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Analysis of Quality Control of Emulsion Flavor Products Based on Stability Properties in Product Applications at PT. XYZ flavours

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ABSTRACT

PT. Flavors XYZ is one of the multinational company in producing flavors and fragrances as raw materials for consumer goods production. PT. Flavors XYZ producing several types of flavors including liquid flavors, powder flavors, and tobacco flavors which are used as ingredients in food, beverage, and cigarette industry. Quality control and assurance is a feature that affects products to be well received by consumers. Quality control and assurance is necessary to ensure products meet the quality standard. Emulsion flavors is one type of flavor produced by this company. The instability is commonly observed in emulsion flavors products, hence the quality control division conducts the surveillance for several days (5 to 7 days) to ensure the product is stable until the expiry date when applied to beverage products. The corrective action which is conducted in emulsion flavors production refers to analysis of cause-effect diagram by detecting the causes of deviations that may affect the quality of products. Those factors including machine, man, material, method, and environment. The methods which are used for fixing problems including machine reparation, re-adjust the configuration settings, and conduct the raw materials replacement of emulsifier which is used in orange emulsion type JJ.

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1. INTRODUCTION

The development of science and technology has made developments in various industries increase rapidly, one of which is an industry engaged in the consumer goods sector. Various companies compete to produce products to become market leaders. The increase in the number of industries in the consumer goods sector has resulted in an increase in market demand for raw materials. This is the background for producers in the field of raw materials to compete to produce quality products in order to gain a position in the market share. Therefore, quality control and supervision of the production process is very influential in determining the competitiveness and position of a product in the market share. One example of an industry that is growing rapidly today is the food industry. In the food industry,

PT. XYZ Flavors is a multinational company engaged in the supply of raw materials engaged in the consumer goods sector. Products produced from PT. Flavors XYZ are flavors which are raw materials related to aroma and taste which are used as food additives and cigarettes. Fragrances are non-food raw materials used as fragrance seeds to produce perfumes, personal care and

household care ingredients. The products produced by PT. Flavors XYZ is the product behind the production of consumer goods that affects people's daily lives, so the products produced must be safe for consumption and safe for the environment as well as of high quality.

PT. Flavors XYZ is a multinational company engaged in the production of flavors and fragrances, which has its headquarters in the United States. Flavor is a raw material related to aroma and taste which is used as an additive to food and cigarettes. The company is headquartered in the United States and has employees of more than 5000 people spread across the world in 65 locations and 33 countries covered in 4 regional areas namely North America, Latin America, Far East Asia or Asia Pacific and Europe - Africa - The middle East. Indonesia is included in the Asia Pacific region.

In producing a product or service, assurance and quality control are needed to ensure that the production process meets predetermined standards so as to produce a quality product. Quality control is carried out from the selection of raw materials to the final production process to ensure that the product development process goes well and ensures the quality of the products produced in order to produce quality products that meet predetermined standards.

Flavor or taste is the sensation produced by food ingredients when placed in the mouth, especially those caused by taste and smell. So there are 3 (three) components that play a role, namely smell, taste, and mouth stimulation. The study of flavor can be explained as follows: - The composition of food and compounds that give "taste" and smell. - The interaction of these compounds with receptors for taste and smell organs where the resulting signal is carried to the central nervous system to give effect to flavor (Zuhra, 2006).

There are various types of flavors produced by flavor houses, one of which is an emulsion type flavor. The application of emulsion flavors is often found in the manufacture of soft drinks. However, the quality of the emulsion flavor must be considered because it is susceptible to instability which can affect the appearance of the soft drink products that are made. Parameters that can indicate the stability of the emulsion product are particle size, turbidity, and the rheological properties of the material. To maintain product quality, quality control is carried out from the selection of raw materials to the final product, so that if there are problems that may result in quality deviations in the product, the root cause of the problem can be traced as an evaluation for further improvement of the production process.

2. METHOD

2.1 Place and Time of Implementation

This internship program is carried out in the Quality Control division (Flavors Division), Operations department, PT. XYZ flavours. This company is one of the companies that produces products in the form of flavors and fragrances for the production of consumer goods. This internship program was held for five months in the period January 19 2015 – June 30 2015.

2.2 Apprentice Implementation Method

This internship activity will be carried out by: 1. Following the company's routine activities with a schedule of activities that have been prepared by the field supervisor and acting as a trainee. 2. Conduct discussion activities with expert staff and make direct observations in the field. 3. Conduct a literature study as a reference for comparison between the data obtained in the field and the existing theory. 4. Perform data collection and data analysis in accordance with the directions of the field supervisor. 5. Make a special assignment as the final report of the internship.

2.3 Internship Activity Data Retrieval Method

In general, research methods and data collection in this internship activity: observation and identification of existing problems, observation and data collection, detection of factors that may affect results, analysis of improvement methods to be used, taking action on the results of analysis of improvement methods.

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 Emulsion Flavor Quality Control at PT. XYZ flavours

Quality control carried out at PT. Flavors XYZ includes quality control of raw materials, production processes, final products, and during the storage process

a. Raw Material Control

Raw materials obtained from suppliers are tested for the quality of these raw materials. The control process is carried out by two methods, namely the direct method by means of direct testing by the quality control department, and indirect checking, namely by examining specifications and quality certificates or Certificate of Analysis (COA) from raw material suppliers who have been tested completely. accompanied by standard relative density or Specific Gravity (SG) values, refractive index (Refractive Index), color, and odor (Marciano, 2003). The company's Quality Control party conducts a physical inspection of the material and matches it with the standard raw materials used previously and with the inspection sheet. The inspection sheet contains about 40 item information consisting of the item name, batch number, product code number,

The selection of raw materials for emulsifiers with the types of corn starch and purity gum was carried out by conducting experiments to make small-scale emulsions for each batch of raw materials to be used. The experiment was started by making a water phase, with an emulsifier ratio of 33%, 2% sodium benzoate and 2% citric acid, the mixture was then blended at high speed for 5 minutes. After finishing blending, the mixture is separated into 2 containers, one of which is made into an emulsion by mixing oil mixed with ester gum when blended and the result is put in the oven at 50o for 24 hours, the rest of the water phase is left for 24 hours. After 24 41 hours, the resulting emulsion mixture was removed from the oven and observed. if there is a separation between the oil phase and the water phase exceeding 25%, the QC party must give the emulsifier batch a reject status so that it is returned to the supplier. For the water phase which has been allowed to stand for 24 hours then the viscosity value is measured. The standard value of the viscosity of the raw material received is 30 cPs – 60 cPs.

b. Emulsion Production Process Quality Control

The production process is carried out using materials that have passed the qualification of the quality control section during the raw material quality inspection. Quality control during the production process is carried out by examining the sanitation of the work environment and workers. Workers are required to wear special clothes, cover their hair, masks, wash their hands with soap or alcohol so that the conditions for the production process remain sterile. Sanitary inspection of the work environment includes the work tools used, the production room to avoid microorganism contamination. Sanitation inspection of the company's work environment is carried out by means of a swap test once a week. The production equipment used is checked and routinely so that the calibration used is correct, the equipment works optimally (such as in the process of compounding, stirring, homogenizing, to the packaging process) and ensure that there is no damage, tool setting errors, or leaks so that production results are optimal. This effort is made to maintain the quality of the final product so that it is optimal.

After these specifications are in accordance with QC standards, the production team begins to continue making prehomo. Making this pre-homo aims to stabilize the emulsion by lowering the interfacial tension between the two layers, namely the oil phase and water phase layers so that the particle size becomes smaller and the particle distribution is more uniform so that it will make it easier to break up the particles and facilitate the next homogenization process so as to get better results. wanted. The pre-homo process is carried out until it reaches the particle size.

c. Quality Control of Emulsion End Product Process

For each batch of emulsion produced, the production team must submit samples to QC. These samples include water phase samples, oil phase samples, pre-homogenized samples, first to third homogenization samples (depending on product specifications). Testing of water phase samples includes testing the value of pH, viscosity, specific gravity, and refractive index values. Analysis on the pre-homo sample included pH and viscosity, on the sample after homogenization (pass 1, pass 2, and so on) the parameters analyzed were pH, viscosity, specific gravity value, and turbidity value 44 (turbidity).

After making the water phase and oil phase according to specifications, the next stage of manufacture is pre-homo production. In pre-homo preparation, the particle size is controlled to produce a particle size of <1.5%. After reaching this size, the pre-homo sample is submitted to QC for analysis. The parameters analyzed in the pre-homo samples were viscosity and pH. The pH value of the pre-homo sample is generally almost the same as that of the sample after homogenization. Viscosity values between pre-homogenized samples and after homogenization are generally different. The viscosity value of the sample that has been homogenized is greater,

this is because the particle size in the sample at the pre-homo stage is larger than the sample that has undergone homogenization.

In the homogenization process, pass 1 homogenization, pass 2 homogenization, and so on. The number of homogenization passes depends on the specifications submitted by the customer. Emulsion flavored products should be stored in a cool place. Viscosity value is one of the parameters that must be analyzed before the product is sent to the customer. The viscosity value between homogenization pass 1 is smaller when compared to homogenization pass 2, the greater the homogenization pass, the viscosity value will increase. This happens because there is a reduction in particle size from the process of each homogenization pass which results in an increase in the viscosity value. In addition, the number of homogenization passes used can increase the stability of the emulsion (Jost, et al., 1986).

3.1.2 Identification Regarding Deviations in the Quality of Emulsion Flavor Products

Quality improvement can be initiated through the identification of quality problems that occur or opportunities for improvement that might be made (Gaspersz, 2007). Identification of product quality deviation problems is carried out by observing problems that often arise. According to Zhang (2011), the problems that are often encountered in the production of emulsion flavors for soft drinks are creaming (or commonly called ringing, namely the formation of a whitish ring above the neck of the syrup tube), sedimentation, and coalescence processes. During the peak season (i.e. from March to April), the production of flavor emulsion in the largest capacity is the production of orange emulsion or OE (with product code AA and CC) and non-citrus cloudifier emulsion (with product code JJ).

Before the goods to the customer, the QC must ensure that the product is of good and stable quality. Therefore the QC observes it for 5 to 7 days before the goods are sent. This was done because in the previous observation the particles moved quickly on the 3rd to 7th day after the production process, after the 7th day the particle movement began to slow down. This observation was carried out by checking each batch of products that have been produced every day for several parameters of the final product checking procedure, namely the stability test (in the form of a ring test by centrifugation separation and making flavor samples of 48 emulsions which were applied to the sweetener solution that was left to stand), inspection viscosity values, and particle size checks.

a. Observations with Viscosity Value Measurements

Emulsion stability can be determined by the process of creaming, flocculation, and coalescence. The process of changing the properties of the emulsion which can cause creaming, flocculation, and coalescence processes can be observed by measuring the particle size distribution and measuring the viscosity of the emulsion phase (Huang et al., 2001). Observations by measuring the viscosity are carried out every day on samples for 5 days before the product is sent to the customer.

The indicated viscosity values are varied. The high viscosity value is influenced by the nature of the hydrocolloid used as a stabilizer. Based on the data in the table, it can be seen that the viscosity of the product in each batch has a different range of values. This is due to the use of several stabilizers with different types. The viscosity value in each batch is very fluctuating. The greater viscosity value is thought to be due to the formation of lumps so that before measuring the viscosity of the emulsion sample it must be poured from one container to another repeatedly.

Table 1. Observation Data of Emulsion Flavor Viscosity Value

Jenis Emulsi	Tanggal Produksi	Nilai Viskositas (cPs) Hari Ke-							
		0	1	2	3	4	5	6	7
AA1612	20/3/2015	430			490	420	420	440	430
AA1643	21/3/2015			360	350	380	370	360	350
AA1654	22/3/2015		280	280	300	290	280	270	
AA1705	24/3/2015	460	460	440	420			420	400
AA1716	24/3/2015	300	300	290	280			280	270
JJ1211	25/3/2015	330							
JJ6782	25/3/2015	700	680						
JJ8853	26/3/2015	340	320						
AA1677	26/3/2015	330	330			320	310	310	
AA1749	27/3/2015	260			260	250	250		
JJ6864	7/4/2015	650	640						
JJ6945	9/4/2015	680							
JJ7956	9/4/2015	760							
CC1981	11/4/2015	580		580	570	560	550		

The data shows that the lower the viscosity value from day to day, the product is suspected to be unstable and can also be proven by treatment with the ring test. This happens because at a low viscosity, the dispersed phase (droplets) will easily move in the dispersion medium so that the chances of collisions between fellow droplets are higher and the droplets will tend to coalesce into larger particles and agglomerate (Kailaku, et al. 2012). According to Jost, et al., (1986), the storage factor also affects the viscosity of the emulsion. The longer the product is stored the lower the viscosity. This is due to the presence of protonization which can cause a decrease in the binding power of the stabilizer and supports the opening of the polymer configuration.

b. Observation with Stability Test

One form of observation made to identify problems that occur in the production of flavored emulsions is to perform a stability test. The first form of stability test is to make flavor emulsion samples that are applied to a sweetener solution, this is done to find out whether the product is stable or not after being applied and not given separation treatment. The second form of stability test is to carry out gravity separation by means of centrifugation or commonly called a ring test. The gravity separation process can speed up the creaming or ringing process (Arora, 2009).

Table 2. Observation Data of Emulsion Flavor Products Based on Ring Test

Jenis Emulsi	Tanggal Produksi	Status Kestabilan							
		0	1	2	3	4	5	6	7
AA1612	20/3/2015	OK		OK	OK	OK	OK	OK	OK
AA1643	21/3/2015			OK	OK	OK	OK	OK	OK
AA1654	22/3/2015		OK	OK	OK	OK	OK	OK	
AA1705	24/3/2015	OK	OK	OK	OK			OK	OK
AA1716	24/3/2015	OK	OK	OK	OK			OK	OK
JJ1211	25/3/2015	*Ring*							
JJ6782	25/3/2015	OK	*Ring*						
JJ8853	26/3/2015	OK	*Ring*						
AA1677	26/3/2015	OK	OK			OK	OK	*Ring*	
AA1749	27/3/2015	OK			OK	OK	*Ring*		
JJ6864	7/4/2015	*Ring*	*Ring*						
JJ6945	9/4/2015	*Ring*							
JJ7956	9/4/2015	*Ring*							
CC1981	11/4/2015	OK		OK	OK	OK	OK		

3.1.3 Analysis of Factors Causing Emulsion Flavor Stability Problems

After the data collection process, the problems that arise in the production of flavor emulsions at PT. XYZ flavors can be identified. The problem is then discussed by the quality control, production, and process engineers. The stability problem is a problem that is prone to occur in emulsion flavor products. To prevent more product damage, a repair method is needed to prevent the problem from occurring, so that the factors causing the problem must be traced and analyzed first so that the repair method chosen is appropriate. Based on the data that has been obtained, the resulting quality of the emulsion flavor product is varied. Products of good quality and without problems are produced at the beginning of the peak season. But in the next few days, the resulting product experiences instability, which is then given a reject status by the QC. Factors that can cause quality problems and deviations can be determined by using a cause-and-effect diagram or Fishborne diagram. According to Wignjosoebroto (2006), in an analysis using a causal diagram, it is known that there are five significant main causal factors that need to be considered, namely the work environment, raw materials, work methods, people. (man), and other work machines or equipment (machine or equipment). Factors that can cause quality problems and deviations can be determined by using a cause-and-effect diagram or Fishborne diagram. According to Wignjosoebroto (2006), in an analysis using a causal diagram, it is known that there are five significant main causal factors that need to be considered, namely the work environment, raw materials, work methods, people. (man), and other work machines or equipment (machine or equipment). Factors that can cause quality problems and deviations can be determined by using a cause-and-effect diagram or Fishborne diagram. According to Wignjosoebroto (2006), in an analysis using a causal diagram, it is known that there are five significant main causal factors that need to be considered, namely the work environment, raw materials, work methods, people. (man), and other work machines or equipment (machine or equipment).

3.1.4 Identification of Main Causes of Quality Deviations and Field Trials

Based on the cause and effect analysis and the discussion process, the most important causal factors for the emergence of quality deviation problems for emulsion flavor products come from materials and machines. These two factors are then traced to be analyzed and evaluated for corrective actions that will be used to prevent quality deviations from occurring in the future.

3.1.5 Repair Method

After discussing the root causes and trials, it was decided that the repair method to be used was in accordance with the results of the trials, namely the use of machine settings as in the trial activities and the replacement of raw materials in JJ emulsion products. In addition, improvements also occurred when checking the ringing test, which was initially carried out by dissolving the emulsion with a 32o Brix sugar solution for orange emulsion and a 33o Brix sugar solution for 67 NC Cloudifier products. Checking the ringing test on JJ type emulsion products is carried out by adjusting the dosage according to what is applied by the customer to the product, namely dissolving 1% of the emulsion in a 24o brix sugar solution.

3.2 Discussion

Another parameter analyzed in the quality control of emulsion flavor production is the value of the specific gravity of the emulsion phase. According to Tan (1998) one of the parameters that can affect the stability of the emulsion is specific gravity. In accordance with Stokes' law, the difference in density between the oil phase and the sugar solution in soft drinks is the main factor that can affect the stability of the emulsion. The emulsion flavor that will be applied to soft drinks must have a small specific gravity value with the specific gravity of sugar solution for soft drinks. This aims to prevent the emergence of creaming or white ringing on the top layer of the neck, the formation of creaming occurs due to an imbalance between the density of the oil phase and the water phase so that the oil particles tend to move upwards (Taherian et al., 2008).

Measurement of turbidity or turbidity is carried out on samples that have been homogenized. The procedure for measuring turbidity is by dissolving the emulsion with a concentration of 0.2% in water. The solution is then measured using a spectrophotometer with a light wave of 450 nm. Turbidity measurement is one of the parameters that determines the quality of the 46 flavor emulsions produced according to the purpose of the emulsion being applied in soft drinks, namely giving a cloudy appearance to beverage products. The turbidity value also affects the stability of the emulsion, this can be seen from the profile of the emulsion product between pass 1 homogenization and the next pass, the turbidity value in pass 1 homogenization is greater than the next pass homogenization (for example pass 2 to pass 3). This happens because the particle size in the pass 1 homogenization emulsion is larger than the next pass homogenization (eg pass 2 to pass 3). According to Hernandez, et. al. (1991), the turbidity value of the emulsion increases with increasing particle size (with a maximum size of 0.5 μm). Turbidity measurements were carried out a maximum of 30 minutes after the concentration of the emulsion was dissolved because if the turbidity value was not measured within 30 minutes after dissolving, the average particle size value would increase so that the results would be invalid because they differ from the actual particle size. the turbidity value of the emulsion increases with increasing particle size (with a maximum size of 0.5 μm). Turbidity measurements were carried out a maximum of 30 minutes after the concentration of the emulsion was dissolved because if the turbidity value was not measured within 30 minutes after dissolving, the average particle size value would increase so that the results would be invalid because they differ from the actual particle size. the turbidity value of the emulsion increases with increasing particle size (with a maximum size of 0.5 μm). Turbidity measurements were carried out a maximum of 30 minutes after the concentration of the emulsion was dissolved because if the turbidity value was not measured within 30 minutes after dissolving, the average particle size value would increase so that the results would be invalid because they differ from the actual particle size.

Some products have specifications for a stability test which is commonly called a ringing test. The types of products that pass the ringing test are usually products that will be used for concentrated syrup drinks and not for ready-to-drink types of drinks. The stability test was carried out on the product by making an emulsion flavor sample which was applied to the sweetener solution used in soft drink products, besides that the stability test was carried out by centrifuging the emulsion flavor which was dissolved in the sweetener solution. The creaming or ringing process can be accelerated by using centrifugal action on sample application. This process is one of the processes to evaluate and predict the stability of the emulsion when applied to beverage

products (Auernhammer, 2008). The stability test process was carried out by dissolving 1 – 1.2% of the emulsion flavor in a syrup base and then centrifuging it for 20 minutes. The results of the stability test will show the level of emulsion stability in the form of a vertical line along the tube resulting from the sedimentation process. However, if a white horizontal line appears near the neck of the tube, it can be concluded that the emulsion is experiencing creaming (or it can be called ringing) and is unstable. According to Pichot (2010), the creaming or ringing process is characterized as a yellowish-white layer that is on the top layer of the emulsion. The results of the stability test will show the level of emulsion stability in the form of a vertical line along the tube resulting from the sedimentation process. However, if a white horizontal line appears near the neck of the tube, it can be concluded that the emulsion is experiencing creaming (or it can be called ringing) and is unstable. According to Pichot (2010), the creaming or ringing process is characterized as a yellowish-white layer that is on the top layer of the emulsion. The results of the stability test will show the level of emulsion stability in the form of a vertical line along the tube resulting from the sedimentation process. However, if a white horizontal line appears near the neck of the tube, it can be concluded that the emulsion is experiencing creaming (or it can be called ringing) and is unstable. According to Pichot (2010), the creaming or ringing process is characterized as a yellowish-white layer that is on the top layer of the emulsion.

For the improvement of the JJ type product, the emulsifier was replaced from modified starch purity gum to corn starch. The process of checking the ringing test on a sugar solution with a different brix can affect the results. This is because brix is directly proportional to relative density. However, after making improvements to this type of product it produced the same results both in checking using a 32o brix and 24o brix sugar solution. It can be concluded that the properties of the product are more stable in both 32o brix and 24o brix sugar solutions. Based on these data it is known that after the replacement of the emulsifier there is a difference in the results. The results of these improvements will then be used for further production. From these improvements, the process of selecting raw materials becomes more selective so that the materials used are of high quality.

4. CONCLUSION

In the internship activity with the analysis of quality control of emulsion flavor products at PT. Flavors XYZ can be concluded that: Analysis of quality control for the production of flavor emulsions applied by the company in the form of raw material quality control, production process quality control, and final product quality control. Quality control is carried out to prevent quality deviations in products that can affect customer satisfaction. In carrying out quality control, it is not only the process of analysis and measurement but also observation and experimentation that is needed to find out whether there are quality deviations in raw materials that can affect the characteristics of the final product; The quality problem of emulsion flavor products which is a priority to be discussed is the problem of stability. Quality deviations that arise in emulsion flavor products in the form of creaming or ringing which is the formation of a white ring-shaped layer on the surface due to the difference in density between the oil and water phases, this problem can be overcome by increasing the amount of homogenization or the number of passes so that the particles are more reduced and homogeneous. Based on the analysis of the cause-and-effect diagram, factors that are suspected to influence the emergence of problems or quality deviations are: a) environment, in the form of storage conditions of raw materials and final products, b) materials, in the form of selection of materials to be processed, 70 c) methods, in the form of several different treatments at each repetition, d) human, in the form of lack of accuracy and lack of knowledge about the basics of emulsion, and e) machine, in the form of engine damage where the piston delivery and homogenizing valve cannot work optimally and replacement of pump settings with manual settings so that it can have a negative impact on the final product; Based on the analysis using causal diagrams and the results of the discussion, the main root causes of product quality deviations in the flavor emulsion 3 types of products are influenced by the machine and material selection. Identification of the root of the problem is done by observing and collecting data first, which can then be decided on corrective action or remedial action so that problems do not arise at a later time. These corrective actions are in the form of component repairs and adjustments to the appropriate settings, as well as replacement of emulsifier raw materials for the JJ product type.

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Based on the observations from the internship activities carried out in the Quality Control division, the suggestions that can be given by the author are: There is a need for training for compounderers regarding the basic theories of emulsions and what factors can influence the characteristics of the final emulsion product; Preventive actions or preventive actions such as checking machine components that are used regularly are better done before the peak production season in order to prevent deviations in the quality of the final product; Choose a reliable raw material supplier vendor, if there is a replacement or addition of a new vendor supplier, a trial must be carried out on the goods received and discussions with several parties; The checking process with a ringing test is adjusted to the dosage used by the customer in product application, this aims to adjust to customer demand and to prevent the production process from being reworked as a result of the checking process not according to the customer's dosage standards; Quality control procedures and final product checking will be better if every few months are corrected if there is a change in procedures, and it is best if all QC employees, production parties, and process engineers are aware of these procedures.

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