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An Evolving Freezing Storage Technique of Food Products

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Abstract

Freezing is reducing the bacterial growth and proper storage, but ice crystal formation might result in damaging to the quality of the food. For storage of safe food, we must give an attention to the taste, colour, texture, smell and appearance. Removal of heat from the food is done thorough refrigeration process only and has to maintain the temperature during storage, transport and retailing etc. During the process, the ice crystals are formed in the food products is named as frozen food. The main aim is to maintain the temperature of food product at prime level. The cold storage follows both chilling and freezing processes for the preservation of vegetables from between -18^{0}c and -35^{0}c to avoid the physical, microbiological and chemical activities that causes deterioration in foods. Food materials are preserving through blast freezer, plate freezer, contact freezer, immersion freezer, cryogenic freezer, individual quick freezer etc.

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Keywords

Blast freezer, plate freezer, contact freezer, immersion freezer

Introduction

Refrigeration processes for freezing have changed in commercial refrigeration field. Technologies have been based around the use of refrigerant to transfer heat from the product.

This has primarily done through refrigeration system, latest technique etc. The various freezing methodology are used like air – blast freezing, contact freezing, immersion freezing etc is used where the packaged and un- packaged food (Pham, 1986).

When the food products are to be preserved in its original fresh state for longer periods, then they are usually frozen and stored approximately at – 15°C or below. Such storages are known as frozen storages. The products in good condition should only be frozen. They are directly taking them into frozen storages after washing (Rahman, 1999).

There are various methods available for food freezing system, these include: air-blast freezers (batch and continuous), fluidized bed freezers, impingement freezers, liquid immersion freezers, plate freezers, liquid nitrogen freezers and carbon dioxide freezers.

In air blast freezer, the air is flow at high viscosity fluid it has flow across around irregular surface geometries, thus providing a more uniform freezing rate over the whole product. Other freezing methods such as plate freezing (contact freezing) offer faster cooling times, but can only be used with products of a suitable geometry (Mascheroni, 2007).

The storages which are used for long term storage purposes are known as cold storages. The short – term storage are takes place at retail purpose. The storage period depends on the type of product stored and its condition on entering the storage. The maximum storage period for long term storage ranges from seven to ten days for some sensitive products and upto six or eight months.

When perishable foods are to be stored for longer period, they should be frozen and stored in frozen storages. The relative humidity are major criteria which must be controlled in the storage of all perishable food. It may be noted that low relative humidity and high air velocity causes excessive dehydration.

Refrigeration technologies

Thermoelectric cooling

The thermoelectric cooling or peltier effect cooling is producing a heat flux between the two types of material. This type of cooling system is commonly used in minor cooling system or electronic cooling system. But peltier cooling system in inefficient for large of food products compare to vapour – compression refrigeration system. This system has low COP and it emits more waste heat and consumes more power (Magnussen, *et al*., 2008).

Magnetic Refrigeration

The magnetic refrigeration is a cooling technique based on magnetocaloric effect and an intrinsic property of magnetic solids. In this system also refrigerant is used as like as vapour compression system. The paramagnetic salt are used as refrigerant.

A strong magnetic field is applied to refrigerant, and forcing its various magnetic dipoles to align state and lowered entropy. A heat sink then absorbs the heat released by the refrigerant due to its loss of entropy. Thermal contact with heat sink is broken, the system is insulated and magnetic field is switched off. So the heat capacity of the refrigerant is increases, thus decreasing its temperature below the temperature of the heat sink.

Electrocaloric Refrigeration

The refrigeration based on the super elastic materials and these materials are undergo a temperature change when experiencing an mechanical stress. The super elastic materials deform reversibly at high strains, resulting in phase transformation from an austenitic to martensitic phase. The material experience a stress in austenitic phase to martensitic phase, cause s the material to heat up and during the relieving the stress, the material restores austenitic phase and absorbs heat from the surrounding.

Mechanism of vapour compression refrigeration system

Compressor

The low pressure and temperature vapour refrigerant from evaporator drawn into the compressor through the inlet or suction valve A, where it is compressed to a high pressure and temperature. This high pressure and temperature vapour refrigerant is discharged into the condenser through the delivery or discharge valve B.

Condenser

The condenser or cooler consists of coils of pipe in which the high pressure and temperature vapour refrigerant is cooled and condensed. The refrigerant while passing through the condenser, gives up its latent heat to the surrounding condensing medium which is normally air or water.

Receiver

The condensed liquid refrigerant from the condenser is stored in a vessel known as receiver from where it is supplied to the evaporator through the expansion valve or refrigerant control valve.

Expansion valve

It is also called throttle valve or refrigerant control valve. The function of expansion valve is to allow the liquid refrigerant under high pressure and temperature to pass at a controlled rate after reducing its pressure and temperature. Some of the liquid refrigerant evaporates as it passes through the expansion valve, but the greater portion is vaporized in the evaporator at the low pressure and temperature.

Evaporator

An evaporator consist of coils of pipe in which the liquid vapour refrigerant at low pressure and temperature is evaporated and changed into vapour refrigerant at low pressure and temperature. In evaporating the liquid

vapour refrigerant absorbs its latent heat of vaporization from the medium (air, water or brine) which is to be cooled

Acoustic Refrigeration

The thermoacoustics is interaction between temperature, density and pressure variation of acoustic waves. Cooling is achieved by compressing, expansion of inert gas or mixture of gases.

The components in acoustic refrigeration system are cylinder, acoustic driver, a porous media and two heat exchangers. Due to the oscillation of gases, the compression and expansion of sound waves creates and makes temperature difference.

The temperature difference created removes heat from cold side and rejects heat from hot side. When the pressure is high, gas travel through hot heat exchanger and when the pressure is low, gas moves towards cold heat exchanger.

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