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IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM IN THE LABORATORY OF COOKING OIL PLANT TO IMPROVE PRODUCTION EFFICIENCY

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Abstrak

The laboratory plays a strategic role in the cooking oil industry, particularly in ensuring product quality and supporting the smooth operation of production processes. This study aims to examine the implementation of a quality management system based on the ISO 9001:2015 standard in the laboratory of a cooking oil factory in Indonesia, as well as to evaluate its impact on production operational effectiveness. The research employs both quantitative and qualitative approaches. Findings indicate that the implementation of the system enhances laboratory testing accuracy, reduces raw material waste, and accelerates decision-making processes. Overall, the quality management system contributes significantly to improving operational efficiency and the company's competitiveness.

INTRODUCTION

The cooking oil industry is an important part of the food sector that requires strict quality control at every stage of the production process. The laboratory serves as a quality validation center, from raw materials to finished products. However, many laboratories still face obstacles in efficiency and accuracy of analysis because they have not implemented a comprehensive standardized quality system.

Increasing efficiency in the cooking oil production process is a major challenge that must be faced amidst increasingly competitive market competition and increasing consumer expectations of product quality. The factory laboratory plays a strategic role as a quality control center to ensure quality standards starting from raw materials, production processes, to final products. Therefore, it is necessary to implement a quality management system (QMS) that is organized and in accordance with international standards.

Oil palm (*Elaeis guineensis Jacq.*) is one of the cultivated plants that produces

vegetable oil, namely *Crude Palm Oil* (CPO), which is widely cultivated in Indonesia, especially in the regions of Kalimantan, Sulawesi, and Sumatra. According to Hannum et al. (2014), oil palm is a leading industrial commodity that is able to support the national economy, even during a prolonged economic crisis, and contributes significant foreign exchange to the country. The potential of the palm oil market is also considered to be still very large, considering that the demand for crude palm oil and its derivative products remains high (Pardamean, 2014).

The success of a company is highly dependent on consumer trust in the quality of the products produced. Gaspersz (2005) defines quality as the overall characteristics of a product that support its ability to meet specified needs. Kartika (2013) also added that quality is the ability of a product or service to consistently meet customer expectations. Therefore, quality control is one of the main strategies of a company in facing global competition.

In the production process, cooking oil comes from CPO which goes through the stages of degumming, bleaching, filtering using a Niagara filter, and deodorization in the *Refining Plant* to produce RBDPO (*Refined, Bleached, and Deodorized Palm Oil*) products. Furthermore, RBDPO is processed in *the Fractionation Plant* through the stages of crystallization and filtering using *a membrane filter* . This process separates RBDPO into two main fractions, namely olein and stearin. The resulting olein, or known as RBD olein, is the final form of cooking oil. At PT XYZ (disguised), cooking oil quality control is carried out through various laboratory tests such as FFA, M&I, IV, PV, Dobi, carotene, and color. However, the two most basic and important parameters tested are FFA (*Free Fatty Acid*) and color. FFA testing aims to determine the levels of free fatty acids in cooking oil, which are indicators of the level of damage due to triglyceride breakdown and fatty acid oxidation (Ilmi et al., 2015). Meanwhile, color testing is conducted to assess the visual appearance of the final product. At PT XYZ, the cooking oil produced is generally packaged in bulk (large volume).

Bulk cooking oil has significant differences compared to packaged cooking oil. The main difference lies in the stages of the production process, where in packaged cooking oil additional filtering is carried out using *polishing cloth* before the product is packaged. In addition, packaged cooking oil is also added with additional ingredients in the form of vitamin A to increase the nutritional value of the product. On the other hand, bulk cooking oil does not experience additional ingredients, but is still suitable for consumption. According to Widayat and Haryani (2006), bulk cooking oil has a higher fat and oleic acid content compared to packaged cooking oil. However, the use of bulk oil remains safe as long as it is not used excessively and is not used repeatedly until it changes color to blackish.

ISO 9001:2015 is an international quality standard developed by the International Organization for Standardization (ISO), a non-governmental organization that formulates various global standards. ISO 9001:2015 is a quality management system designed to help organizations consistently meet customer needs and drive continuous performance improvement. This standard provides a framework for organizations to manage the quality of products and services, while continuously improving customer satisfaction and operational process effectiveness.

The implementation of ISO 9001:2015 aims to support organizations in achieving the following strategic aspects:

1. Ensuring customer satisfaction – By consistently meeting customer needs, expectations and requirements, organizations can maintain and increase customer confidence in the products or services provided.
2. Improving product and service quality – Through a process-based approach and the principle of continuous improvement, product and service quality can be continuously improved to meet expected standards.
3. Optimizing organizational performance – Implementing a Quality Management System enables company operations to be more systematic, measurable, and capable of experiencing continuous performance improvements.
4. Strengthening business competitiveness – In a competitive business environment, the implementation of ISO 9001:2015 serves as a strategic tool to increase customer satisfaction while ensuring compliance with applicable regulations and rules.

Seven Basic Principles of ISO 9001:2015:

Based on the ISO 9001:2015 standard, the quality management system is built on seven main principles that form the basis for its implementation, namely:

1. **Focus on Customer**
   Organizations are expected to be able to thoroughly understand customer needs and expectations, then strive to meet them, and if possible, exceed those expectations.
2. **Leadership**
   Top management has the responsibility to demonstrate strong leadership, provide clear direction, and build a shared vision in order to achieve the established quality objectives.
3. **Personnel Involvement**
   Employees are seen as an important asset of the organization. In the context of ISO 9001:2015, all personnel are actively involved and empowered to contribute to the continuous improvement of organizational performance.
4. **Process Approach**
   Every activity and resource is managed as part of an interrelated process, so that the results achieved are more efficient, consistent, and in line with expectations.
5. **Continuous Improvement**
   Organizations must continually seek and implement improvement opportunities to enhance customer satisfaction and address stakeholder needs.
6. **Data Based Decision Making**
   Every important decision taken by an organization should be based on valid data and verifiable information, not just guesswork or intuition.
7. **Relationship Management**
   The long-term success of an organization is greatly influenced by harmonious and mutually beneficial relationships with external parties, such as suppliers, business partners, and other stakeholders.

Benefits of Implementing ISO 9001:2015:

Implementing ISO 9001:2015 can provide various strategic benefits for organizations, including:

- Increase customer satisfaction and loyalty levels.

- Optimizing the effectiveness of business processes and operational activities.
- Reduce costs due to production errors, wasted resources, and the need for rework.
- Maximize the use of existing resources efficiently.
- Increase awareness and commitment to quality among all employees.
- Minimize risks and prevent more complex problems from arising in the future.
- Building a positive corporate image and strengthening reputation in the eyes of stakeholders.

RESEARCH METHODS

This study applies a descriptive approach using a case study method that focuses on the internal laboratory at one of the cooking oil factories, namely PT XYZ.

❖ **Data Collection Technique:**

1. Direct observation was conducted to monitor the product quality testing process both before and after the implementation of the Quality Management System (QMS).
2. Structured interviews were conducted with various stakeholders, including laboratory analysts, supervisors, and quality managers to obtain in-depth information regarding system implementation.
3. Document analysis, namely a review of quality documents and laboratory test results reports over a period of one month.

The data obtained were analyzed descriptively and comparatively, by comparing the conditions before and after the implementation of SMK. Efficiency evaluation was carried out based on waste indicators, rework costs, and waiting time duration. Meanwhile, the quality aspect was measured based on the percentage of products that met the established quality specifications.

❖ **Indicators Analyzed:**

In this study, there are several main indicators analyzed to evaluate the impact of implementing a Quality Management System, namely:

1. **Test Duration Time** : measures the efficiency of the time required in the laboratory testing process.
2. **Frequency of analysis errors per month** : reflects the level of accuracy of test results and the effectiveness of the quality control system.
3. **Amount of test material consumed** : used to assess the efficiency of resource use in each test process.

RESULTS AND DISCUSSION

Characteristics of PT. XYZ Cooking Oil

Cooking oil produced by PT XYZ has met the applicable quality standards. The assessment of the quality of this product is not only based on its chemical composition, but also includes physical or visual characteristics. Fitriyono (2014) stated that cooking oil should not have a pungent odor and should have a neutral aroma. The yellowish to reddish color of the oil usually comes from carotenoid pigments that are dissolved in the oil content.

Cooking oil products from PT XYZ show physical characteristics that are consistent with the reference, especially in terms of odor, taste, and color. The oil does not have a sharp aroma and tends to be neutral, which is the result of the filtration

process *using* the Niagara filter in *the Refining Plant unit* . This process effectively removes additional compounds carried over during the initial processing of crude palm oil (CPO), resulting in a purer and safer final product for consumption.

In terms of taste, PT XYZ cooking oil is also bland, without a striking taste, because non-oil ingredients have been separated during the filtering stage. The color of the oil produced varies depending on the carotene content in the CPO raw material used.

To ensure the conformity of cooking oil color with quality standards, PT XYZ uses the *Lovibond Tintometer tool* . This tool works on the principle of visual observation through a lens like a microscope, and measures color based on four scales, namely red, yellow, blue, and neutral. This measurement helps maintain product quality consistency, especially from the aspect of visual appearance which is important in consumer perception.

PT. XYZ Cooking Oil Quality Standards

Standards are specification documents prepared through mutual agreement between interested parties, based on scientific knowledge, technological developments, and practical experience aimed at improving product safety and quality aspects. These documents are generally approved by authorized institutions at the national, regional, or international levels (Hurst, 2006). In the context of cooking oil quality control, quality standards serve as a reference to ensure that the product is safe for consumption.

In Indonesia, one of the main guidelines in determining product quality is the Indonesian National Standard (SNI). SNI is a general reference for various domestic products, including cooking oil. In addition, international quality standards are also used, such as the PORAM (Palm Oil Refiners Association of Malaysia) standard, which is commonly applied in the cooking oil industry in Malaysia and Singapore.

PT XYZ adopts two quality standard systems, namely:

- PORAM standards, which are used as guidelines for export products, and
- The company's internal standards, which are applied in the distribution of products to the domestic market.

Quality control is carried out by a periodic sampling method every hour of the fractionation process. Olein samples taken from the membrane filter line are then tested in the laboratory for various quality parameters, including:

- FFA *(Free Fatty Acid)*
- M&I *(Moisture and Impurities)*
- IV *(Iodine Value)*
- *Melting Point*
- PV *(Peroxide Value)*
- *Colour (* Colour *)*

Each of these parameters has an important role in assessing the characteristics of cooking oil, such as product stability, visual clarity, resistance to oxidation, and level of safety for consumption.

The analysis process is carried out by the laboratory team with a sampling procedure from the results of the filtration process in the Fractionation Plant unit. Olein samples are collected from the *membrane filter outlet* , which are then analyzed periodically every hour. Laboratory testing of these quality parameters is very important to ensure that the cooking oil produced by PT XYZ meets the established quality standards, both for local and export needs.

Cooking Oil Quality Testing Parameters at PT XYZ:

1. Free Fatty Acid (FFA)
   FFA testing aims to measure the levels of free fatty acids contained in cooking oil. An increase in FFA values generally indicates degradation of oil quality due to the hydrolysis process. A high FFA value indicates that the oil has been damaged and has an impact on quality degradation. Conversely, a low FFA value indicates better oil quality. High FFA content in oil can also cause irritation, such as an itchy throat when consumed.
2. Moisture & Impurities (M&I), This parameter consists of two main components:
   - Moisture, which is a test to determine the water content in cooking oil. High water content can accelerate oil damage through hydrolysis reactions. Therefore, the lower the water content, the better the stability and quality of the oil.
   - Impurities, which is a test to identify the content of dirt or foreign substances in oil. The lower the level of impurities, the higher the quality of cooking oil. Oil with a low M&I value tends not to spark when heated, making it safer to use.
3. Iodine Value (IV)
   This test is conducted to determine the level of unsaturation of fatty acids in cooking oil. A high IV value indicates that the oil has a greater level of unsaturation, which usually keeps it liquid and clear at low temperatures. Conversely, a low IV value indicates that the oil tends to solidify and appear cloudy at low temperatures.
4. Melting Point (M.Pt ^{o}C)
   Melting point is a parameter that indicates the melting point of cooking oil. The lower the melting point, the faster the oil heats up when processed. This has an impact on the time efficiency in the heating process.
5. Peroxide Value (PV)
   The peroxide value is used to assess the level of oxidation that occurs in unsaturated oils due to exposure to air. PV is the main indicator for assessing oil damage due to oxidative reactions. The smaller the PV value, the better the quality of the oil. Conversely, a high PV value indicates that the oil has been damaged and is not suitable for long-term consumption.
6. Colour
   Cooking oil colour testing is conducted to evaluate the visual appearance influenced by the quality of CPO raw materials and the effectiveness of the bleaching process, including the use of *bleaching earth (BE)* . This test is conducted using a Lovibond Tintometer, which can measure colour based on visual observation through a lens, with colour scale indicators such as red, yellow, blue and neutral.

Implementation of Quality Management System in PT XYZ Laboratory:

1. **Improved Testing Accuracy**
   Through the implementation of the Quality Management System, the laboratory routinely carries out equipment calibration activities and validation of test methods. These efforts have increased the accuracy of test results by up to 20%. Higher accuracy contributes to a decrease in the number of products that do not meet specifications and more appropriate use of raw materials.

2. **Time Efficiency and Cost Savings**
   SMK supports early detection of non-conformities in the production process through data-based monitoring. This speeds up analysis and decision-making time from 8 hours to just 3 hours. In addition, a 7% decrease in production costs per quarter was recorded as a result of the efficiency achieved.
3. **Human Resources Competency Improvement**
   Ongoing training programs for laboratory analysts have improved understanding of quality procedures and awareness of the importance of record keeping and documentation. As a result, there has been a decrease in the rate of human error.
4. **Impact on Production Performance**
   With a strengthened quality control system, the frequency of retesting and the number of rejected batches can be minimized. The direct implication is a 12% increase in production *throughput* within one month of implementing SMK.
5. **Discussion**
   Improving the quality of the testing process in the laboratory also supports faster and more accurate decision making. This is possible because the SMK requires systematic documentation, scheduled calibration procedures, and regular training. Through the implementation of the SMK, companies are able to ensure product conformity with quality standards, reduce operational costs, and increase customer satisfaction and competitive advantage in the market.

CONCLUSION AND SUGGESTIONS

CONCLUSION

Based on the research results, it can be concluded that the implementation of the Quality Management System referring to ISO 9001:2015 in the laboratory of PT XYZ's cooking oil factory has a significant positive impact. This system has succeeded in improving product quality, reducing waste and operational costs, and accelerating the overall work process. More than just a tool for meeting standards, the implementation of this system has proven to be an important strategy in driving continuous improvement and achieving the company's long-term vision.

SUGGESTION

1. Other companies in the food industry sector are advised to adopt an ISO-based quality management system as an effort to increase competitiveness and product quality assurance.
2. Routine evaluation and ongoing training are required to maintain consistency in the implementation of the quality system.

The implementation of digital systems in the testing and documentation process in the laboratory is expected to increase efficiency and accuracy in the long term.

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