

Title Vacuum cooling technology for the agri-food industry: Past, present and future
Author Da-Wen Sun and Liyun Zheng
Citation Journal of Food Engineering, Volume 77, Issue 2 , November 2006, Pages 203-214
Keywords Vacuum cooling; Rapid cooling; Chilling; Refrigeration; Air blast chilling; Water immersion chilling

Abstract

The principle of vacuum cooling is based on rapid evaporation of part of the moisture of the product under vacuum. Vacuum cooling can be used to shorten processing time, extend product shelf life, and improve product quality and safety. Traditionally, vacuum cooling is used in the agricultural industry to pre-cool leafy vegetables and mushroom in order to rapidly remove field heats. Recently, vacuum cooling has been applied to cool viscous food products and bakery products in the food industry, and tuna in the fish industry.

Food safety concern has driven cooked meat manufacturers to explore new method to reduce cooling time, which has consequently led to a comprehensive research study of vacuum cooling of large cooked meat joints in the past few years including mathematical modelling of the vacuum cooling process using finite element method and computational fluid dynamics (CFD), especially thorough research work has been carried out by the Food Refrigeration and Computerised Food Technology (FRCFT) Research Group in National University of Ireland. Currently, research studies on vacuum cooling of ready meal components have also been conducted in FRCFT Research Group.

This paper first discusses the principles and equipment of vacuum cooling and critically analyses the advantages and disadvantages of this technique. Much effort is then spent on reviewing the development of this technology for the agri-food industry, in particularly, the latest research results from the FRCFT Research Group, which have carried out extensive research work since 1997 funded by the Non-Commissioned Food Research Programme and the Food Institutional Research Measures administered by the Irish Government Department of Agriculture and Food. Future prospects of research and development of vacuum cooling technology is finally addressed.