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Tittel: *Heat Pumping Systems for Chilling of Fish - Use of Impingement Freezer for Super Chilling*

Abstract

Superchilling is a technology with great advantages. Prolonging of the shelf life of the product, while keeping the quality, using a processing technique that increases the effectiveness of the production, will be of great value both for consumers and the industry. In this study it has been looked at superchilling using an impingement freezer. Impingement freezers are particularly suitable for superchilling. They ensure a quick and energy effective crust freezing of the product. A calculation model based on Plank's equation was derived for calculation of the freezing time when superchilling. In order to get accurate results, experiments were carried out to find the heat transfer coefficient for the impingement freezer being used. Superchilling experiments using three different cod products were carried out to test the derived calculation model.

Results from the experiments shows that the calculations were accurate for the freezing time for all three products when using a logarithmic approximation for enthalpy gradient in the ice layer. For longer freezing times the calculations were accurate within a 10% margin up to an ice fraction of 32% for both cod blocks and pieces of cod loins.

In this study there has been looked at two different freezers that is suitable for superchilling. The two was the CBC freezer from Skaginn hf and an impingement freezer (Advantec 1800) from JBT. Both freezers are good alternatives for superchilling of fish were the CBC freezer from Skaginn, which is a part of a greater process line, is especially suitable for products that need gentle handling. The impingement freezer from JBT has a great capacity and in this context it has a low investment cost.