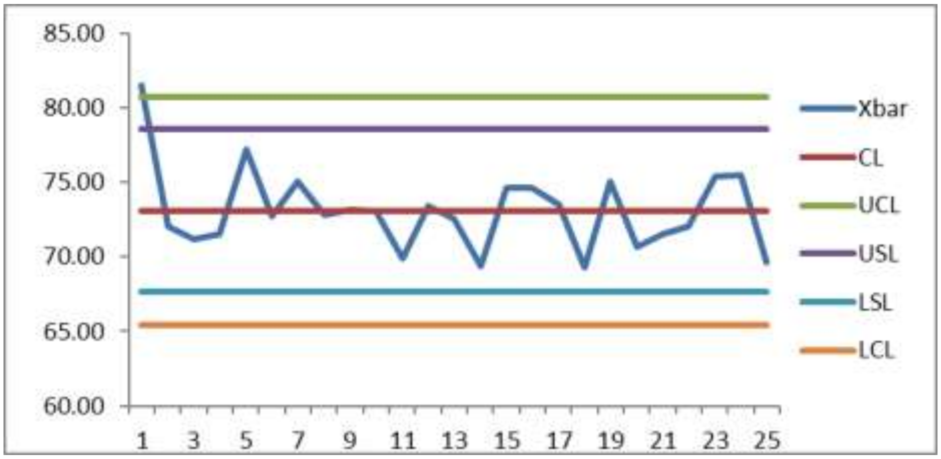

Figure 3: Average Egg Surface area control chart

Table 5. Upper and Lower control limits of Average Egg Volume

Sample No	X1	X2	X3	X4	X-bar	CL	UCL	USL	LSL	LCL	Range
1	58.79	89.20	65.37	59.06	68.11	57.48	66.54	64.10	50.86	48.42	30.41
2	55.18	54.49	56.15	58.09	55.98	57.48	66.54	64.10	50.86	48.42	3.60
3	64.68	57.12	50.17	48.95	55.23	57.48	66.54	64.10	50.86	48.42	15.73
4	63.62	50.80	57.78	50.17	55.59	57.48	66.54	64.10	50.86	48.42	13.45
5	67.86	59.81	62.56	58.09	62.08	57.48	66.54	64.10	50.86	48.42	9.77
6	54.49	50.80	64.26	59.38	57.23	57.48	66.54	64.10	50.86	48.42	13.46
7	62.56	64.68	50.80	61.50	59.89	57.48	66.54	64.10	50.86	48.42	13.88
8	58.79	59.06	56.15	53.57	56.89	57.48	66.54	64.10	50.86	48.42	5.49
9	63.62	53.57	55.18	57.78	57.54	57.48	66.54	64.10	50.86	48.42	10.05
10	51.72	55.18	52.65	70.55	57.53	57.48	66.54	64.10	50.86	48.42	18.83
11	56.77	51.72	50.17	56.15	53.70	57.48	66.54	64.10	50.86	48.42	6.60
12	61.50	59.81	57.12	53.25	57.92	57.48	66.54	64.10	50.86	48.42	8.25
13	55.75	59.06	57.12	55.18	56.78	57.48	66.54	64.10	50.86	48.42	3.88
14	50.80	60.99	50.80	49.88	53.12	57.48	66.54	64.10	50.86	48.42	11.11
15	64.26	58.79	56.15	58.09	59.32	57.48	66.54	64.10	50.86	48.42	8.11
16	60.44	57.78	63.86	54.49	59.14	57.48	66.54	64.10	50.86	48.42	9.37
17	59.81	59.38	64.68	48.41	58.07	57.48	66.54	64.10	50.86	48.42	16.27
18	60.82	44.40	60.82	46.65	53.17	57.48	66.54	64.10	50.86	48.42	16.42
19	64.68	52.28	55.15	67.08	59.80	57.48	66.54	64.10	50.86	48.42	14.80
20	55.18	60.02	44.40	58.79	54.60	57.48	66.54	64.10	50.86	48.42	15.62
21	51.72	58.79	53.57	58.09	55.54	57.48	66.54	64.10	50.86	48.42	7.07
22	59.06	51.05	51.72	61.83	55.92	57.48	66.54	64.10	50.86	48.42	10.78
23	64.68	51.72	53.57	70.91	60.22	57.48	66.54	64.10	50.86	48.42	19.19
24	63.62	61.83	64.26	51.72	60.36	57.48	66.54	64.10	50.86	48.42	12.54
25	62.85	54.22	49.25	46.91	53.31	57.48	66.54	64.10	50.86	48.42	15.94
				SD =	3.31					R bar	12.42

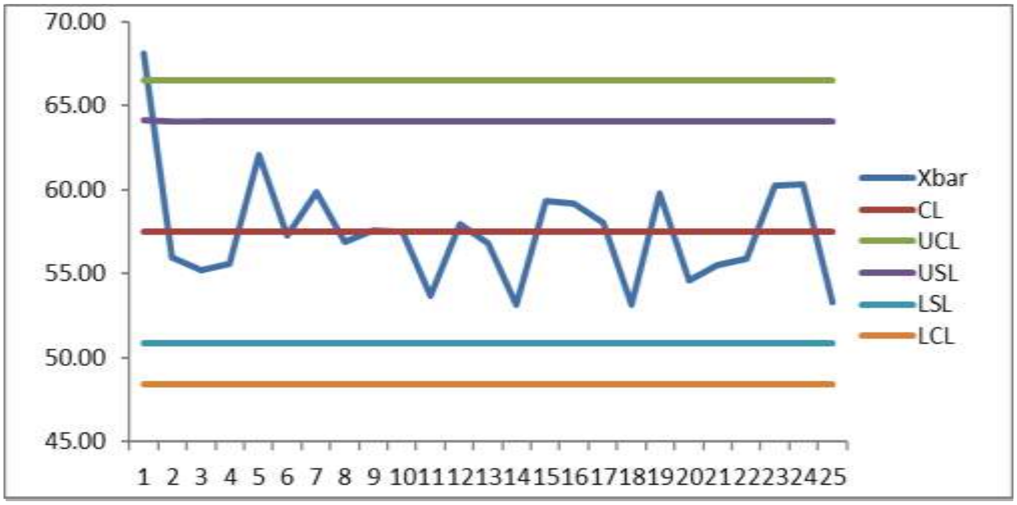

Figure 4. Average Egg Volume control chart

The Walter Shewhart Control Charts with standard deviation are separated into different grades based on the weigh, surface area and volume. Using Micrisoft Excel, the Shewhart Control Charts with standard deviation for sample subgroup size n =4 are shown in Figures 2, 3 and 4. The charts corresponding control limits are shown in Table 6.

Table 6. Shewhart Control Chart Limits

Control Limits	Weight	Surface Area	Volume
UCL	65.54	80.76	66.54
USL	62.52	78.55	64.10
CL	59.04	73.10	57.48
LSL	55.56	67.65	50.86
LCL	52.55	65.44	48.42

An outlier observation can be made based on the ratio as

$$\frac{Largest\ value\ of\ the\ set}{Smallest\ value\ of\ the\ set} > 2$$

or an observation falls outside the 3σ control limits (UCL/LCL). If any outliers are in the observations, then they can be removed in the set and then the modified Shewhart control chart limits are used to find out the grading sizes. The outliers in the data violate the sample comes from the normality condition.

V. Determination of Grade Sizes

Control charts are used to classify the eggs with the help of 3σ, 2σ control limits. For the weights of the eggs, the UCL, LCL and CL are 65.54, 59.04 and 52.55 respectively followed by surface area 80.76, 73.10 and 65.44 and volume 66.53, 57.48 and 48.42

respectively. These limits are used to sort out the grading sizes. Table 4, shows the grade sizes of the eggs respective geometrical properties.

Table 7. Grade sizes of Egg with engineering properties

Grading Size	Weight of eggs		Surface area of eggs		Volume of eggs	
	Range in gm	No. of eggs	Range in cm^2	No. of eggs	Range in cm^3	No. of Eggs
Small	52.55-55.56	16	65.44-67.65	16	48.42-50.86	16
Medium	55.56-62.52	70	67.65-78.55	72	50.86-64.10	70
Large	>62.52	14	>78.55	12	>64.10	14
Total		100		100		100

VI. CONCLUSIONS

All the three engineering measures, the egg grading sizes is consistent. They are small size eggs 16% medium size eggs 70% and large size egg 14%. The results are assured about 99.73% as well as manual classification. Classification of grade sizes are the most preferable measure in the market while purchasing products and it helps consumers to get a right value for right product based on the acceptance. The grading sizes into three groups reduce the loss of items considerably while transporting, sorting and handling the objects. It helps to maintain homogenous sizes for reducing the loss of items in costs and materials.

If adding computer visions of image processes for sorting and there by grading sizes can be enhanced good will and loyalty, but also in terms of costs for scrap and rework. Grading

sizes of an objects is decided to keep the process within specification of extreme items 99.73% and medium size of items 95.45%. The technology +- 3 sigma and +- 2 sigma area cover the normal distribution control limits for grading sizes are same to the American Egg Board classification. Thus Shewhart control has the adaptability of grading egg sizes as in the American Egg Board classification. Further Shewhart control charts technique can be used much diverse area for reducing the losses of post harvesting products. This approach is similar to six sigma program developed by Motrola in the late 1980s as response to the grading sizes on production processes Grading eggs of small size is classified as weight 1.8 ounces (51.029 gm) Medium size as weight 2.1 ounces (59.535 gm) and large size as 2.4 ounces (68.045 gm)

Technical support software consultancy using Shewhart control charts helps to develop for designing automatic censor machines to grade the eggs into three groups small, medium and large as weight < 56.47 gm, 56.47 – 62.13 gm and > 62.13 gm respectively.

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