Preservation by Strengthening the Water molecule Using Magnetic Field

Aravindda swmay.V
Mechanical Engineering, LICET, Chennai, India
vas111095@gmail.com

Abstract

The cryopreservation of food items and organs have long been considered impossible because the cells in the organs suffer from serious damage due to formation uneven ice crystals and difference in pressure .this leads to the loss of nutrients in the food items and incase of organs its worse its makes them unusable or makes them fail their purpose of storage. In this study, we discussed about the theoretical concept of storage of food and organs using the vacillating magnetic field. This similar technique is being used by certain Japanese companies to store bacteria for research purposes. A combination of different techniques is attempted to achieve an optimimum result.

Keywords—cryopreservation; magnetic field; storage;

1. INTRODUCTION

It has been estimated that the food wastage in India is equal to that of the food consumed in United Kingdom. We waste about forty percent of our food .the main cause of this is the perishability of the food items and it's the same in the field of the organ preservation also. The main problem faced by these separate fields is the perishability of their products. The common solution followed for them is freezing. This new way of freezing the food items and human parts by strengthening the hydrogen bond has found to increases their perishability significantly.

The general method used by them is to freeze the food by storing it in the cold storage. This method has many flaws such as the degradation of the nutrient of the food; the other problem is that the cellular level fibers are broken and the number of times they can be refreeze is also very limited

The method of freezing involves three stages .They are cooling the product to a its freezing point, removing the latent heat of crystallization and at last cooling the product to the required temperature. The efficiency of a freezing process is determined by the transition phase part where the conversion of ice to water takes place. The main defect of conventional freezing methods is the formation of large crystals of ice, which damages the tissues. Hence it becomes necessary to achieve fine crystals which are distributed finely both on inside and outside to arrest the tissue damages.

In case of organ preservation, the widely used method of preservation is dipping them in an organ storage solution. However using this method the duration of storage is not very high; hence various freezing techniques are being tried. They are known as cryopreservation. The speci c issues associated with cryopreservation of cells/tissues are ice-crystal formation and hypertonic damage related to the concentration of the intercellular uid. Since it is difficult to freeze all the cells of a large-volume organ under a given condition, these problems are particularly complicated. Further, since the component cells of a parenchyma organ are not identical, the optimal temperature may differ from cell to cell. The freezing temperature/speed and the protective solution may have to be selected, and the appropriate freezing conditions may have to be determined for each organ.

2. FREEZING UNDER A VACILLATING MAGNETIC FIELD

Preview

This method involves freezing food under a vacillating magnetic field which causes less damage to the cells. A synonymous method is used by a Japanese food company, which is based on electric field. We think that the same technique can be followed to preserve organs and food using magnetic field. This will also reduce cell injuries and enhance the vitality of the preserved tissues and food Effect on Water molecule in a magnetic field

Maintaining the Integrity of the Specifications

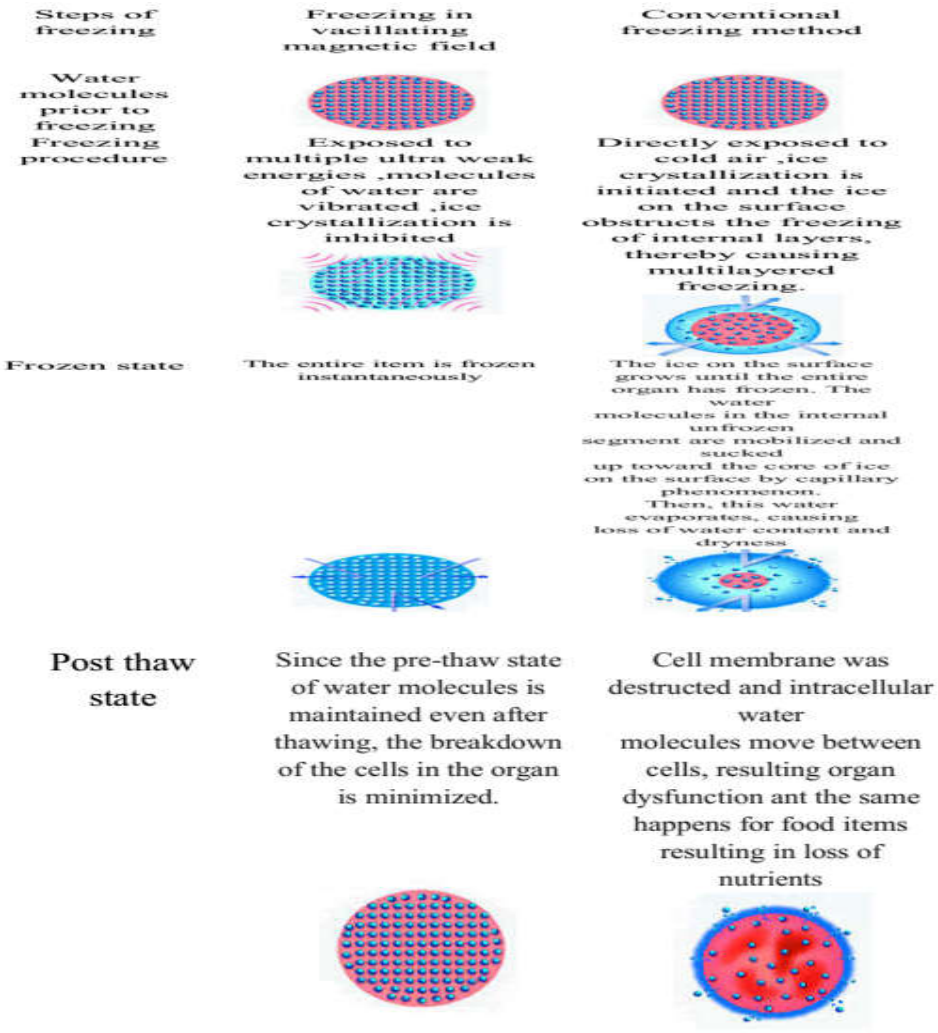
Water in its liquid form is affected form is affected by magnetic fields and this effect on water is generally used in its purification .it has been found that water can be levitated on very high magnetic fields approximately 10 T. it's also been found to increase cluster size in liquid water . the evaporation has been found to increase in weak magnetic fields(15mT).

The van der waals bonding amongst the water molecule is found to be weakened by the magnetic field, but this effect is more than counter acted by the dampening forces generated by reducing the thermal motion of the basic charges. Due to this any weakening of the van der waals forces leads to the strengthening of the hydrogen bonding and greater cyclic hydrogen bonded clustering.

This eases the super cooling and increases the melting point of the water. This phenomenon of water can be used in freezing food stuffs and tissue as they contain almost 80% water. This method of freezing is different from other method as they freeze the items almost instantively and thereby minimizing the breakdown of cells in the food and the organ. Thawing is the process to change from a frozen solid to a liquid by gradual warming

.

FREEZING IN VACILLATING MAGNETIC FIELD



Effect of this method

- Higher degree of super cooing can be attained than normal conventional methods
- The time period of freezing can be reduced significantly
- The items under this method is frozen in a non-destructive state

Fig. 1

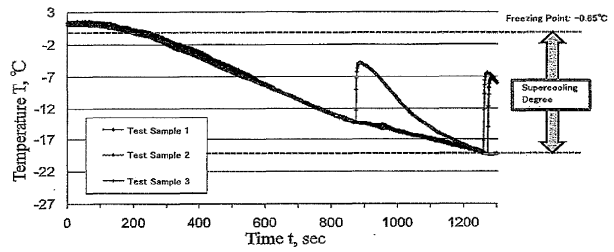
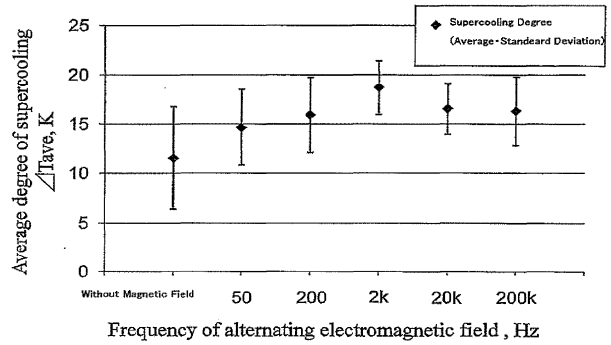


Fig. 2



These figures and graph are found by the experiments of similar method performed by certain Japanese companies
The figure 1 represents the temperature vs time in a magnetic environment
The figure 2 deals with the average degree of super cooling to magnetic field frequency

Fig. 3

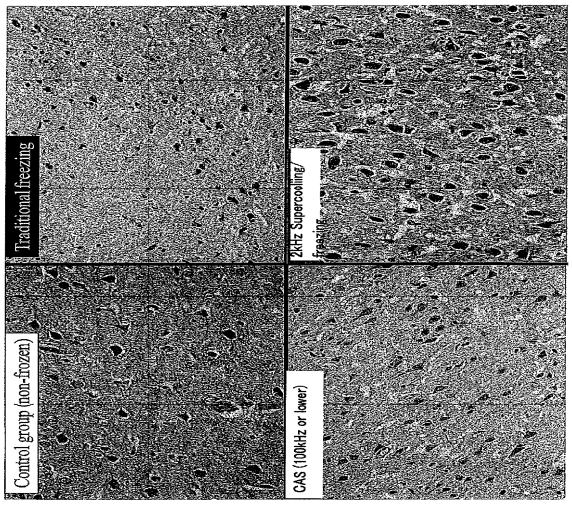
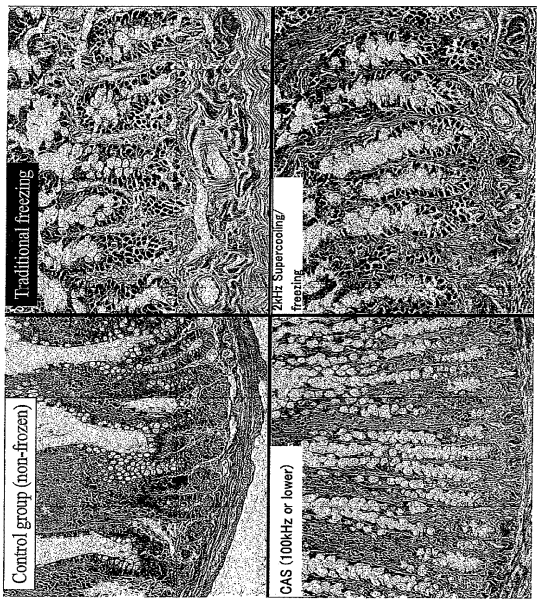


Fig. 3 shows results of microscopic observation of a section of the brain tissue of a rat (non frozen),and that of a whole frozen rat by a quick freezing method (traditional freezing), freezing at a magnetic field frequency of 100 Hz or lower (CAS),and the method of the present invention (super cooling and freezing at 2 kHz).

Fig. 4



[Fig.4] shows results of microscopic observation of a session of the small intestine tissue of rat (non-frozen), and that of a whole frozen rat by a quick freezing method (traditional freezing), freezing at a magnetic field frequency of 100 Hz or lower (CAS), and the method of the present invention (super cooling and freezing at 2kHz).

The freezing experiment

Two Lewis female rats (250–300 g) were fasted for 24 hours and euthanized by ether inhalation. The organs were not removed from the body, which was directly used in the freezing experiments. One rat was frozen in freezing equipment (ABI) that generated a vacillating magnetic eld. The brine tank of the freezing equipment was lled with 60% ethylene glycol. The rat was enclosed in a nylon pack from which air was removed to the maximum possible extent; the nylon pack was placed in a weighted gauge and submerged in the brine tank. At a magnetic- eld intensity of 0.1–0.2 mT, the experimental material was cooled to 2°C over a period of 1 hour and then cooled at the rate of –0.5°C/minute and frozen to –30°C. The entire cooling procedure, from the start of cooling to the completion of freezing, was performed in 2 hours and 45 minutes. The material was stored in an ultra cold freezer at –80°C until it was used in the experiment. Another rat was used as the control and frozen in the ultra cold freezer at –80°C for the same time period. After freezing, the animals were preserved for 24 hours and soaked in a saline solution at 30°C for rapid thawing.

Results of the experiment

The extent of tissue breakdown was different between organs, but the results indicated that cryopreservation in the magnetic environment was more suitable for organ preservation. The results showed that this technique reduced tissue breakdown, especially in the brain, pancreas, small intestine, and ovary. When the small intestine was preserved in an ultra cold freezer, ice crystals grew and melted in the tissue, creating a number of apparent spaces; however, ice-crystal formation was inhibited during cryopreservation in the magnetic environment. using this technique in India and its effectss

In food sector As India is a densely populated country, the amount of food it waste is high .Freshly produced food worth 4.4 bn euro is lost every year in India due to poor refrigeration. The implementation of this technique can save almost of billions of money and this inturn will help in reducing cost as we are charged for more than we have to pay due to these losses incurred in storage. Then another most important gain is the availability of food to all due to this method as the nutrient content is kept intact and the food lost is also reduced .even though india is one of the largest producers of dairy products,a certain percent of it is lost in the storage this method can help in retrieving these lost product and prevent them from being inconsumable.

In Organ preservation

1. The organ preservation is one of the leading problems in any countries as there is a demand and supply deficit for the organs. Some people have to wait for years to find suitable donors and since the most of the organs can be preserved only for few weeks it makes it much difficult for the patients. This method has proved to increase the shell life of most of the organs. Thus this method helps in saving lakhs of life by making available certain organs
2. India has the capability to take care of its demands in organ supply if it ensures proper storage facilities.

CONCLUSION

Owing to the development of the immune suppression regimen, organ transplant has become an established method for treating organ failure. Nevertheless, shortage of donors is a serious problem. Every year, an increasing number of organ-transplant candidates die due to the unavailability of donor organs. If the organs can be preserved for longer periods in a good condition, more transplant candidates will be able to receive appropriate organs or select better-matched organs, thereby reducing the dosage of oral immune suppressants. The food storage sector is a big industry which feed billions of people ,The perishability of goods in these is a serious problem which is increasing day by day .We hope that our technique would atleast provide a small development in addressing the above problems.

References

1)Zhou YC, Cecka JM : Preservation. Clin Transpl, 1992:383-90.
2) Monzen K, Hosoda T, Hayashi D, et al : The use of a supercooling refrigerator improves the preservation of organ grafts. Biochem Biophys Res Commun, 2005;337(2):534-9.
3) Wahlberg JA, Southard JH, Belzer FO : Development of acold storage solution for pancreas preservation. Cryobiology, 1986;23(6):477-82.
4.) Ploeg RJ, Goossens D, McAnulty JF, et al : Successful 72hour cold storage of dog kidneys with UW solution. Transplantation,1988;46(2):191-6.
5) Koshima I, Inagawa K, Urushibara K, et al : Supermicrosurgical lymphaticovenular anastomosis for the treatment of lymphedema in the upper extremities. J Reconstr Microsurg, 2000;16(6):437-42.
6) Fukushima T, Nakagawa T, Noguchi S, et al : Temporary ovarian transplantation for iatrogenic sterility. ACSC, 2009;1(1):38-41.
7) Ong WC, Nakagawa T, Noguchi S, et al : Super-Microsurgery forvascularized ovarian transplantation and cryopreservation. ACSC, 2009;1(1):30-3.
8) Inaba H, Takeya K, Nozu S : Fundamental Study on Continuous Ice Making Using Flowing Supercooled WaterJSME Int. J. Ser. B, 1994;37:385-93.
9) Shichiri M, Araki Y : Nucleation mechanism of ice crystals under electrical effect. J. Crystal Growth, 1986;78:502-8.
10)patent WO 2011/058959 (19.05.2011 Gazette 2011/20)