

MAINTAINING THE PRODUCTION OF OYSTER MUSHROOMS SUPPLY CHAIN THROUGH THE DIVERSIFICATION OF ITS PROCESSED PRODUCTS USING STATISTICAL PROCESS CONTROL (SPC)

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Abstract. Oyster Mushroom Farmer Group (KPJT) is a community in Ranupakis and Klakah Village at Klakah District, Lumajang Regency that has a vision to maintain the business continuity of its members in the cultivation and processing of oyster mushrooms. This group intervened in the production of oyster mushroom commodities produced especially those that could not be sold freshly by buying it at market prices. Furthermore, to increase its economic value by processing it into several valuable processed products. Increasing the leverage product competitiveness towards similar products, innovation, efficiency and competitive strategies are needed. Diversification of processed products is key to maintaining the supply of oyster mushrooms purchased from group members can be resold at a higher value so that the purchase of mushrooms from group members continues. Therefore, the role diversification are needed to be able to contribute various and appeal to the customer processed product oyster mushroom. Among the results of the diversification of processed products oyster mushroom are shredded mushrooms, steak mushrooms, crackers mushrooms, satay mushrooms, crispy mushrooms, mushroom meatballs, bread mushrooms, and etc. Statistical process control (SPC) used in measuring and controlling quality by monitoring the processing of oyster mushrooms into several derivative products.

1. Introduction

Last year in 2018, Ranupakis and Klakah village in Klakah district, Lumajang Regency, East Java Province, community service activities for farmers and mushroom communities were held, the results of which included a solution to the problem on the side of Manut KPJT mushroom producers: the application of sterilization technology (steamer) on mushroom media to overcome and prevent caterpillar pests, so that it is expected to maintain the productivity of the crop. Then to solve the problem at the group level of mushroom bread producers: the use of deep frying in the producers of mushroom chips and krispy mushrooms to maintain the quality of the products produced, reinforcement in the production of processed mushroom meatballs to increase the variant of mushroom bread products, which until now has reached 12 outlets spread in Lumajang and Pandaan. The freezer and vacuum sealer packaging equipment is very helpful for maintaining stock availability for a longer period. Besides trying to diversify other processed products, namely: mushroom bread, soy sauce, spices pecel, sausages, bon funds made from oyster mushrooms. The last problem that can be resolved is the management side that has been carried out including: strengthening the institutional system within the Manut KPJT group in the form of strengthening the organizational structure and specialization of the business fields of each unit to maintain production and marketing stability at the group level. Application of POS tape technology to improve management of product sales records and online income calculation, especially at mushroom bread product sales outlets managed by Manut KPJT. In

collaboration with UPT Food and Beverage, Jember Polytechnic, the PPDM team will continue to develop diversification of mushroom-based food products such as mushroom bread, soy sauce, nuggets, sausages, shredded, and oyster mushroom-based pecel spices from the results of research by the State Polytechnic Lecturer in Jember to be applied into new production centers at PPDM Manut's KPJT partners. Food and Beverage UPT State Polytechnic Jember has experience in developing mushroom-based food products such as meatballs, nuggets, sausages, shredded, seasoning "pecel", chips and crispy oyster mushrooms from the results of research by the State Polytechnic Lecturer in Jember. The potential of the last three mushroom bread mushrooms shows the interest of people to consume mushroom bread continues to increase along with the popularity and popularization of oyster mushrooms as a delicious and nutritious food. In line with the spirit of the downstream research and priority programs of the government to develop and strengthen rural communities, various efforts continue to be encouraged. Ranupakis Village is a village that has the potential to be developed towards the Oyster Mushroom Sentra Village and its Processed Products.

KPJT Manut tries to do the best possible production process in order to get mushroom bread that meets the standards. However, it does not rule out the possibility of errors occurring in the production process and added to the Manut KPJT there is no quality control being carried out so it is most likely that errors will occur that cause the mushroom product to be deformed. These errors can occur due to existing raw materials, labor, or machinery so special attention and supervision is needed so that the product produced is suitable. Errors that occur have an impact on the results of mushroom bread produced including defective products such as non-standard shapes, the quality of taste decreases, there is dirt on the fungus, and the weight is not uniform. Statistical quality control is a problem-solving technique that is used to monitor, control, analyze, manage, and improve products and processes using statistical methods (Statistical Process Control). Statistical process control and statistical quality control are two different terms that are often misinterpreted. Process control and statistical quality control is a system developed to maintain uniform standards of the quality of production, at a minimum level and implement assistance to achieve efficiency³. If done together, an overview of current and future process performance will be seen. The seven Statistical Process Control aids are one of the methods used to analyze quality statistically. This tool is used because it is sufficient in analyzing the quality of production in general, so as to improve product quality. Quality control techniques also use several kinds of control devices such as p control chart, process capability, pareto diagram and cause and effect diagram. This is to produce superior quality with a stable process and reduce the impact of losses due to errors in the production process⁴. The purpose of this study is to analyze the application of mushroom quality control using a control map and find the factors that cause a process beyond control.

2. Research Methods

The research design in this article is quantitative descriptive. Types of data used in this article are quantitative data and qualitative data. Sources of data in this study use primary and secondary data. Primary data in the form of damaged product data that occurred during a period of 20 days and the results of interviews with mushroom bread owners. While secondary data used are data obtained from company production data, company profile brochures, and other information such as a collection of journals, theses from other researchers, books and the internet.

Data analysis methods carried out are as follows:

1. Collecting Data on the Amount of Production and Damaged / Defective Products Using Check Sheet
2. Analysis using the P Full Chart (P-chart)
3. Analysis using Process Capability
4. Analysis using Pareto diagrams
5. Finding the Most Dominant Factors by Using a Fishbone Chart

3. Result and Discussion

Check Sheet

"Check sheets are useful to simplify the process of data collection and analysis and are useful for analyzing problem judges based on the frequency of types or causes and making decisions to make improvements or not".

Table 1. Research data (check sheet) on processed mushroom production

Observation (day-)	The Amount of Processed mushroom	Non Standar	Proportion of Defective (p)	percentage of defective Product (p%)
1	1395	28	0,0201	2,01%
2	1055	44	0,0417	4,17%
3	1170	26	0,0222	2,22%
4	1020	30	0,0294	2,94%
5	1315	26	0,0198	1,98%
6	1190	33	0,0277	2,77%
7	1290	24	0,0186	1,86%
8	1200	27	0,0225	2,25%
9	930	24	0,0258	2,58%
10	1170	33	0,0282	2,82%
11	1060	25	0,0236	2,36%
12	985	23	0,0234	2,34%
13	1040	29	0,0279	2,79%
14	1180	24	0,0203	2,03%
15	830	23	0,0277	2,77%
16	990	32	0,0323	3,23%
17	1260	29	0,0230	2,30%
18	1060	26	0,0245	2,45%
19	930	29	0,0312	3,12%
20	1232	27	0,0219	2,19%
Jumlah	22302	562	0,5119	
Rata-Rata	1115,1	28,1	0,0256	

In table 1 above shows the sample data from mushroom bread is not suitable so that calculation and determination of control limits can be done by using the p control chart, the following p control chart is presented in graphical form:

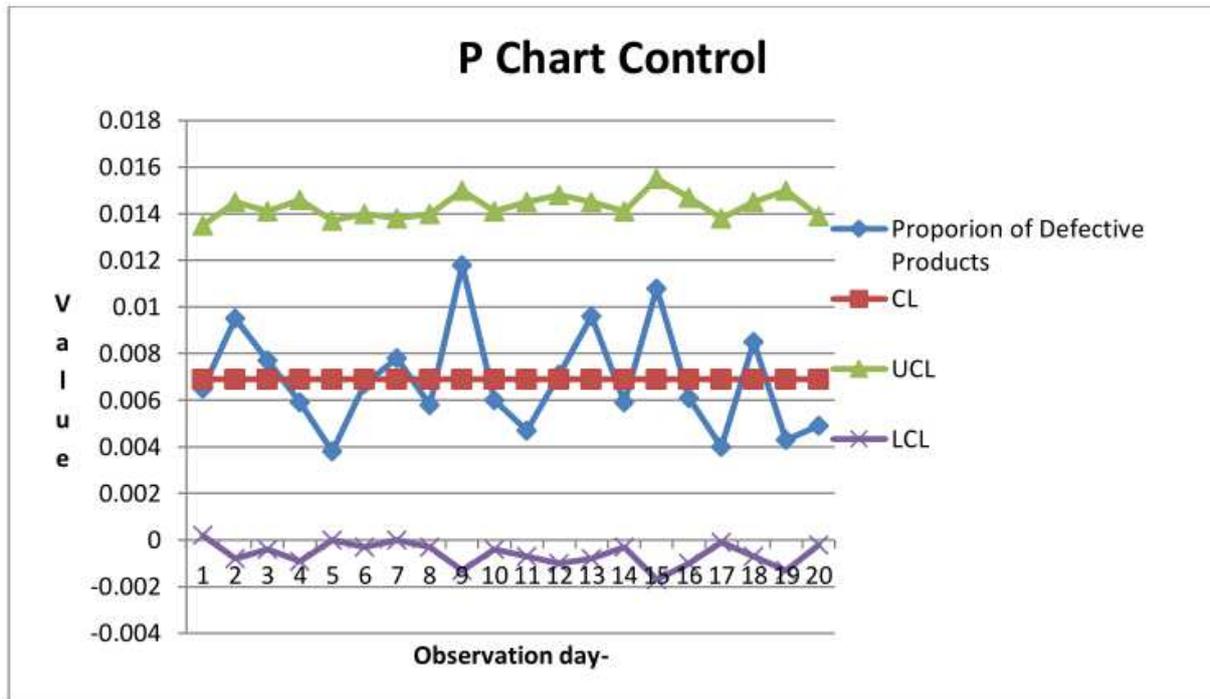


Figure 1. Full Control Map of Mushroom Bread (research data)

Based on the results of the control chart p in figure 1, it can be highlighted by the judge that the points of control limit on the mushroom bread p map are inappropriate because there are those that are still outside of statistical control. This can be seen clearly in Figure 1 that there is a point that is outside the upper control limit (UCL) or the lower control limit (LCL), so it can be said that the process on the mushroom bread is not appropriate and not yet controlled. The point is in the second observation with the value of the proportion of defects = 0.0417; CL = 0.0256; UCL = 0.0402; and LCL = 0.0110.

Process Capability

In the control chart calculation p on the mushroom bread process is not appropriate, it can determine the process capability (Cp) to measure the ability of a company to produce products that can meet predetermined product criteria. The following is a calculation of process capability (Cp):

$$Cp = 1 - pbar = 1 - 0,0256 = 0,9744$$

Process capability on the mushroom bread criteria shows a result of 0.9744 which means that KPJT Manut is able to produce mushroom bread with uniform shapes and sizes of mushroom bread as expected by the company, so that the company's ability to produce mushroom products with good shape and size uniformity is 97 % with product defects produced by 3%

Pareto Diagram

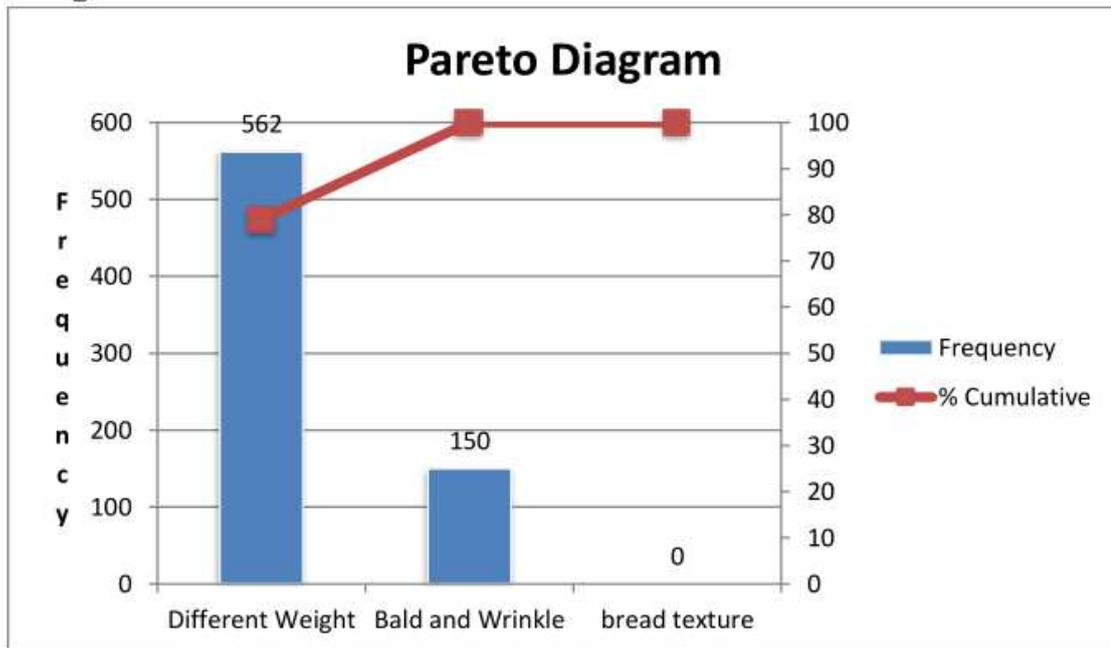


Figure 2. Pareto Error Diagram of Mushroom Bread

Based on the Pareto diagram above, it can be seen that errors that occur in mushroom bread products with non-uniform weight criteria have an error percentage of 79%, criteria for Bald and Wrinkle have an error percentage of 21%, and bread texture criteria have an error percentage of 0% . The results of the Pareto diagram above can be concluded that the errors that often occur in Manut KPJT are non-uniform weight with an error percentage of 79%.

Cause and Effect Diagrams (Fishbone Diagrams)

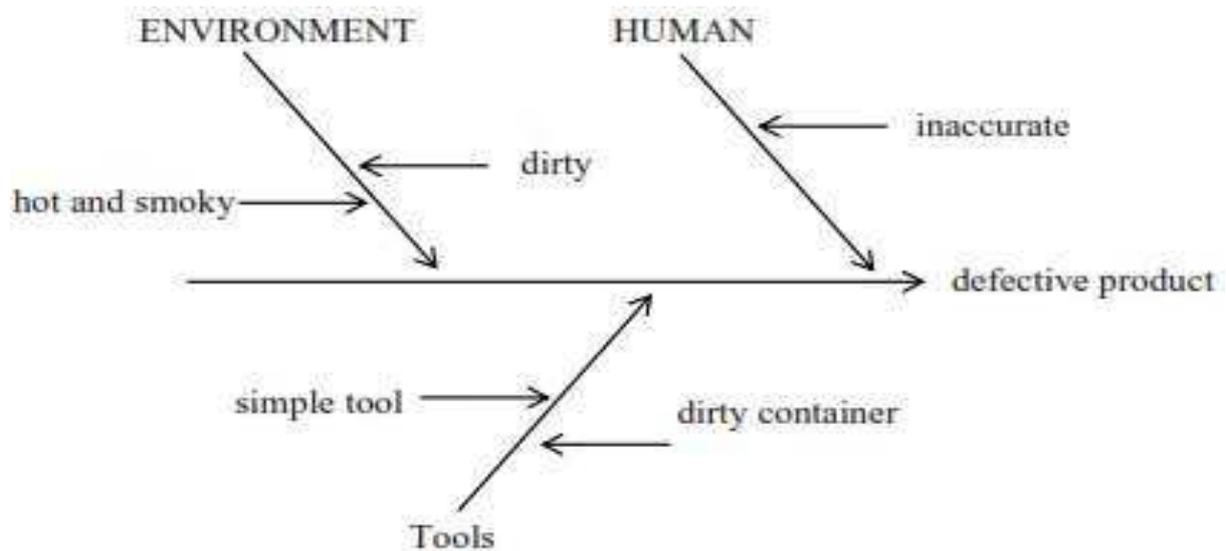


Figure 3. Cause and Effect Diagrams

In the diagram of cause and effect diagram above can be highlighted by mushroom what causes that make mistakes occur in the results of mushroom bread products in KPJT Manut, the following is the description of Figure 2.

a. Human

In every job there needs to be accuracy in carrying out the work so that the results of the work are in accordance with what was planned from the start. However, errors often occur from the results of the work due to lack of meticulousness of workers in doing their work. This also happened to workers at KPJT Manut in the raw material processing section. Workers who are not careful in carrying out the work of making mushroom bread, there are some things that are not uniform and there are some mushroom breads whose appearance is small pebbles or earth. The cause of the lack of meticulousness of workers in carrying out their work is in a hurry to do work, often chatting with other workers, lack of focus due to fatigue, and an uncomfortable working atmosphere. Therefore, there needs to be increased supervision from the owner of his workers so that workers can carry out their work properly and there needs to be an increase in the owner's attention to his workers so that workers feel comfortable carrying out their work.

b. Environment

1) Gross Production Site

there is a production process going on sometimes there are impurities such as ash or dust that participate in the production process that makes some of the mushroom bread produced slightly dirty. The reason for dirty production sites is the effect of wood fuel used by the company in the production process such as ash which makes the production place dirty and is due to the arrangement of the production sites from the beginning to the end of production into one in one place. So that there is a need for structuring in the place of production both arrangement of the place for sorting, grinding, cooking, cutting, and others so that the place of production is kept clean.

2) Hot and Smoky Conditions

Hot and smoky conditions that arise due to the fuel used is firewood, sometimes making workers feel hot and make their eyes hurt. This will have an impact on the results of the work carried out, so there needs to be attention of the owner in providing air ventilation for the release of smoke from fuel and ventilation for the entry of air or wind from outside to the production site to keep it cool.

c. Tool

1) Prints Are Not the Same

Bread molds that are not the same in the mushroom bread process produce non-uniform results. This is caused by using simple and long-standing printing tools. This can be seen from the results of the control chart p in Figure 2, it can be highlighted that the control chart boundary points p with product criteria not in accordance with the standards are still in statistical control. It is clearly seen in Figure 2 that there is no point that is outside the upper control limit (UCL) or the lower control limit (LCL), so it can be said that the process on the mushroom bread criteria is under control. Therefore, it is necessary to improve the mold by buying a new one so that the size of the mushroom bread becomes uniform.

2) Dirty Water Collection Tank

Dirty water reservoirs can make the water in them also dirty, a contributing factor is that water tanks are rarely cleaned by workers. This will have an impact on the yield of mushroom bread that is produced because most of the processes in producing mushroom bread from the beginning to the end require water, so the need for routine cleaning of the container of water by the worker after each production of mushroom bread so that cleanliness of the container of water and water remains awake.

4. Conclusion

Manut KPJT in Lumajang Regency has implemented quality control by controlling the main raw materials to be used (selection of mushrooms), controlling the production process in accordance with the procedures for making mushroom bread, and controlling the selection of water for the production process. The application of quality control using the p control chart on each criterion shows that to avoid defective products there is one criterion that points to the results of research that are outside the UCL and LCL control lines ie on inappropriate mushroom bread. This shows that in the process of inappropriate mushroom bread there is still a process that has not been controlled. Factors that cause errors occur in the production of mushroom bread in KPJT Manut are human factors caused by inaccurate, environmental factors caused by hot and smoky conditions and dirty production sites, tool factors caused by simple cutting tools and water storage tanks dirty.

Based on the calculation of the process capability obtained, shows that the company's ability to produce mushroom bread products in accordance with the expected criteria is already in the good category so it needs to be maintained. However, there needs to be extra supervision from the owner of his workers so that workers can carry out their work in accordance with what has been planned and there needs to be attention from the owner in correcting the mistakes that occur in the production process that results in the results of mushroom bread. If all errors can be handled properly, then the proportion of defects in mushroom bread products will be reduced so that it is expected to increase the amount of production from the Manut KPJT in Lumajang Regency.

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