ABSTRACT

DIANTA MUSTOFA KAMAL. A Model of Stepping Medium Temperature Freezing System with Exergy Method on Beef Preservation. Under the Supervision of ARMANSYAH H. TAMBUNAN, SOEWARNO T. SOEKARTO, dan RADITE PRAEKO AGUS SETIAWAN.

Beef preservation was required to maintain the quality of the product during distribution and storage. There were some common different freezing systems, such as; (1) Drying, (2) Adding chemical solution, and (3) Freezing. Among these systems, freezing system was considered the best method to keep the product fresh after thawing. By using the second law thermodynamics, the inefficiency of energy consumption on freezing system could be analyzed. The method to analyze it was known as exergy analysis.

In conventional freezing method, the product was frozen at the constant medium temperature with the great energy consumption. However, the current developing of a freezing system model with stepping system was intended to control the input of energy from the pre-cooling to the freezing stage. The stepping system was conducted with controlled medium temperature since medium temperature of freezer influenced the energy consumption.

Besides the exergy efficiency, the quality product should also be the first priority in choosing the preservation system. The quality of the product was influenced by the freezing rate. The greater the freezing rate, the smaller the size of ice crystal would be, in which it might lessen the broken cell of the product, and the product was still fresh after thawing. In contrast, the small freezing rate resulted in low quality product since the big size of ice crystals potentially broke the cell walls which lead to the harm of the product texture when thawing.

Commonly used freezers are applying conventional method that use constant medium temperature leads to great amount of energy consumption. Based on the exergy analysis, the current research created the freezing system using stepping medium temperature so that the inefficient energy of process could be analyzed. From the moment to the rest of the paper, the freezing system using stepping medium temperature will be called exergetic freezing system.

The current research developed the prototype of exergetic freezing system by modifying contact plate with multi-evaporator and product moving system in continuing tray.

The research was aimed at designing and improving a model of beef freezing system in a three-stage process, and to discuss the effectiveness of exergy and energy of the suggested model.

The underlying thought for the suggested model was the increase of exergy efficiency through the application of exergy method. The fresh beef that was straightly obtained from the butcher used as a sample product in the research. The freezing method was divided into three periods: pre-cooling, freezing, and sub-freezing. Pre-cooling is the first stage when initial temperature of product decrease until freezing point. Freezing stage is phase change of product, and the sub-freezing is the last stage when phase change temperature of product decrease until safety freezing temperature.