Analysis of Crude Palm Oil Production Yield Results at AA Company

Aulia Ishak\textsuperscript{1} and Michael\textsuperscript{2}

\textsuperscript{1,2}Department of Industrial Engineering, Faculty of Engineering, Universitas Sumatera Utara, Medan, Indonesia

Email: michaelpan1218@gmail.com aulia.ishak@usu.ac.id

Abstract. Company can not be separated from the production process in carrying out its business activities. Therefore, the company strives for the production process to be carried out properly, economically, and to prevent obstacles to the company's operations. In the production process carried out by AA Company, production operations are the responsibility of the Refinery and Fractionation division. Observations were made at the Refinery Plant 1, where the division has an interest in carrying out a production schedule related to the processing of Crude Palm Oil (CPO) into Refined Bleached Deodorized Palm Oil (RBDPO) with commerce. Based on field observations, one of the problems that occurred was the RBDPO yield target that was not reached. The company set an RBDPO yield target of 94.50%. But in practice, the yield of RBDPO produced is still below the target set. The idea of problem-solving provided is to analyze the root cause of the problem with Cause and Effect Diagrams, analyze the magnitude of potential failures in the process by using Failure Mode Effect Analysis and provide alternative corrective actions using the 5W + 1H method.

1. Introduction

AA Company is a company engaged in CPO processing by producing palm oil products and their derivatives. The business process in this company is divided into two aspects of marketing, namely B to B (Business to Business) which is marketing products to other industries to be used as raw materials and B to C (Business to Consumer), namely selling products directly to consumers through the market (market). In the production process carried out by AA Company, production operations are the responsibility of the Refinery and Fractionation division. On the off chance that the consequences of QC tests can't satisfy the acknowledgment models, the aftereffects of examination of the entire arrangement of the estimations on that day must be eliminated or should be re-dissected, and an incomplete or full re-approval of the strategy considered [8].

Observations were made at Refinery Plant 1, where this division has an interest in carrying out production schedules related to the processing of CPO to RBDPO with commerce based on the schedule determined from the Production Planning and Inventory Control (PPIC) division. Based on field observations, one of the problems that occurred was the RBDPO yield target that was not reached. The company set an RBDPO yield target of 94.50%. But in practice, the yield of RBDPO produced is still below the target set. Therefore, the purpose of this research is to analyze the root causes of the problems that cause the targets not being achieved and recommended actions that can be given to improve company performance.
2. Research Methodology
Data used in the analysis of field phenomena and problem-solving consists of:

- **Secondary Data**
  Secondary data is data obtained from existing sources. The secondary data used is Refinery Plant 1 production data provided by the production division.

- **Primary data**
  Primary data is data that comes from direct observations. The primary data used is FMEA assessment data obtained through candid interviews with supervisors, operators, and production department helpers.

2.1. Cause and Effect Diagram
A causal diagram is a diagram that shows the relationship between cause and effect [1]. This causal diagram is often also referred to as a Fishbone Diagram because it looks like a fish's skeleton, or the Ishikawa Diagram (Ishikawa diagram) because it was first introduced by Prof. Kaoru Ishikawa [2]. A causal diagram can be used for the following needs:

- Help identify the root cause of a problem
- Help generate ideas for solutions to problems
- Assist in further investigation or fact-finding

2.2. Failure Mode and Effect Analysis (FMEA)
FMEA is a structured procedure to identify and prevent as many failure modes as possible. FMEA is used to identify the sources and root causes of a quality problem [3]. A failure mode is everything that is included in the defect/failure in the design, conditions outside the specified specifications, or changes in the product that disrupts the function of the product [4]. The RPN (Risk Priority Number) is the product of severity, event, and detection times, namely:

$$RPN = \text{Severity} \times \text{Occurrence} \times \text{Detection}$$  \hspace{1cm} (1)

A high RPN value will help consider corrective actions in each failure mode.

2.3. 5W + 1H Method
Alternative corrective actions are prepared to improve the parameters that have been identified previously. Alternative efforts are made using the 5W + 1H method [5]. The method includes questions:

- **What**, what corrective action will be taken to eliminate the disability.
- **Where**, where the corrective action to eliminate the disability will be done.
- **Why**, why does the disability occur so that a way is found to correct the disability.
- **Who**, who will be responsible for corrective actions to eliminate the defects committed.
- **When**, when is the time to carry out repairs to eliminate disability.
- **How**, how corrective actions to eliminate the disability is done.

3. Results and Discussion
Based on the results of the analysis in the field, several main factors are causing the capacity target in the form of RBDPO yield not to be achieved, namely as follows:

- Operators are less reliable in machine settings
- The operator does not focus when working
- High FFA content in CPO
- CPO flow retained in the filter
- The filtration process tends to be long
- The duration of the repair process carried out
- The final heating temperature of the BPO did not reach the target

These factors are then incorporated into cause and effect diagrams for root cause analysis. FMEA analysis is then performed based on the cause of the problem to determine the priority problem solving that must be done [6].

**Table 1.** Problem resolution priority values RBDPO capacity/yield does not reach target

| Part / Process Function | Potential Failure Mode | Potential Effect of Failure | Severity | Potential Causes/Failure Mechanism | Occurrence | Current Design Controls | Detection | RPN |
|-------------------------|------------------------|-----------------------------|----------|-----------------------------------|------------|------------------------|-----------|-----|
| Operators               | The difference in processing time by machine | 7 | Lack of training received | 5 | Providing training to operators | 3 | 105 |
| Human                   | The operator does not focus when working | Low productivity | 6 | Lack of coordination between operators and helper | 6 | Supervision by SIC | 7 | 252 |
| Raw material            | High FFA content in CPO | The production process takes a long time | 7 | The heater in the storage tank is not working properly | 5 | Check through the monitor | 5 | 175 |
|                         |                         |                             |          | Lack of strict application of raw material acceptance standards | 6 | Sorting by logistics | 6 | 252 |
|                         |                         |                             |          | The CPO used is the result of a remelt | 5 | There is no control | 6 | 210 |
| Machine                 | CPO flow retained in the filter | The production process is hampered | 6 | The number of impurities contained in CPO | 7 | Sorting by logistics | 5 | 210 |
|                         |                         |                             |          | Strainer not cleaned regularly | 5 | Maintenance is done when there is no production process | 6 | 180 |
|                         | The filtration process tends to be | The production process takes a long | 6 | Lack of routine replacement of leaf filters | 5 | The helper does the replacement | 3 | 90 |
| Work Method | Problem | RPN Value |
|-------------|---------|-----------|
| 011 | Maintenance is done when there is no production process | 168 |
| 012 | Maintenance is done when there is no production process | 96 |
| 013 | Giving a briefing before work | 90 |
| 014 | Check through the monitor | 288 |
| 015 | There is no control | 112 |
| 016 | Providing training to operators | 72 |
| 017 | Providing training to operators | 140 |
| 018 | Supervision by SIC | 175 |

Based on Table 1 above, several problems have an RPN value above 250 and must be a priority of completion, namely the operator does not focus when working due to lack of coordination between the operator and helper, the high FFA content in CPO due to the lack of strict application of the standard for receiving raw materials and the final heating temperature of the BPO does not reach the target caused by the HP Boiler sensor has a problem. The preparation of an improvement plan for the question above uses the 5W + 1H method, which can be seen in Table 2.
Table 2. Corrective action with 5W + 1H method

| What | Where | Why (Root of the Problem) | Causative factor | Cause of Occurrence | Who | When | How |
|------|-------|---------------------------|------------------|---------------------|-----|------|-----|
| RBDPO Capacity / Yield Does Not Reach Target | Raw material | Lack of strict application of raw material acceptance standards | Logistics | When receiving and sorting raw materials | Ensure the sorting and receiving of raw materials are following the standards |
| | Production Floor | Lack of coordination between operators and helper | SIC | During the production process | Add communication equipment (handy talkies) |
| | Human | Problem with HP Boiler Sensor | Operator | During the production process | Carry out continuous improvement and maintenance |

The following is an explanation of the proposed improvements given based on the root of the problem:

- Ensure the sorting and receiving of raw materials are following the standards
  In processing CPO, AA Company not only received material supplies from Asian Agri, which is an RGE oil palm plantation. But to meet the demands of ever-increasing market demand, AA Company also cooperates with several suppliers who can supply raw materials in the form of CPO. Under certain conditions, companies continue to receive substandard raw materials to meet production targets. However, the FFA content in CPO, which is still high, will disrupt the production process and result in RBDPO results obtained are not optimal. For this reason, it is recommended that companies, especially the logistics department, ensure that the raw materials to be received have met the established standards [7].

- Add communication equipment
  Based on the results of the analysis in the field, operators often experience fatigue when carrying out the refinery process. This is because the operator is required to check and carry out repairs themselves to the engine in the field as well as monitor the state of the tank from a computer screen. Even though the operator in carrying out their duties can ask for help from the helper to overcome the problems that arise in the field. However, due to a lack of coordination between the operator and the helper, the helper is not in position when needed by the operator. Therefore, it is proposed to add communication tools in the form of handy talky (HT) held by the helper, so that the operator can communicate directly with the helper in an urgent situation.

- Carry out maintenance and continuous improvement
  HP Boilers are one crucial component in the refinery process. Its function is to produce steam (steam), which will be used by Final Heater to heat the BPO to reach temperatures of 260-265oC. The purpose of this heating is so that the bonding of free fatty acids (fatty acids) with BPO weakens so that it can be pulled easily by a vacuum. Besides, heating BPO also aims to eliminate beta carotene contained in BPO so that it has a colour that matches the standard. Based on observations made, HP Boilers have sensors that aim to adjust the temperature and pressure of the steam produced. However, the sensors used are still often problematic so that the final temperature of heating the BPO has not been reached. For this reason, it is
recommended that periodic repairs and maintenance be carried out so that the sensor can work better.

4. Conclusions
The results of the field analysis show that there is an indication of a problematic production process in terms of quantity (throughput) in the form of the RBDPO yield target that has not been reached. Several main factors cause the RBDPO yield target has not been reached, i.e., the operator is less reliable in setting the machine, the operator does not focus when working, the high FFA content in CPO, CPO flow is stuck on the filter, the filtration process tends to be long, the length of the repair process is carried out the final heating temperature of the BPO does not reach the target. Based on the analysis using the Cause and Effect Diagram and FMEA, the root of the problem that needs to be prioritized is the solution lack of strict implementation of the standard for receiving raw materials in the form of CPO, lack of coordination between the operator and the helper and the HP Boiler sensor is problematic.

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