Improvement of Shelf Life for Frozen Product

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Abstract

Consumers are increasingly demanding consistently high food quality and have corresponding expectations that such quality will be maintained at a high level during the period between purchase and consumption. Shelf life is very important in food product. Shelf is defined as time which product is safe to be consume by the consumer and product has a high quality in term of sensory, chemical, physical and microbiological. Therefore, the company needs a technology to extend shelf life of frozen product. There are several techniques and method that we proposed in order to solve the problems. Shelf life analysis are carried out involving microbiological test and chemical test to make sure better quality and prolong shelf life. Using the reducing temperature technology to extend shelf life of the product. Using new type of packaging which can eliminate moisture loss and protect the product from contamination. Impact of the study can make sure product produce by the company are safe, of consistently good quality, healthy and inexpensive; food must satisfy the palates of adventurous variety-seekers, but most not alienate traditionalists; food should be perceived as natural and fresh; and food should keep if possible whilst maintaining the required qualities.

Keywords: shelf life, packaging, temperature

1.0 Introduction

Sarimah Food Frozen Enterprise is owned by its founder Puan Sarimah binti Jaafar. Starting at the middle of 2010 the company focuses in the food processing especially in frozen food products. The company is committed to improve the quality of the frozen food products and meeting the expectation from the consumers. These expectations are a consequence not only of the primary requirement that the food should remain safe, but also of the need to minimize unwanted changes in sensory quality. The quality needs are reflected in the labelling requirements to which food manufacturers must conform (Subramaniam, 2000). Shelf life of the products can be affected by many factors such as mishandling of foods during purchasing raw material, processing product, storage and distribution (Singh, 1994). The main problem faced by the company is to find a technique to extend shelf life of pastry product longer than 6 months. This research basically is to identify and solve the problem in process flow of Sarimah's products that can cause shorter shelf life.

2.0 Literature Review

Shelf life is very important in food product. Shelf is defined as time which product is safe to be consume by the consumer and product has a high quality in term of sensory, chemical, physical and microbiological. In this situation, safety of the product in term of microbiological is very important to make sure it meets the customer perceptions. There are many factors that can influence shelf-life of the product and can be divided into two which intrinsic and extrinsic factors. Product's raw material, product formulation and structure can be categorized as intrinsic factors. Factors happen during final products are in the food chain can be categorized as extrinsic. Food products are commonly exposed to wide range of environmental conditions during storage and distribution. Oxygen, light, temperature and humidity are the example of environmental factors that can affect the shelf life of the food products. When the shelf life of the products decreases because of these factors, it can affect the consumer acceptance towards product and can be dangerous if the consumer consuming them. Therefore, it is important to develop procedures which can be using to evaluate the shelf life of the food products. Food deterioration can be led by microbiological, physical, and chemical changes. Factors that can influences growth of microorganism during storage including the physicochemical properties of the food itself such as pH, moisture content and preservatives used during the production of the food. External environment of the food also can affect the food shelf life such as surrounding gas composition and storage temperature. (Gacula, 1975)

Food deterioration can occur from reaction of food with the external species such as oxygen and reactions within the food itself. Rancidity is usually happened in the Fat-containing foods and can occur thru flavor reversion, lipolytic/hydrolytic and oxidative reactions. For fruits and vegetables can be

affected by enzyme processes and for meat shelf life can be affected by oxidation. Chemical hydrolysis can occur in products containing intense sweeteners, reducing sweetness, and non-enzyme browning can occur in many foods from Maillard reactions. Food that expose to light also can deteriorate, such as in term of color loss, rancidity and loss flavor (IFST, 1993).

Deteriorative physical changes in food commonly caused by the moisture content migration. Fresh product usually deteriorates through moisture loss such as fruits and vegetable. Dry product also can be affected, for example breakfast cereals and biscuits can lose their crispness through moisture loss. Other example is the migration of water from the vegetable component into the dressing which cause Delicatessen Salads deteriorate. Migration of moisture from surface of frozen foods also cause freezer burn to the food frozen products. Other example of migration in food which can limit shelf life of the product, such as the bleeding of colors in composite products like chilled desserts and migration of fat from one food component to another. Food product shelf life can also affect by physical changes in packaging materials, added with chemical reaction. Microbiological and chemical reaction can happen when atmosphere equilibrium change cause by permeability changes in the packaging. Migration of external volatiles into the food also can happen because of that changes resulting in the development of taint. Products with a longer shelf-life can seriously be affected by migration of chemical components from the packaging material towards the food products (Labuza, 1985).

3.0 Materials and Methods

In this study, the goals and objectives of this project will focus on methodology design, invention and technique based on latest technology that: Provides a technique to extend shelf life of frozen product for longer than 6 months to be exported overseas. Enhances the final product to meet desired quality. Provides an easy, flexible, reliable technology base for the future. Based on the problem faced by the company, there are analysis that we used to analyzed the cause towards shorter shelf life product and method that can be used to solve that problems.

3.1 Microbiological Analysis

The growth of microbial pathogens that affect the safety of the product and microbial growth, which leads to the spoilage of a food product are two important aspects to be considered in determining the microbiological stability of a product. Five samples of frozen food were collected from the company and microbiological analysis was conducted start from week 1 to week 8. Five samples were stored at freezer below -18°C. Aerobic colony counts and yeast & mold counts were conducted by using Plate Count Agar and Potato Dextrose Agar respectively. The purpose of conducting the microbiological analysis are to determine the aerobic count and yeast & mold count on each of the sample so

that the quality and the shelf life of each of the product are being monitored, tested, and placed electrode(s) in tap water or pH 7.0 buffer solutions for storage and shut off meter. (RODEL, 1993)

3.2 Sensory Evaluation Test

Sensory evaluation test is widely use as measurable concept to calculate the acceptance of the consumer towards food product. Acceptance refers to an individual experience, a feeling or an emotion with a hedonic aspect (Cardello, 1996). Sensory measures of quality changes on storage are an essential measure of perceived quality, but are expensive and time-consuming to operate. They also suffer from high variability when carried out over long time periods, requiring regular panel calibration. If valid instrumental methods are available, they can be of great value in augmenting sensory data. Acceptance of a food measured in affective sensory tests with the potential consumers of the product or services. Five products had been stored in the freezing condition which is -18°C. Every two weeks for almost three months' sensory analysis had been done to analyses whether product still can be accepted by the panelist. All types of product samples are cooked for 3 minutes using portable cooking pan in 150-degree C then prepared for serving by cutting into approximately 2.0 cm cubes. Fifty panelists were used to evaluate taste, texture, aroma, color and overall acceptance of product using 9-point of hedonic scale test. (KRESS-ROGERS, 1997)

4.0 Result and Discussion

4.1 Microbiological Analysis

Based on Figure 1, the results show that all of the products had aerobic count and yeast & mould count in the range of 102 to < 104 CFU/g. There is no standard microbial count for frozen food stated in Malaysian Food Act 1983 but study conducted by Elson et al. (2004) states that the aerobic colony counts of ≥107 cfu/g for frozen foods indicates unsatisfactory microbiological quality. Since all of the product of Sarimah frozen food is below that range, it is concluded that the product is still safe to consume until week 8. However, the presence of microbial count should be taken into consideration and further improvement should be meet to control any increases number of microorganisms during storage. The microbiological load of the frozen foods at the point of sale is influenced by factors such as handling, processing, storage and transportation. Growth of a specific microorganism during storage depends on several factors, such as the physicochemical properties of the food itself. The example of the properties is pH, moisture content, presence of preservatives and the processing method used in the production of the food. In Sarimah's food product, mostly of the product are high in moisture content which one of the main causes of the deterioration of the product. Packaging

use and storage temperature also are the problem that cause of the microbiological contamination towards Sarimah's food products.

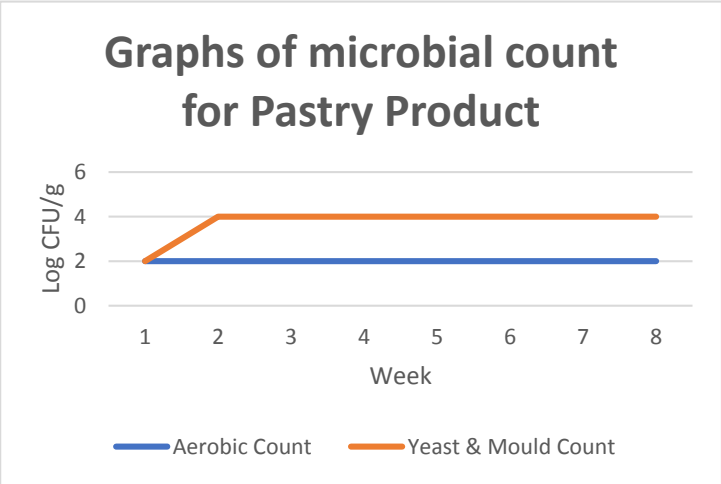

Figure 1: Graph of microbial counts, ie. Aerobic colony counts, yeast and mould counts in Pastry Product

4.2 Sensory Evaluation

From the figure 2 of sensory evaluation result show that of the majority panelist can accepted the taste, aroma, texture and color of the products. But some panelist responded that some aspect of the pastry product had been reduce, specifically their original taste and aroma. For the other products the panelist still can feel the original taste and aroma of the products. The initial quality of a food product is determined by the quality of the raw materials and the processing methods used during the manufacture of the product.

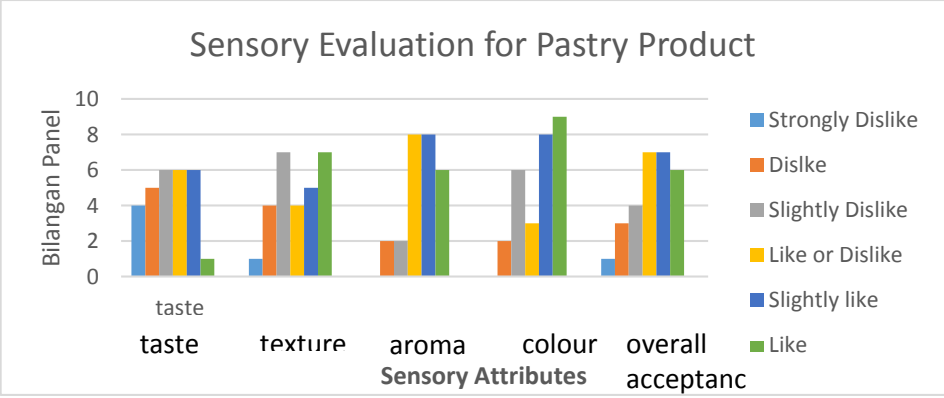

Figure 2: Graph of Sensory Evaluation for Pastry Product

4.3 Extended the Shelf Life using Packaging

In food industry, packaging is widely using to extend shelf life products. There are many factors to be considered in choosing the optimal packaging form and material for any particular product, including the product characteristics, processing considerations, shelf-life required and overall cost. In many cases, packaging is an integral part of the processing stage. Packaging also act as preservation role and it is very popular among food industry as the methods to maximize or extend product shelf life. Packaging also has several other important roles in term of make sure delivering safe and making product more attractive. Packaging must contain the products, which mean preventing leakage and make sure all the product keeping together. Leakage is not only undesirable in that it almost certainly renders the product inedible but it can also cause irrevocable and costly damage to neighboring packs and products.

For the Sarimah, product packaging plays an important role to ensure extended shelf life. This is because all foods contain certain percentage of water like pastry product. Moisture likely the most factor that can cause undesirable changes in such pastry product. Products such as pastry with low moisture content demand the use of packaging with high moisture barrier to avoid contamination. Moisture loss also critical especially if packed when still warm. It becomes an ideal condition for microbiological growth which leads to spoilage. Thus, there is a need for Sarimah product to use moisture permeable packaging material as well as those that provide a moisture barrier.

The main effect of oxygen gain on food products is to oxidase any fatty constituents, causing rancidity which can be readily detected by taste and smell even at fairly low levels. Whenever a product contains fat we can assume that an oxygen barrier is required, although the nature and content of the fat, and whether or not any antioxidants are used will determine the degree of barrier. Shortbread biscuits are a typical example of a product needing a good oxygen barrier (H, 1996).

The use of plastics in packaging has been one of the most significant developments of the late twentieth century and now accounts for 30% of the total value of all packaging materials used. Plastics packaging is the fastest growing sector, replacing the traditional materials of glass, metal and paper and board. In these examples the change to plastics has meant a reduction in the total overall cost of the product, considering the unit cost of packaging and the cost of storage and distribution. In some instances, e.g. crisps and bread, plastics have also brought increased shelf-life owing to their barrier properties. Polyethylene film bags are used for Sarimah pastry products. This type of plastic can have increased shelf life owing to their barrier properties (Paine F, 1983).

4.4 Reducing Temperature to Extend Shelf Life

Food freezing is the preservation process that depends on the reduction of product temperature to levels well below temperature to levels well below the temperature at which ice crystals begin to form within the food. By reducing the

temperature of the product to -10 c to -20 c, the normal reactions that cause deterioration of foods are reduced to negligible or minimal rates. (Hartel, 1997) In theory, the freezing process is the removal of thermal energy from the food product to the extent required to reduce the temperature below the freezing temperature of water. Freezing generally requires less time than drying or canning. It retains foods' natural color, flavor, and nutritive value.

Baked goods and many other prepared foods also benefit from the extension of shelf life associated with the reduced temperature of frozen-food storage. Reducing the temperature of a food product slows down both enzyme activity and the growth of microorganisms. Reducing to temperatures of 18 ºC and below virtually stops such activities and even kills some microorganisms, although not enough for the process to be commercially useful for this purpose. When considering how packaging integrates with either chilling or freezing as a means of extending shelf-life, it is important to understand that in this case the main method of preservation is by maintaining the correct temperature. The packaging provides more of a secondary means of preserving the product. No matter how good the barrier or how effective the pack seals, if the temperature of the product is not maintained at the required level throughout all stages in the supply chain, spoilage will occur. The packaging must withstand the temperature changes brought about by the chilling or freezing processes by remaining physically stable. This applies equally to any printing inks and adhesives used. The packaging must provide a good moisture barrier specially to protect frozen foods dorm excessive drying out like freezer burns. And adversely affects both texture and taste. Also limiting the amount of free air space in the pack by using materials that conform as closely as possible to the product shape will limit the amount of moisture trapped inside at the point of packing.

5.0 Conclusion

The findings of this study have important implications to the consumer perception Sarimah pastry frozen product has a shelf life more than 6 months. Impact of the study can make sure product produce by Sarimah company are safe, of consistently good quality, healthy and inexpensive; food must satisfy the palates of adventurous variety-seekers, but most not alienate traditionalists; food should be perceived as natural and fresh; and food should keep as long as possible whilst maintaining the required qualities. Sarimah product also become more attractive with the usage of new type of packaging. Sales of their product increase significantly with the increasing in quality. Sarimah also manage to improve their market sales.

References

Barbosa-Cánovas, G. V. (2003). Unit Operations in Food Engineering. Lleida, Spain: CRC Press LLC.

Gacula, M. C. (1975). The design of experiments for shelf-life study. Journal of Food Science, pp 399-403.

H, E. A. (1996). Fundamental of Packaging Technology. Melton Mowbray: The Institute of Packaging.

Hartel, D. R. (1997). Principles of Food Processing. US: Springer. Journal of Food Processing and Preservation, pp 252-261.

IFST. (1993). Shelf Life of Foods - Guidelines for its Determination & Prediction. London: Institute of Food Science & Technology.

KRESS-ROGERS, E. (1997). Handbook of Biosensors and Electronic Noses: Medicine, Food and the Environmen. Boca Raton: CRC Press.

Labuza, T. a. (1985). Accelerated Shelf Life Testing of Foods. London: IFST.
Paine F, P. Y. (1983). A Handbook of Food Packaging. London: Blackie.

Rodel, W. (1993). Water activity and its measurement in food. London: Cambridge: Woodhead Publishing.

Singh, R. (1994). Shelf Life Evaluation of Foods. US: Chapman & Hall.

Subramaniam, D. K. (2000). The Stability and Shelf-Life of Food. Cambridge CB1 6AH: Woodhead Publishing Limited.