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A REVIEW PAPER ON COMPARATIVE STUDY OF DIFFERENT TYPES OF INSTANT REFRIGERATING TECHNIQUES

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Abstract: - *The present paper work deals with the review of comparison between different types of rapid-freezing methods. The intention of this paper work is to observe dissimilar types of design and to determine the best type depending upon several necessary factors. The study deals with the determination of design that perfectly fits in the counter-top category. Hence the invention should be a kitchen-type application that can produce a single serving of ice in minimum amount of time. Different types of instant refrigerating techniques are taken under consideration so as to find the type that consumes minimum amount of time and power.*

***Key Words*: (Rapid freezing, Counter top, Instant Refrigeration, Single serving, Time consumption)**

1. INTRODUCTION

Refrigeration may be defined as the process of achieving and maintaining a temperature below that of the surroundings, the aim being to cool some product or space to the required temperature. One of the most important applications of refrigeration has been the preservation of perishable food products by storing them at low temperatures. Refrigeration systems are also used extensively for providing thermal comfort to human beings by means of air conditioning. Air Conditioning refers to the treatment of air so as to simultaneously control its temperature, moisture content, cleanliness, odors and circulation, as required by occupants, a process, or products in the space. The subject of refrigeration and air conditioning has evolved out of human need for food and comfort, and its history dates back to centuries. The history of refrigeration is very interesting since every aspect of it, the availability of refrigerants, the prime movers and the developments in compressors and the methods of refrigeration all are a part of it. The French scientist Roger ThÝvenot has written an excellent book on the history of refrigeration throughout the world. The following can be called as a refrigeration process

1. Cooling of a pot of water by mixing it with a large block of ice
2. Cooling of water by creating vacuum over it

1.1 Natural Refrigeration

In olden days refrigeration was achieved by natural means such as the use of ice or evaporative cooling. In earlier times, ice was either:

1. Transported from colder regions,

2. Harvested in winter and stored in ice houses for summer use or,

3. Made during night by cooling of water by radiation to stratosphere.

In Europe, America and Iran a number of icehouses were built to store ice. Materials like sawdust or wood shavings were used as insulating materials in these icehouses. Later on, cork was used as insulating material. Literature reveals that ice has always been available to aristocracy who could afford it. In India, the Mogul emperors were very fond of ice during the harsh summer in Delhi and Agra, and it appears that the ice used to be made by nocturnal cooling. In India Tudor's ice was cheaper than the locally manufactured ice by nocturnal cooling.

1.1.1 Art of Ice making by Nocturnal Cooling:

The art of making ice by nocturnal cooling was perfected in India. In this method ice was made by keeping a thin layer of water in a shallow earthen tray, and then exposing the tray to the night sky. Compacted hay of about 0.3 m thickness was used as insulation. The water looses heat by radiation to the stratosphere, which is at around -55° C and by early morning hours the water in the trays freezes to ice. This method of ice production was very popular in India.

1.1.2 Evaporative Cooling:

As the name indicates, evaporative cooling is the process of reducing the temperature of a system by evaporation of water. Human beings perspire and dissipate their metabolic heat by evaporative cooling if the ambient temperature is more than skin temperature. Animals such as the hippopotamus and buffalo coat themselves with mud for evaporative cooling. Evaporative cooling has been used in India for centuries to obtain cold water in summer by storing the water in earthen pots. The water permeates through the pores of earthen vessel to its outer surface where it evaporates to the surrounding, absorbing its latent heat in part from the vessel, which cools the water. It is said that Patliputra University situated on the bank of river Ganges used to induce the evaporative-cooled air from the river.

1.1.3 Cooling by Salt Solutions:

Certain substances such as common salt, when added to water dissolve in water and absorb its heat of solution from water (endothermic process). This reduces the temperature of the solution (water salt). Sodium Chloride salt (NaCl) can yield temperatures up to -20°C and Calcium Chloride (CaCl2) up to - 50°C in properly insulated containers. However, as it is this process has limited application, as the dissolved salt has to be recovered from its solution by heating

1.1 Sub Heading 1

1.2 OBJECTIVE

Aims and objectives present an outstanding agenda for the support in a research allowance application. The principle objectives or scope of this project can be shortened as follows;

1. The objective of this work is the determination of fastest type of refrigerating technique.

2. Investigating several specific types of freezing techniques as well as the methods involved in them.

3. Determining the most economical type of technique on the basis of its operational cost and output value, amount of time required and power consumed.

1.3 limitations of the study

Since Compactness of equipment has always been seen as a sign of advancement, therefore the designs with smaller dimensions are considered better. The method is judged on the basis of the power it consumes and the output it delivers. The method will also be judged on the time it consumes VS quantity it produces. Methods providing Single serving of ice in the least time with minimum amount of power consumption will be preferred. Methods and components of methods will be investigated for its cost and effectiveness.

2. LITERATURE REVIEW

Sagar D. Patil, Kiran D (2013) Most of the research work done so far deals with an objective of low energy consumption and refrigeration effect enhancement. Thermoelectric refrigeration is one of the techniques used for producing refrigeration effect. Thermoelectric devices are developed based on Pettier and See beck effect which has experienced a major advances and developments in recent years. The coefficient of performance of the thermoelectric refrigeration is less when it is used alone, hence thermoelectric refrigeration is often used with other methods of refrigeration. This paper presents a review of some work been done on the thermoelectric refrigeration over the years. Some of the research and development work carried out by different researchers on TER system has been thoroughly reviewed in this paper. The study envelopes the various applications of TER system and development of devices, This paper summarizes the advancement in thermoelectric refrigeration, thermoelectric materials, design methodologies, application in domestic appliances and performance enhancement techniques based on the literature.

DESIGN, MODELING AND SIMULATION OF A THERMOELECTRIC COOLING SYSTEM (TEC) by Pooja Ayer Mani (2016)

Thermoelectric Cooling (TEC) The literature showed a number of studies on TEC. The study started off early and in the most recent studies, Terry summarized the phenomena of thermoelectric, their materials and their applications. Scotsman also briefed thermoelectric concepts in the early ages and the modern developments in thermoelectricity that gives an idea of all the concepts that have already been covered. A lot of work was done with respect to the element size of a thermoelectric system. Semenyuk in an international conference mentioned the working of a miniature thermoelectric device at low temperatures. Optimum Design of Thermoelectric System the recent developments in thermoelectric needs to be addressed in order to investigate their optimum design. Literature shows several methods on how to optimize thermoelectric parameters. Analyzing parameters like the number of thermocouples, the element geometric ratio, and the thermal conductivity, which is defined as the thermal conductance of elements, is a very practical way to study the optimum design of the thermoelectric parameters. The literature also showed 43 some techniques that can help analyze the optimum design of thermoelectric parameters. Dimensionless parameters for a thermoelectric cooler system were introduced by Yamanashi [28] in order to optimize thermoelectric parameters. The paper studied the effect of different dimensionless parameters on the TEC performance as a function of dimensionless electrical current.

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Air cycle systems produce low temperatures for refrigeration by subjecting the gaseous refrigerant (Air) to a sequence of processes comprising compression, followed by constant pressure cooling, and then expansion to the original pressure to achieve a final temperature lower than at the start of compression. The first air cycle apparatus working on the above principle was invented by Dr John Gorrie, a Florida based physician, as a means for the production of artificial ice to treat yellow fever patients. His open cycle machine was patented in 1851. Over the following 25 years or so several other refrigeration pioneers secured patents on air cycle refrigeration systems. These include a closed air cycle system developed by the Alexander Kirk in Scotland based on the Stirling engine, the single and two-cylinder cold air machines developed by Franz Windhausen of Germany,

the air refrigeration machine developed by Paul Gifford of France, and the Bell-Coleman open air cycle developed by Joseph Coleman in collaboration with Henry and John Bell of Glasgow. In this study as a new refrigeration technology interested and Magnetic Refrigeration based on the magneto-caloric effect (MCE) has become a promising competitive technology for the conventional gas-compression/expansion technique contributed climate change occurred negative environmental effect due to increasing energy consumption is investigated. Magnetic Refrigeration is a refrigeration type based on magneto caloric effect (MCE). It is well known Gd element is a magnetic materials given the best magneto caloric effect and Gd5Si2Ge2, MnAs1_xSbx, (Mn, Fe) and La (Fe, Si) 13 compounds have been used magnetic materials on magnetic refrigeration technology. It is possible to make refrigeration under 1K temperatures with the magnetic refrigeration and liquefaction of hydrogen and helium. Recently, there have been two breakthroughs in magnetic-refrigeration researches: one is that the magnetic refrigerators on near room temperature,; the other one is that to discover a new magnetic materials for room-temperature applications. The new materials are manganese–iron–phosphorus and arsenic (Mn, Fe (P, As)) alloys. Nowadays rotary and reciprocating type magnetic refrigerators are exits and studies are going on for the developments of these refrigerators.

President, Commission A1 "Cry physics and Cry engineering" of the IIR Accelerator Technology Department, CERN, Geneva, Switzerland This Author aims at introducing cryogenics to non-specialists. It is not a cryogenics course, for which there exists several excellent textbooks mentioned in the bibliography. Rather, it tries to convey in a synthetic form the essential features of cryogenic engineering and to raise awareness on key design and construction issues of cryogenic devices and systems. The presentation of basic processes, implementation techniques and typical values for physical and engineering parameters is illustrated by applications to helium cryogenics. Oliver Evans in his book "Abortion of a young Steam Engineer's Guide" published in Philadelphia in 1805 described a closed refrigeration cycle to produce ice by ether under vacuum. Jacob Perkins, an American living in London actually designed such a system in1835. The apparatus described by Jacob Perkins in his patent specifications of 1834. In his patent he stated "I am enabled to use volatile fluids for the purpose of producing the cooling or freezing of fluids, and yet at the same time constantly condensing such volatile fluids, and bringing them again into operation without waste".

Methodology

Investigation is been done on Five different methods of refrigeration so that the most economical method among the five can be determined. Each method is considered from the starting procedure and is evaluated on the basis of;

1] Operating cost.

2] Working principle.

3] Time consumed.

4] Quantity produced.

5] Power consumption.

3. CONCLUSION

In the present study of five different types of refrigerating methods, The thermoelectric method of instant cooling has shown remarkable performance. So far in the study, it has proven to be approximately three minutes faster than the other methods of refrigeration.

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