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Research Article

"Hazard Analysis Critical Method (Haccpm) Implementation Analysis On Scrap Reduction At Pt. Tci Garut''

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Abstract: Efforts to produce products in accordance with consumer needs, companies are required to produce quality products. Commitment to product quality will have a positive impact and win the competition for companies, especially in the food sector. For that, it is necessary to standardize the quality management system that is globally recognized. Hazard Analysis Critical Method (HACCPM) is a method to ensure food safety by obtaining HACCPM certification from the food organization used by PT. TCI Garut is a guarantee of food safety. The HACCPM method can identify key points in the production process, and it can help reduce the number of defective products produced. The results of applying the HACCPM method, PT. TCI Garut obtained HACCPM certification to ensure the food safety of its products, and succeeded in reducing the number of defective products from an average of 2.21% before HACCPM application to 0.91% after HACCPM application. From the results of HACCPM application, these important points are caused by the danger of pollution and the danger of additives that can endanger the health of consumers.

Keywords: HACCPM implementation, the amount of scrap

1. Introduction

Cocoa or chocolate is one of the current agricultural commodities which is very easy to develop. According to the National Statistics Agency, the total area of cocoa plantations in Indonesia in 2014 reached 174,061,000 hectares and the amount of cocoa production in Indonesia in 2014 reached 6,516,000 tons. The processed product of cocoa pods in the form of chocolate is a type of food that has many consumers. The type of chocolate that many farmers grow is the type of Criolo or Flavor Cocoa. You can enjoy processed products from chocolate, such as cocoa powder, chocolate candy, and chocolate fat. The processed chocolate will later be reprocessed into delicious snacks.

One of the processed chocolate snacks that are very popular with the community is chocolate that is produced by PT. TCI Garut requires food safety guarantees that are recognized by the world so that its chocolate products can easily enter domestic and international markets. The amount of processed chocolate production at PT. TCI Garut varies every day depending on low season or high season conditions and must consider the product stock in the warehouse. However, even though it depends on the low season and high season conditions, one employee can process 50 kg of chocolate. PT. TCI Garut mostly processes its chocolate products manually. Both during the chocolate cutting process, chocolate tying, giving the topping contents to the chocolate, to the chocolate packaging process. Total percentage of defective products during annual production.

Table 1. Number Of Defective Products During Annual Production (pcs)

	Filled chocolate product	Non-filled chocolate product	Powdered chocolate products	Total
2013	13,104	6,955	2,218	22,277
2014	4,839	2,722	1,613	9,174

Source: PT.TCI Garut

Table 2. Total Percentage Of Defective Products During Annual Production

	Filled chocolate product	Non-filled chocolate product	Powdered chocolate products	Total
2013	1.3%	0.69%	0.22%	2.21%
2014	0.48%	0.27%	0.16%	0.91%

Source: PT.TCI Garut

Tabel above show thatThe number of defective products was 22,277 pcs from the annual production of 1,008,000 pcs or 2.21% of the total production, and after applying HACCPM the total number of defective products was reduced to 9,174 pcs or 0.91% of the total production. The defects in the product are caused during the production process, such as when chocolate is melted, when the chocolate is removed from the mold and packaging will be carried out immediately. The product defect is caused by a product that has less or more grams, then the product is broken, the brown appearance is not shiny, and the texture level is not soft. All production processes are still done manually. Only at several stages of the production process that have used the machine. To maintain its quality, in 2014 PT.TCI Garut received HACCPM certification which is a license for food safety assurance in producing food product processing that is safe for consumption.

2. Problem Formulation

In the chocolate production process at PT TCI Garut, there are still some serious problems, namely the number of defective products produced after the production process. However, after PT.TCI Garut has used the HACCPM method in its production process, the number of defective products has decreased. So in this study the formulation of the problem is:

1. How is the process of applying HACCPM in the production process at PT.TCI Garut?
2. How is the production flow carried out by PT TCI Garut in producing its chocolate products?
3. How effective is the HACCPM method in reducing the results of defective products at PT.TCI Garut?
4. How is the effect of HACCPM application on the chocolate production process at PT.TCI Garut?

3. Study Objectives

a. General Purpose

The purpose of this research is to collect, process and analyze data and interpret it about influence analysis HACCPM application to the chocolate production process, especially the reduction in the amount of scrap at PT.TCI Garut.

b. Special Purpose

The specific objectives of this research are to find out:

1. The process of applying HACCPM in the production process at PT.TCI Garut.
2. The flow of production carried out by PT TCI Garut in producing its chocolate products.
3. The effectiveness level of HACCPM used in the chocolate production process of PT. CTI Garut.
4. The impact of the HACCPM method on the chocolate production process. TCI Garut.

4. Benefits of Study

The results of this study are expected to provide theoretical and practical benefits.

a. Theoretical benefits

The results of this study are expected to provide benefits, namely:
implementing the theory obtained by the university to be applied in an industrial environment.

b. Practical Benefits

The research results are expected to be an input for companies to get input on how to plan the HACCPM system implementation in the industry to ensure food safety and consumer confidence.

5. Research Framework

In order to produce a quality product, the product must have a standard that has been previously set by the company, which refers to national and international standards, such as SNI, ISO, OHSAS, HACSP, etc. These standards will be an added value of these products, because people want to get the best products and do not cause harm when consumed or used, because products that automatically have national and international standards or certifications can guarantee quality and are Time is safe. The problems that are often faced by manufacturers are related to the existence of defective products that are produced, so that the products produced do not meet standards

and cannot be sold. If this happens, the company will suffer losses because its products do not meet quality standards and cannot be sold.

As with PT. TCI Garut is a company engaged in cooking with its main product chocolate. The company is headquartered in Garut, West Java and produces a variety of delicious chocolate filling products. PT. TCI Garut itself has problems in producing defective products. When PT.TCI Garut first operated until the 2013-2014 production period, it only relied on the taste of making chocolate products, most of the chocolate products were still manual or still manual in the production process. Until mid 2014, PT. TCI Garut has obtained Hazard Analysis Critical Method (HACCPM) certification which is an international standard for food quality assurance and has been applied in its production process.After PT. TCI Garut uses the HACCPM method in its production process, the number of defective products produced is reduced.

Referring to Freshty Yulia's (2008) previous research entitled "Implementation of Integrated Quality Management" conducted by the Maya Pakalongan Food Industry, the report shows that the HACCPM method used in the production process can reduce defective products from 0.7% to 0.46%. . Research conducted by Novianingdyah Pramesti et al. (2013) show that HACCPM can help increase the level of displacement torque in the layout during pasteurization and increase the displacement efficiency by 20.05%. In addition, in research conducted by Ayunita Kusuma Wardani (2015), PT companies used the effectiveness level of the HACCPM method. The effective rate of Indohama fish is 85%.

Based on the previous research described above, there is a yield equation that has a positive impact on the production process, and the theoretical concept is similar. Therefore, the author can follow the previous research paradigm to find and prove the impact of previous research. HACCPM in the production process Affects the number of product defects that can produce efficiency during PT. TCI Garut.

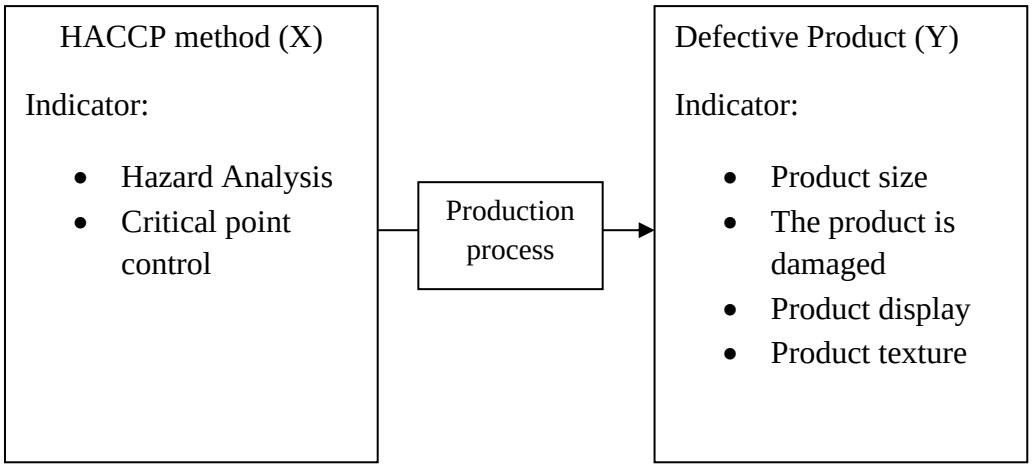


Exhibit 1.Research paradigm

6. Result and Discussion

6.1 Implementation of the production process at PT. TCI Garut

PT. TCI Garut is a company engaged in the food sector, which is a chocolate product that is produced in a way that makes it a delicious snack and can be used as a souvenir for Garut Regency. TCI Garut Indonesia still uses manual production, only relies on expertise and does not have a special factory. However, since 2014, PT. TCI Garut Indonesia has started to build a modern manufacturer based on Good Manufacturing Practices (GMP), Hygienic Standard Operating Procedures (SSOP) and Hazard Analysis Critical Control Points (HACCPM).

6.2 Implementation of the Hazard Analysis Critical Method in the Company.

The application of the HACCPM method is based on the principle of 5 initial steps and 7 application of the HACCPM method. The following is the application of the HACCPM method based on the following 12 implementation guidelines:

1. Form the HACCPM team

The HACCPM team is a group of people in the company responsible for designing, implementing and controlling the HACCPM system, who are representatives of the various departments of the company. And dealing directly with the certification body, the HACCPM Team consists of 5 members.

2. Product Description

This is complete detailed information about the product, including materials, packaging, storage conditions, durability, distribution methods, display methods and various other general information.

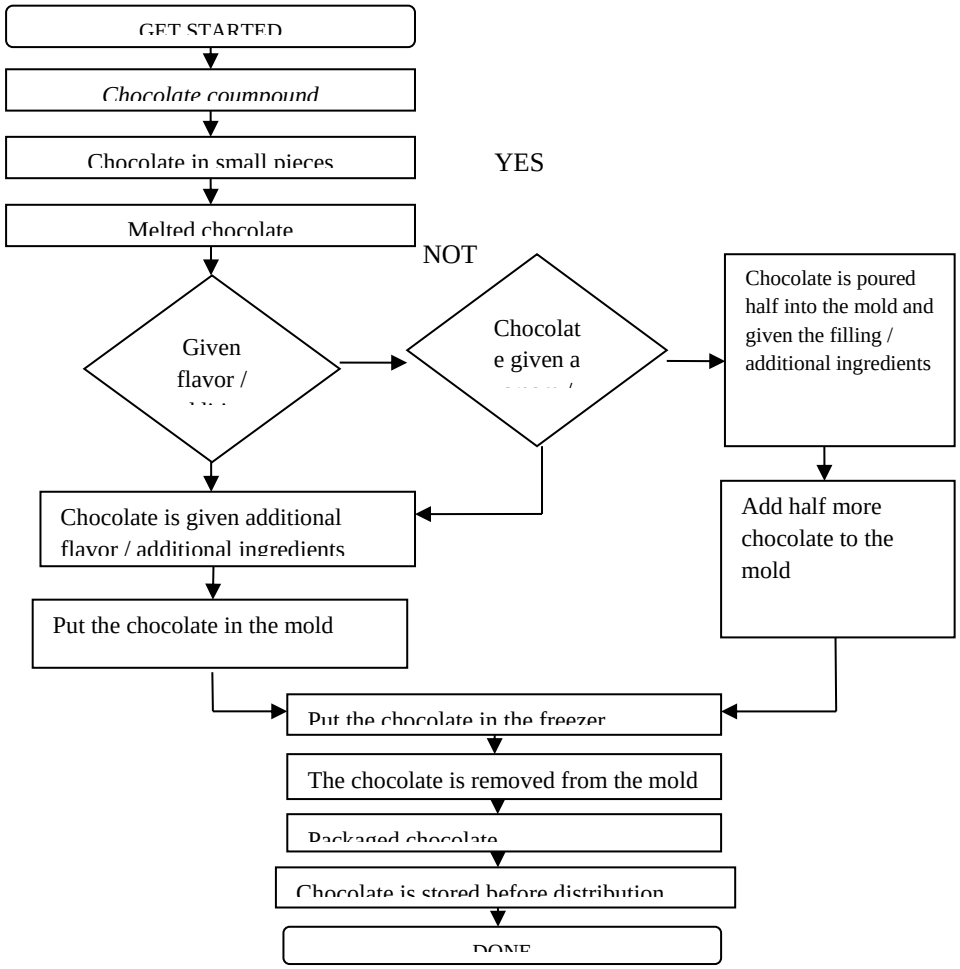
3. Identify usage plans

The chocolate product consumer segment of PT. TCI Garut from children to adults. The products produced are chocolate bar products that can be consumed, as well as chocolate products that are brewed with warm or cold water.

4. Make a flow chart

The flow diagram illustrates how the production process is carried out. The following is a flow chart for making chocolate at PT. TCI Garut:

Exhibit 2. Flow Chart Image



Source: PT. TCI Garut

5. Confirm the flow chart on the site

The on-site flow chart confirmation is a recheck between the flow parameters that have been made and the actual production process. The HACCPM team will ensure daily production operations at all stages of the production process.

After determining the 5 initial steps for implementing the HACCPM method, the next step is to determine the 7 principles of the HACCPM method, namely:

1. Principle 1: Hazard Analysis

The HACCPM team lists the hazards that may occur at each stage of production from the input material to the final product (Jabarullah et al.. 2020). In this stage, the company's HACCPM team performs a job called risk analysis, which includes two (two) stages, namely hazard analysis and determination of risk categories. Hazard analysis is a systematic assessment of certain foods and raw materials to determine risk. Food safety risks that

must be examined include: chemical pollution safety, physical pollution safety and biological pollution safety (including microbiology).

2. Principle 2: Define critical control points or CCPs

For each major hazard, it should be determined whether a critical control point exists. The HACCPM team determines where high risk hazards can be controlled. To help figure out where the correct CCP should be, a CCP decision tree can be used. A decision tree diagram is a series of logical questions that ask each hazard

There are 4 (four) decision tree diagram questions, namely:

Q1: Are there any precautions?

Q2: Are the stages specifically designed to eliminate or reduce possible hazards to an acceptable level?

Q3: Can the contamination with the hazard identified occur beyond an acceptable level or can this increase to an unacceptable level?

Q4: Will the next Stages eliminate or reduce the identified hazard to an acceptable level?

3. Principle 3: Setting Critical Limits

The main limitation is the limit that can be accepted or permitted by the company for the products it produces. If the resulting product is not in accordance with the plan in terms of size, composition, taste and composition, the product will not reach consumers because it is feared that it will bring danger and criticism to consumers. Has an impact on the sustainability of the company.

4. Principle 4: Establish a critical control point monitoring and control system

Key points are monitored during the production phase so that these phases can be carried out to the maximum extent possible. This monitoring is expected to clarify and assist the HACCPM team in fulfilling its responsibility to improve the company's food quality assurance.

5. Principle 5: Establish corrective actions

Corrective action is carried out if the critical point exceeds the critical limit. Based on table 5.5, when the chocolate is cut into small pieces and half of the chocolate is put into the mold, if there is contamination, the corrective action taken is to remove contaminants and always maintain the cleanliness of the tools, workers and raw materials to be processed. At the stage the chocolate is put back into the semi-finished product mold, if the chocolate is too thick or too runny it will repeat the production process of this part.

6. Principle 6: Establish verification procedures to ensure that the HACCPM system is running effectively

The verification procedure carried out by the HACCPM team is to check all existing report forms during the seven stages of applying HACCPM principles. If the production process is considered feasible, the product can be sold. Conversely, if the production process is deemed inadequate, steps will be taken according to the decision of the competent agency.

7. Principle 7: Establish documentation

The document proves its contents. If there are corrective actions that must be taken so as not to harm the company and consumers, the document can be used as a reference. The document can be a picture or video taken during this process.

6.3 Chocolate Production Defects Results PT. TCI Garut Indonesia before and after applying the HACCPM method

In the production process, manual production processes and production processes using machines, defective products become a problem. There are many causes of product defects, one of which is an error in production. TCI Garut Indonesia, the classification of defective products is broken products, the texture is not soft, the color of the product is not shiny, the weight of the product is too large or insufficient. However, apart from that, what matters most is the safety of edible chocolate products. Therefore, the use of the HACCPM method can reduce the degree of defect in the product and increase the safety of these products against substances that are harmful to humans.

The following is the total number of products and the number of product defects that were produced before and after applying the HACCPM Method in the production process at PT. TCI Garut Indonesia.

Table 3. Total Production Results for 2013-2014

No.	Month	Production (pc)	Number of defects (pc)	Percentage
1	May'13	87 800	2639	3.01%
2	June'13	100 800	2392	2.37%
3	July'13	100 800	2446	2.43%

4	Aug'13	159 100	3756	2.36%
5	Sept'13	48700	518	1.06%
6	Oct'13	48700	481	0.99%
7	Nov'13	87 800	2237	2.55%
8	Des'13	120200	2557	2.13%
9	Jan'14	100 800	2324	2.31%
10	Feb'14	48700	978	2.01%
11	Mar'14	48700	854	1.75%
12	Apr'14	48700	942	1.93%
	Total	1000 800	22277	2.21%

The number of products produced in 2013-2014 was recorded at 1,000,800 units of chocolate of various flavors and types. The number of defective products produced was quite a lot, namely as many as 22,277 units. Then the percentage of the number of defective products produced is 2.21% of the total production. This year, PT. TCI Garut Indonesia has not implemented the HACCPM method in its production process. After applying the HACCPM method in its production process, the total production in 2014-2015, the total number of production and the number of defective products produced are as follows:

Table 4. Total Production Results 2014-2015

No.	Month	Production (pc)	Number of defects (pc)	Percentage
1	may'14	120200	1624	1.35%
2	June'14	51700	983	1.90%
3	July'14	160 400	1783	1.11%
4	Aug'14	100 800	1163	1.15%
5	sept'14	48700	354	0.73%
6	oct'14	87 800	651	0.74%
7	nov'14	64100	532	0.83%
8	des'14	120200	833	0.69%
9	jan'15	100 800	639	0.63%
10	feb'15	48700	296	0.61%
11	mar'15	48700	143	0.29%
12	apr'15	48700	116	0.24%
	total	1000 800	9174	0.91%

After the application of the HACCPM Method, the amount of production did not increase or was the same as in the previous year of 1,000,800 units of chocolate with various flavors and types. The total number of defective products also decreased, to 9174 units of the total production. The percentage of the number of defective products produced is 0.91%.

6.4 Comparison of the number of defective products before and after applying the HACCPM method using the t-test and its impact

The purpose of the t-test for two independent variables is to compare (differentiate) whether the two variables are the same or different. The point is to test generalizability (the significance of research results in the form of a comparison of two sample averages).

The comparison of the two samples is divided:

a) Correlated sample
   Correlated samples are usually found in experimental research designs
b) Uncorrelated sample (independent)
   Independent samples are samples that are not related to each other.

The formula and steps for calculating the t-test for samples that are mutually independent are as follows (Sudjana, 2005: 239):

2. Perform the variance homogeneity test with the following degrees of freedom:

$df_1 = n_1 - 1$ = Degrees of freedom for numeration

$df_2 = n_2 - 1$ = Degrees of freedom for the denominator

n_1 = number of samples with higher variance

n_2 = number of samples with lower variance

3. Determine the F value from the table with $\alpha = 0.05$.

If the value of F stat ≤ F crit, then this means that the variance is homogeneous.

If the value of F stat > F crit, then this means that the variance is heterogeneous.

4. Perform independent t-test calculations. The formula for the t-test is used if the variance of the two groups is homogeneous:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\left(\frac{s_1}{\sqrt{n_1}}\right)\left(\frac{s_2}{\sqrt{n_2}}\right)}} \qquad \text{with } s^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

The test criteria used:

- Accept H_0 and reject H_1 if $-t_1\text{-}a/2 < t < t_1\text{-}a/2$ with $t_1\text{-}a/2$ is obtained from the t distribution list with odds (1-a / 2) and dk = $n_1 + n_2 - 2$.
- If the variance of the two groups is heterogeneous, the t-test formula which is used are:

$t' = \frac{\overline{x_1}}{\sqrt{(s_1^2/n_1)+(s_2^2/n_2)}}$ with the test criteria, accept H_0 and Reject H_1

if: with $-\frac{w_1 t_1 + w_2 t_2}{w_1 + w_2} < t' < \frac{w_1 t_1 + w_2 t_2}{w_1 + w_2}$

$w_1 = w_1^2 / n_1$;
$w_2 = w_2^2 / n_2$;
$t_1 = t\ (1\text{-}a / 2)\ (n_1\text{-}1)$;
$t_2 = t\ (1\text{-}a / 2),\ (n_2\text{-}1)$.

Tabel 5. Comparison Result Data and Output Data Defective Product Data Table

Data before HACCPM implementation (pcs)	Data after HACCPM application (pcs)
2639	1624
2392	983
2446	1783
3756	1163
518	354
481	651
2237	532
2557	833
2324	639
978	296
854	143
942	116

Table **Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Mean Error
Pair 1	Before	1843.67	12	1044,614	301,554
	After	759.75	12	544,773	157,262

Table **Paired Samples Correlations**

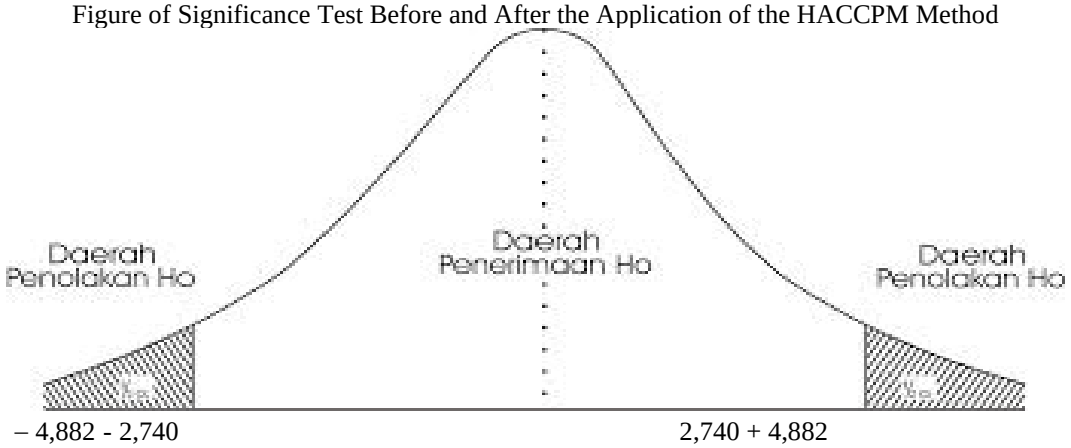
		N	Correlation	Sig.
Pair 1	before after	12	.700	.011

Table **Paired Samples Test**

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Mean Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	before after	1083,917	769,141	222,032	595,228	1572,606	4,882	11	.000

Seeing the results of the effect of the application of HACCPM on the number of defective products produced, from the correlation table, the correlation value (r) is obtained of 0.700. So, the percentage effect of HACCPM application on the number of defective products produced r^2= x 100% = 49%. The results of the correlation value if interpreted in the correlation coefficient table are in the medium category (located between 0.40-0.599). So, there is a moderate relationship between the application of HACCPM with the number of defective products produced by 49% and the remaining 51% is influenced by other factors.$0{,}700^2 = 0{,}49$Based on the results of t value calculation, it can be seen that t table with a significance level of 95% of 0.005, t stat of 4.882 and t table with dk = (n_1 + n_2) -2 = (12 + 12) -2 = 22 of 2.074. So it can be concluded that t stat ≥ t crit, which means that H_0 is rejected and H_1 is accepted, thus there is a significant difference between the number of defective products before the application of the HACCPM Method and the number of defective products after the application of the HACCPM Method in the production process at PT. TCI Garut Indonesia.

Figure of Significance Test Before and After the Application of the HACCPM Method



6. Conclusion and Recommendation

a. Conclusion

Before applying the HACCPM method in its production process, Tama Cokelat only relies on the feelings or intuition of its workers to produce its chocolate. But after applying the HACCPM method, the production process only relies on the feelings or intuition of the workers. following the implementation of the HACCPM Rules have been amended. HACCPM implementation is based on 5 initial steps and 7 application of company principles. The five steps that will be implemented are:

1. Forming the HACCPM team,
2. Describe the product,
3. Determine the plan of use,
4. Create a flow chart,
5. Confirm the flowcharts in the field.

In addition, the 7 principles of HACCPM are:

1. Determine the hazard analysis,
2. Determine critical control points,
3. Set critical limits at each critical control point,
4. Create a system to monitor and control key points,
5. Establish corrective actions,
6. Establish verification procedures, and
7. Create documents.

Before adopting the HACCPM method, the number of defective products produced during 2013-2014 was 22,277, accounting for 2.21% of 1,008,000 products. After adopting the HACCPM method, the number of defective products in 2014-2015 decreased from a total output of 1,008,000 to 9,174 with a percentage of 0.91%. From the calculation results obtained a significant difference in the number of defective products before and after the application of HACCPM. It can be seen from the calculation results that before and after the application of HACCPM, the correlation value or the value of the relationship between defective products is 49%, and the remaining 51% is influenced by other factors. In addition, the difference before and after HACCPM administration is also large.

b. Recommendation

Advice for companies

To increase the maximum production effect and reduce the number of defective products at PT. TCI hopes the company will pay attention to the following suggestions:

1. Train the production staff

The reason for holding this training was because they saw that the defective products produced so far were caused by workers' mistakes, these workers were not careful and did not consider PT. The TCI Garut process is generally still done manually, and machines are rarely used.

2. Provide bonuses and rewards to employees.

Giving bonuses and rewards is expected to improve employee performance and reduce personnel turnover, so that the final production can meet the target and reduce the number of defective products produced.

3. Use the right tools and raw materials.

The means used in production will affect the results of the product itself. In the production process, it is highly recommended to use production equipment that is not harmful to employees or production results, and to use appropriate raw materials, which are also not harmful to consumers, so as to reduce the number of the last defective products of PT. Tamaki Kola Indonesia.

Suggestions for readers

The results of this study are expected to be a reference for further research and can provide new insights for readers.

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