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Reducing defect in the packing process through statistical process control: A case study of pasteurization milk process

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Abstract

This research aims to study the factors that cause defects in pasteurized milk packaging process. Also to find ways to rectify the defect caused through application some of seven quality control (7QC) tools. In this case, used only four QC tools including Pareto chart, check sheet, causes and effects diagram, and graph to analyze causes and solutions in packaging process. This research was supported by Waritchaphum daily cooperative limited (WDCL) as a case study. However, the production process was the pasteurized milk production process. The problem of defective product was considered in the process of pasteurized milk packaging. From the analysis of factors affecting the problem of defect products through statistical methods. After the operation, the main cause was the employee performance. Then, to improve and correct the employee's performance. Finally, can reduce the amount of defective products 52 percent.

Keywords: *7QC tools, SPC, UHT milk, defective, QC story*

1. Introduction

Quality has developed one of the most important customer decision factors in the selection between the competing product and services. Quality control (QC) may be defined as that characteristic which concentrates a product or service as having fitness for purpose. There are different reasons why a product may have unsatisfactory quality. Statistical process control (SPC) method composition a central role in quality improvement efforts and recognized as an efficient and powerful tool in dealing with the process control features.

Currently, Waritchaphum dairy cooperative limited [1, 2], Sakon Nakhon provinces of Thailand, is experiencing problems in the production process of defective products. Which is considered an important issue It is important to check the cause and take corrective action. Because resulting in increased production costs. For this research, we focus on studying only the reduction of too many defective products. The Waritchaphum dairy cooperative Limited (in this paper will call it “WDCL”) has two types of milk production business, namely pasteurized milk and UHT milk. The researcher then surveyed and analyzed the problem through selecting the research topic from the production line that has the largest amount of

products. The initial data collection, found that in the production process there are many defected products.

2. Objective of this Study

This research aims to reduce the quantity of defective products occurring in pasteurized milk packaging process, for the case study of WDCL to be defect reduced more than 50 percent through statistical methods.

3. Research Methodology and Tools

3.1 Statistical Process Control

Statistical process control (SPC) [3,4] is a methodology to monitor and analyse process inputs factors and productivities, income corrective actions if the process is out of control limits which is updated based on the process data. Anyway, SPC is the application of statistical methods to the monitoring and control of a production process to ensure that it operates at its potential to produce a compatible product. It is found that, SPC is a technique used to control deviations and find the cause of deviations. Which is divided into specific causes, and common cause. After that, take action to correct the above reason.

3.2 Seven QC Tools

7 QC tools [4] are a collection of problem-solving tools, was compiled and developed for analysis and quality problems solving processes (QC circle or quality group activities). The QC story can be classified into 3 groups as follows [5]:

3.2.1 The quality control tool set for analysing data stability is intended as a model study, and considering that is the population considered to normalized through tool set, under this purpose is the Pareto chart.

3.2.2 The tools data sets for analysing variations in data with the objective of both being a sample study and analytical study. Which, in the first objective, consists of a Check sheet and Graph tool. For the purpose, the analysis will use Control charts tool for separating non-natural causes of variation out of the natural causes fluctuations.

3.2.3 Tool set for analysing cause and effect, usually this is the study with the objective of analytical study and should be studied via inferential statistics. So it will be the

most effective but with the principles of simplification. Therefore, it is recommended to use descriptive statistics instead. It consists of a Cause and Effect diagram or Fishbone diagram for determining the cause of the cause. Identification of causes and results, will use a Fishbone diagram to clarify the problem.

3.3 Methodology

Research methodology to find the losses that occur in various activities of the pasteurized milk packaging process. This research, to find ways to reduce or eliminate the defective products from the system. In order to continue the production operation and meet the set goals. Initially, the researchers used 7 QC tools to find and identify activities or non-value-generating things at various points in the pasteurized milk packaging process. Which will use the guidelines steps for problem solving and QC story quality development. Applied to reduce defective products and conducting research to improve product quality and production processes. Which there is a sequence of work procedures which are [4,5]:

1. Defining problem topics
2. Surveying conditions and setting goals
3. Planning for revisions
4. Cause analysis
5. Defining countermeasures and actions
6. Monitoring
7. Normalization

In which the researcher will conduct the research in accordance with the sequence of the QC story workflow in all seven steps**.**

3.3.1 Define problem topics.

Defining and collecting problem lists in order to study the problems of a business, it is necessary to conduct studies and understand to understand the scope of the process. In this case study, studied various types of businesses of WDCL. Found that the pasteurized milk production line having the largest amount of revenue and sales. After that, collecting business data of WDCL to determine the location of the production system causing defective products through considering the production volume of various types of businesses After defining in the production process of pasteurized milk and the amount of loss by analyzing the activities of each step of pasteurized milk production. Therefore, found that the loss occurs at each step as shown in Figure 1.

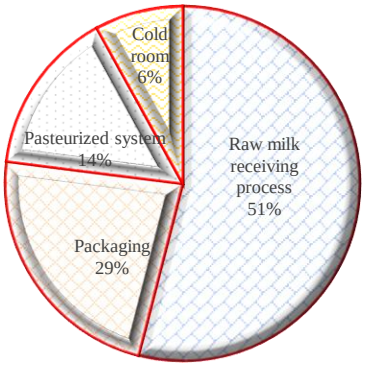

Figure 1 The proportion of loss in each step of pasteurized milk production

The results, from the data collection with Check sheet tool (frequency of product defects) in pasteurized milk packaging process to show the problem by recording the number of times the product was faulty That occurred clearly in which the analysis of problem selection will be conducted by using the Pareto chart, as shown in Figure 2

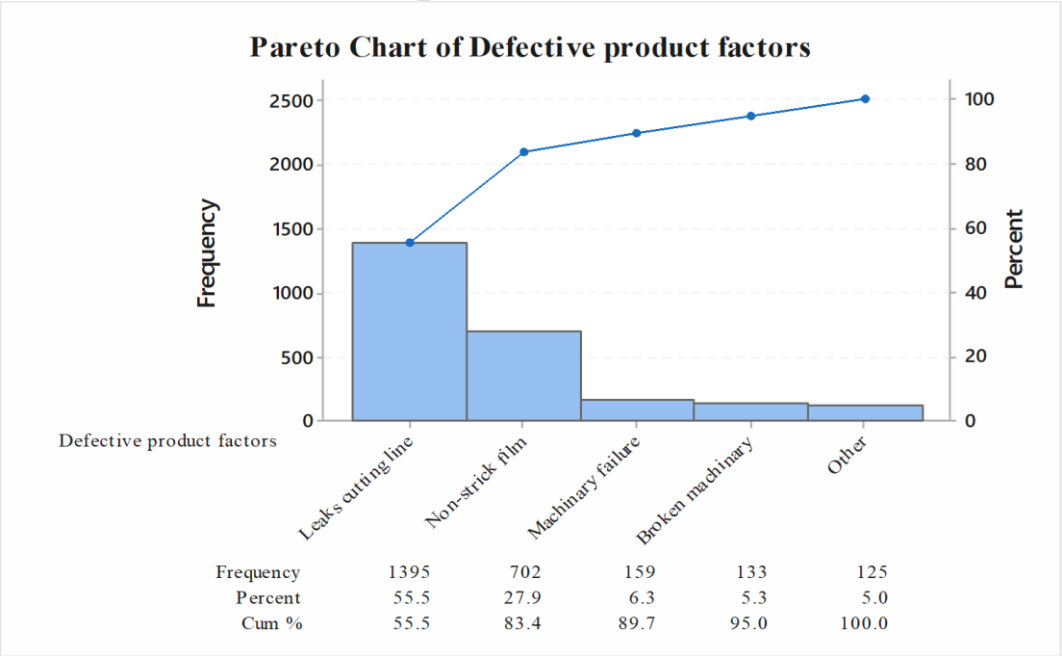

Figure 2 Defective product factors through Pareto chart

The results, Pareto chart (figure 2) based on the principle that there are very small amounts of important information while small amounts of important information represent

stability. The data shown on the Pareto chart shows the factors from the analysis of the problems causing product defects. To achieve the objective is to reduce defect products occurring in the pasteurized milk packaging process by 50 percent. From the result, found one main problems, cause of defective products in the pasteurized milk packing process is milk leaks along the traces.

3.3.2 Surveying conditions and setting goals

After determining the topic of the problem. And then, analyze the cause of the problem and find a solution, but since the said problem is still unknown the root cause and still do not know how to fix. Therefore, it is necessary to explore the current conditions in order to understand the problem condition before taking action.

3.3.3 Planning for revisions

In this step, the planning of the analysis process is planned. Then, solve problems it is based on observation data, considering the ability and suitability of the process to find solutions to problems.

3.3.4 Cause analysis

The researcher has chosen to use Fishbone diagram showing cause and effect to find the relationship between the factors that cause through the QC story process to analysis and problem solving. The reasons to consider from 4 M fundamentals are; man, machines, methods and raw materials, which will show the relationship of the causes that cause quality changes resulting in defective products. The analysis of variation to study the relationship between cause and effect, it is absolutely necessary to brainstorm from the quality group activities (QC circle) to get to the cause of the problem. And then, prove the facts for further solutions. The result of this brainstorming can be summarized as shown in Figure 3.

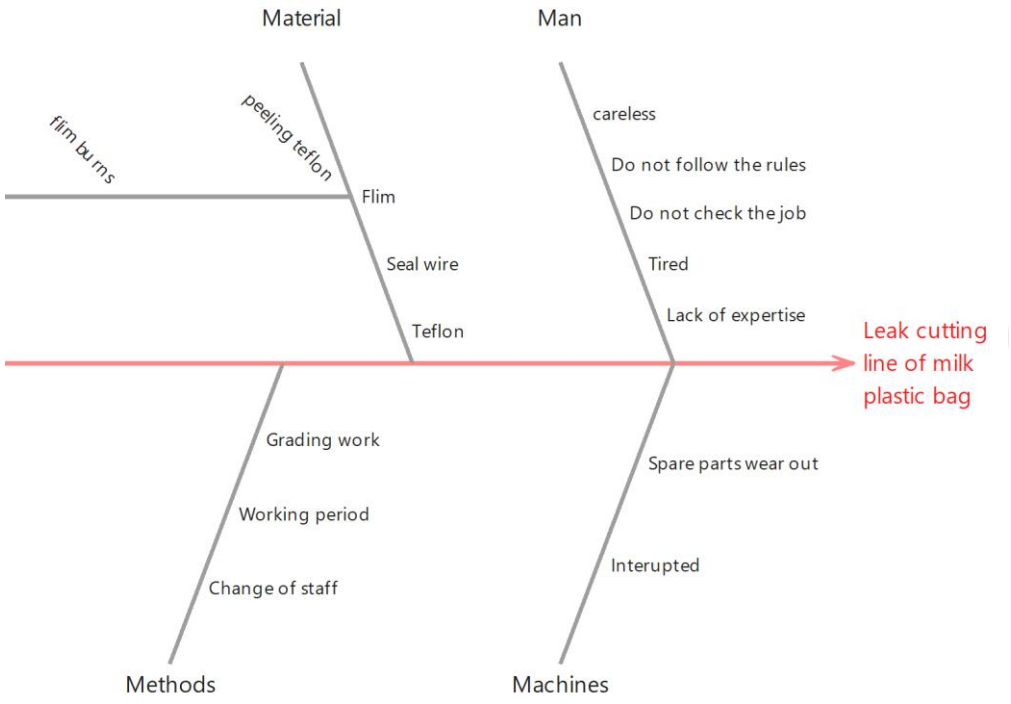

Figure 3 Cause and effect diagram of Leak cutting line effect

3.3.5 Defining countermeasures and actions

From problem analysis, components related to the problem of defective products caused in pasteurized milk packaging process through a Fishbone diagram showing cause and effect of packaging process problem, will find that all possible causes of the problem from the main problems are leaks along the cuts. Therefore, it is necessary to cut the choice of possible causes. With the method of data collection as the frequency of occurrences of minor causes with a Check Sheet to select the factors that affect the product causing defects.

The collect data, frequency or amount of times the problem occurred (from Check sheet), which will use the total value to create a Pareto chart to select the cause to take corrective action as shown in Figure 4.

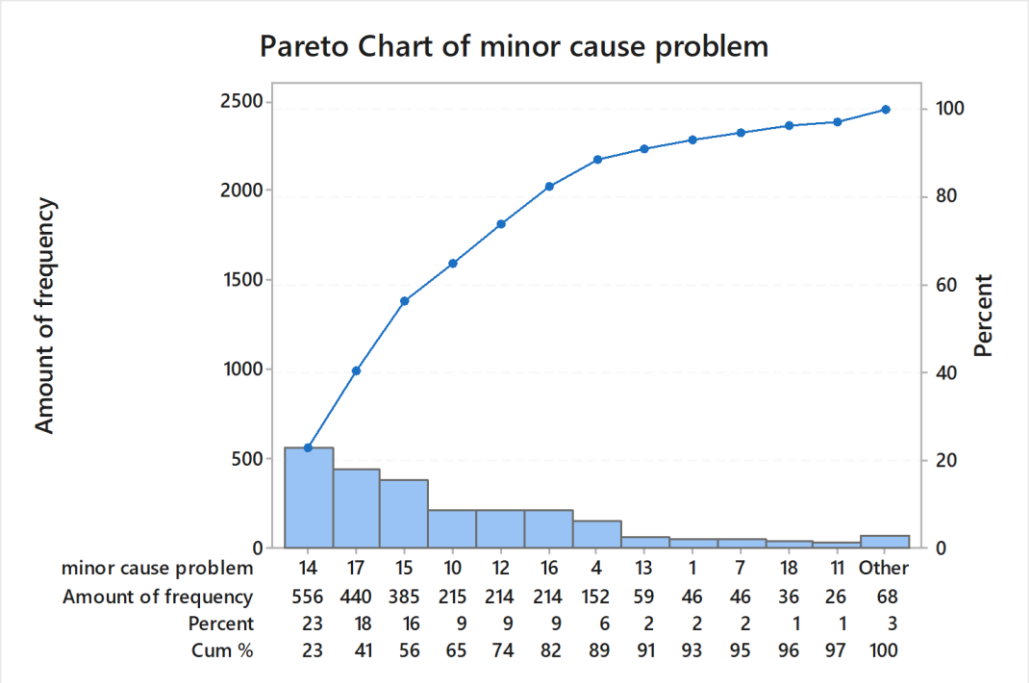

Figure 4 Cause and frequency of the leak cutting line problem

From the picture 4, showing the frequency of the cause of the problem in order to consider and solve the problem. Therefore, to achieve the objective is to reduce 50 percent of the defect products occurring in pasteurized milk, the cause analysis is done and the top three causes (cumulative percentages is 56%) of the problem are resolved.

3.3.6 Monitoring and performance

The various operational procedures, from determining the topic of the problem surveying current conditions and setting goals. Problem solving planning analyzing the root cause of the problem, which knows various problems that occurred in the pasteurized milk packaging process through 7QC tools as an analytical tool. Therefore, has studied for a wide range of solutions to problems as for the problems that occur a lot. The research team, has studied the problem with the related department in order to be the most direct way to solve problems. The researcher needs to find out the true cause of the problem. Therefore, analyze the problem choose the factor that has the highest problem, namely the staffing factor and work factor both of these factors are extremely problematic because employees do not receive training before work and each employee lacks proper guidance etc. The research team

therefore proposed solutions for improvement and data collection after the update with a checklist.

4. Conclusions

The reducing defective products in pasteurized milk filling process via statistical methods for the case study of WDCL, it will procedure the step-by-step approach to solving the problems and improving the quality of the QC story model, applied to reduce defective products and conduct research to improve product quality and production processes. Found that, the defective product caused in leaks occur along the cutting edge of the milk bag film and the sealing of the film does not stick. That's the most frequent problem in pasteurized milk filling processes (packaging process). After that, conducting brainstorming for relevant parties to find out the factors that cause such problems through cause and effect diagram. Found that, the factor that caused the most problems was the work performance of the employees. After implementing improvements and fixing problems, we can reduce the amount of defective products caused in milk leaking on the traces of milk plastic bag film. Which can reduce the amount of defective products to 52 percent.

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