Amol Dhondge

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Profile

Father's Name : Jagannath Dhondge
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Sex: Male
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Languages

English

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Interests

Reading

Playing cricket

Skills

Positive reinforcement

Teaching

Education

From November 2013 to April 2019
Ph.D. (Agricultural Engineering-Renewable Energy Sources)
Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra.
-80.70 % (Grade I)
-Project- Development of Solar Photovoltaic Powered Vapor Compression Refrigeration System

From August 2011 to September 2013
M.Tech. (Agricultural Engineering-Renewable Energy Sources)
Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra
-80.80 % (Grade I)
-Project-Evaluation of Solar-Biomass Hybrid System for Turmeric Drying.

From August 2007 to April 2011
B.Tech.(Agricultural Engineering)
K. K. Wagh College of Agricultural Engineering & Technology Nashik, Maharashtra
-77.20 % (Grade I)
-Project-Studies on Storage of Cut Flowers

From July 2005 to February 2007
HSC (Science)
K. B. H. Jr. College Malegaon, Nashik, Maharashtra
-69.50 % (Grade I)

Computer skills

MS-CIT

AUTOCAD

Publications

1. Effect of packing materials on storage and vase life of cut rose flowers (International Journal of Chemical Studies 2019, Vol. 7(2):857-860)
2. Performance evaluation of solar photo voltaic powered vapor compression refrigeration system (International Jr. of Agriculture Sciences 2018, Vol.10: 6651- 6653)
3. Current approaches in solar pv refrigeration system (International Journal of Pure and Applied Research in Engineering and Technology 2016, Vol. 05(2): 141-149)
4. Innovation Farm Device for Turmeric Harvesting: Design and Development Aspect (Trends in Biosciences 2015, Vol.08(19): 5364-5368)

Extra Curricular Activities

1. National workshop on 'Renewable Energy for Sustainable Development of Agriculture and Industries' (Poster presentation -9 March 2015)
2. International Conference on 'Innovations in Science & Technology: Opportunities and Challenges' (Participant -23 & 24 Sept. 2016)
3. National seminar on ‘Rainfed agriculture in India: Perspectives and challenges’ (Participant 7-9 December 2016)
4. International conference on ‘Technological advances in climate-smart agriculture and sustainability' (Participant 16-18 January 2017)

ENERGY & EXERGY ANALYSIS OF SPV POWERED VAPOR COMPRESSION REFRIGERATION SYSTEM

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Abstract

Energy is the major input to the social, economical, industrial and technological development of any country and its demand is increasing with increasing the population and improvement in the living standard. This paper presents a comparison of the energetic and exergetic performances of a vaccine storage refrigerator using refrigerant R-134a and nano-refrigerant (R-134a + 0.5% Al_2O_3) as refrigerants. The thermodynamic performances such as exergy destruction or losses, exergy efficiency, and coefficient of performances (COP) were investigated and studied. These parameters were measured at different treatments or test conditions under study. It has been found that at higher evaporating temperature, the exergy losses are minimum. The maximum exergy loss occurred in the evaporator and compressor and the values were lies between 36 to 37 per cent of the whole losses in the system. Highest sustainability index was found for nano-refrigerant (R-134a + 0.5% Al_2O_3) compared to that of refrigerant R-134a.

Keywords- *Exergy efficiency, Exergy loss, Refrigeration, Nano-refrigerant, COP*

Abbreviations

$(EX_D)_{evap}$ - Exergy destruction in evaporator, $(EX_D)_{comp}$-Exergy destruction in compressor, $(EX_D)_{exp}$- Exergy destruction in expansion valve, $(EX_D)_{cond}$- Exergy destruction in condenser, EER- Energy efficiency ratio, SI- Sustainability index, $\eta_{exergetic}$- Exergetic efficiency.

Introduction

Energy conservation and environmental protection are keys to sustainable development of domestic economy of any country. Energy demand is also projected to increase by 71% during 2003-2030. The green house gases, global warming and acid rain are the causes of utilizing energy which is harvested from conventional fossil fuel. This is the reason why legislative initiatives as well as research activities aim at the utilization of systems, which lead to an increasing energy saving and use of renewable energy (Date 2010). The production of cold is important in number of fields of human life. In general, refrigeration is defined as any process of heat removal from a place for preserving perishable substances by enhancing their shelf life. Reduction in post harvest losses of horticultural products, which is presently in the range of 25-30%, can be achieved by the efficient cooling system. Energy expenses account for about 28-30 per cent of total expenses in cold storage in India. Hence, electrical energy is a major running cost to maintain the cold storage facility. Technically, the term "exergy" can be defined, according to thermodynamics principle, as the maximum amount of work which can be produced by a system or a flow of matter or energy as it comes to equilibrium with a reference environment (Shukla 2009). When energy loses its quality then exergy is destroyed. Exergy is the part of energy which is useful and, therefore, has its economic value. The exergy analysis acknowledges that, the energy cannot be created or destroyed, it can be degraded in quality. Exergy identifies the reductions in thermal losses attributable to "green" technologies (Genoud and Lesourd 2009). It also identifies the environmental benefits and economics of different energy technologies. Exergy analysis is useful in identifying the causes, locations, and magnitudes of process inefficiencies. Nano-refrigerants are a special type of nano-fluids which are mixtures of nano-particles and refrigerants and have a broad range of applications in diverse fields for instance refrigeration, air conditioning systems, and heat pumps. The effect of nano-refrigerant (properties such as nano-particle type, size and concentration) even at very low concentrations the nanofluid shows a good enhancement in the thermal conductivity and performance of the system (Wang et al. 2006).

Material and Methods

The developed solar photovoltaic (SPV) powered vapour compression refrigeration system was installed in Dept. of unconventional Energy sources & Electrical engineering, Dr. PDKV, Akola, Maharashtra, India. A comparative study was carried out by using refrigerant R-134a (tetrafluoroethane) and nano-refrigerant (R-134a + 0.5% Al_2O_3) and different variables had been studied. The power to the refrigerator was supplied by the solar photovoltaic system (SPV) during day-time (sunshine hours) and battery back-up was provided during off sunshine hours which were charged by SPV system during sunshine hours. Fig. 1 shows the experimental setup of the system. Following formulas were used to calculate the COP of the refrigeration system.

$$COP_{theorotical} = \frac{Q_e}{W_{net}} = \frac{H_1 - H_4}{H_2 - H_1}$$

The actual COP of the designed refrigeration system was calculated as,

$$COP_{actual} = \eta_{cycle} \times \eta_{isentropic} \times COP_{carnot}$$

H_1, H_2, H_3 & H_4 are the enthalpies value at point 1, 2, 3 and 4 respectively in kJ/kg which would be calculated from pressure enthalpy curve.

Where,

η_{cycle} = Cooling efficiency of vapour compression cycle

$\eta_{isentropic}$ = Isentropic efficiency of compressor

Exergy Analysis

The loss of exergy can be calculated by the following formulas

i) Loss of exergy in Evaporator = $T_{ref}(S_1\text{-}S_4) - Q_{ref}$

ii) Loss of exergy in compressor = $T_a(S_2\text{-}S_1)$

iii) Loss of exergy in condenser = $Q_r - T_a (S_2\text{-}S_3)$

iv) Loss of exergy in expansion device or throttling process = $T_a(S_4\text{-}S_3)$

v) Sustainability index (SI) = $1 / (1- \eta_{exergy})$

vi) Exergy efficiency , $\eta_{exergy} = \frac{COP_{actual}}{COP_{carnot}} \times 100$

Where, T_{ref} = Temperature of the refrigerant space, K

T_a = Ambient temperature, K

S = Entropy (kJ/Kg K) at the different state points of the refrigeration cycle (1, 2, 3 & 4)

Q_{ref}= Refrigerating effect, kJ/Kg

Q_r = Heat released by condenser, kJ/Kg

Fig. 1 Experimental set-up of SPV powered refrigerator

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Effect of packing materials on storage and vase life of cut rose flowers

AJ Dhondge and SB Mohod

Abstract
The influence of various packing materials, viz. butter, *kraft* and polythene paper, on the storage and vase life of cut rose flowers (*Rosa hybrida* L) was studied. A rose is a perennial plant of the genus *Rosa*, within the family *Rosaceae*. There are over 100 species of rose. In this paper the ambient storage and refrigerated storage of rose (red and white variety) were compared with effect of wrapping by using butter, *kraft* and polythene paper for 3, 5 and 7 days respectively. The roses with butter paper wrap showed minimum weight loss followed by polythene and *kraft* paper in ambient and refrigerated condition respectively. Butter paper was found to be best wrap paper material by overall acceptability using hedonic scale rating. The refrigerated storage had preserved best appearance, aroma, color and less stem spoilage as compared to ambient condition according to panel called for evaluation by using hedonic scale rating. Among all three wrapped papers the butter paper gives best results upto 3 and 5 days in ambient and refrigerated condition respectively. The white rose preserved good appearance and color than red rose in both storage conditions.

Keywords: packing materials, cut rose flowers, storage life, vase life

Introduction
Flowers, the crowning glory of God's creation are an inseparable part of human life. They are part of age old tradition and culture of Indian society symbolizing purity, peace, passion, love and beauty. Due to their aesthetic, economic and social value their demand in the globe is increasing tremendously. Growing flowers commercially is a recent trend. Flowers have an increasing demand in the local as well as in the international markets. The total area under floriculture in India is 16,7,000 ha with production of 98,7,000 MT of flowers and India exports floriculture product about Rs. 11,999.09 lack (Anonymus 2009) [1]. The major flower growing states are Tamilnadu, Andhra Pradesh, Karnataka, Maharashtra, West Bengal, Uttar Pradesh, Haryana and Delhi in which Karnataka is the leading state having total area under floriculture 26,000 ha with loose flower production 203.9 MT and cut flower production 5867 MT. Important flowers those having more demand are Roses, Gerberas, Carnations, Gladiolus, Chrysanthemums, Marigolds, Asters, Orchids etc. A rose is a perennial plant of the genus *Rosa*, within the family *Rosaceae*. They form a group of erect shrubs, and climbing or trailing plants, with stems that are often armed with sharp prickles. Roses are best known as ornamental plants grown for their flowers in the garden and sometimes indoors. They have been also used for commercial perfumery and commercial cut flower crops. The majority of these ornamental roses are selected hybrids. From the above aforesaid information of higher production and industrial growth, their scope and importance, the under protected cultivated flower like Rose was included under the part of storage stability study.

Methodology
Freshly harvested red and white rose flower samples were obtained from local cultivars of Nashik. Following three wrapping materials were used under the study for keeping the quality of the flowers.

1. Butter paper
2. Polythene paper
3. *Kraft* paper

The wrapped samples were stored at two different conditions i.e. refrigerated storage and ambient storage (Jain *et al*. 2006) [3]. The Refrigerated storage condition was done at 5° C temperature and 80-90 % RH (Palani kumar, 2001) [4].

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Performance Assessment of Solar Photovoltaic Powered Vapor Compression Refrigeration System

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Abstract - In developing countries (like in India) the grid electricity is unavailable or available for few hours. So, preservation of vaccine in such areas become important and to solve this problem an attempt was made to design and develop the efficient SPV powered vapor compression refrigeration system. Eco-friendly refrigerant R-134a was selected. The nano-refrigerant (R-134a+Al_2O_3) was also used in this SPV operated refrigeration system to increase its performance and the results obtained are compared with the refrigerant R-134a. The per cent drop in the temperature of evaporator and condenser section of all various tests by using nano-refrigerant (R-134a+Al_2O_3) was observed to be 6.54 to 4.19, respectively. Average value of COP obtained varies from 2.14 to 2.10 and 2.36 to 2.31 by using refrigerant R-134a and nano-refrigerant (R-134a+Al_2O_3) in half load and full load, respectively. The per cent increase in the value of COP and per cent saving in the power consumption of compressor varies from 10.28 to 10.00 and to respectively, during various test conditions using nano-refrigerant (R-134a+Al_2O_3) in place of refrigerant R-134a.
Keywords: SPV, solar refrigeration, vapor compression, nano-refrigerant, COP

I. Introduction

Energy is the crucial input to the social, economical, industrial and technological development of any country and its demand is increasing with increasing the population and improvement in the living standard. The, total world energy consumption has increased due to rapid growth in world population and economy. Energy demand is also projected to increase by 71% during 2003-2030. Renewable energy is that energy which comes from the natural energy flows on earth. Unlike conventional forms of energy, renewable energy will not get exhausted. Renewable energy is also termed as "green energy", "clean energy", "sustainable energy" and "alternative energy" [1]. Refrigeration and air conditioning are one of the growing industries due to the change in life style and also essential for the increase shelf life of fruits, vegetables and to store certain medicines and vaccines. The solar photovoltaic operated refrigeration useful in the remote area to preserve vaccine where electricity is not available. The World Health Organization reported that in 2002, an estimated 2.1 million people died around the world of diseases preventable by widely available vaccine. So it is essential to develop the solar photovoltaic based refrigeration system to overcome this problem. The same situation also demands for energy efficient and high-performing heating, ventilating, and air conditioning systems. However, the inherently poor thermal transport characteristics of conventional heat transfer fluids limit the development of energy-efficient cooling systems. To overcome this limitation, an engineered colloid was developed by suspending nano-particles into conventional heat transfer fluids, also known as nano-fluids [2]. In refrigeration, the cooling efficiency depends upon the heat transfer performance of various thermal devices may be augmented by active and passive techniques [3]. One of the passive techniques is the addition of ultrafine particles (called nano-particles) to the common heat transfer fluids so that the thermal transport properties of the prepared suspension (called nanofluid) will be enhanced as compared to

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Research Article

PERFORMANCE EVALUATION OF SOLAR PHOTOVOLTAIC POWERED VAPOR COMPRESSION REFRIGERATION SYSTEM

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Abstract: In developing countries large number of people still lives in rural and remote area like in India where the grid electricity is unavailable or available for few hours. In these areas the vaccine preservation becomes an important issue and it is the basic need. The four components of the refrigerator, were designed separately (*i.e.* condenser, evaporator, compressor and the capillary tube) for 60 litre capacity. Eco-friendly refrigerant R-134a was selected. The nano-refrigerant (R-134a+Al_2O_3) was also used in this SPV operated refrigeration system to evaluate its performance and the results obtained are compared with the refrigerant R-134a. The per cent drop in the temperature among evaporator and condenser section of all various tests in two months (*i.e.* January and March) by using nano-refrigerant (R-134a+Al_2O_3) was observed to be 1.98 to 6.54 respectively. Average COP obtained varies from 1.95 to 2.26 and 2.13 to 2.46 by using refrigerant R-134a and nano-refrigerant (R-134a+Al_2O_3) respectively. The per cent increase in the value of COP and per cent saving in the power consumption of compressor varies from 8.85 to 10.19 and 14.03 to 18.36 respectively, during various test conditions using nano-refrigerant (R-134a+Al_2O_3) in place of refrigerant R-134a. The average monthly efficiency of solar photovoltaic system varies from 14.4 to 16.3 per cent for experimental duration.

Keywords: Refrigeration, vapor compression, photovoltaic, solar refrigeration and vaccine preservation

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Introduction

In the present context the energy demand is increasing with increasing the population and improvement in the living standard. It is the crucial input to the social, economic, industrial and technological development of any country. The rapid growth in world population and the economy, especially in developing countries, total world energy consumption has increased and is projected to increase by 71% during 2003-2030. The energy is harvested from conventional fossil fuel and due to its excess consumption, the greenhouse gases are releases to the lower atmosphere¬¬ which results in global warming and acid rain. This is the reason why legislative initiatives as well research activities aim at the utilization of systems, which lead to an increasing energy saving and use of renewable energy. The production of cold has applications in a considerable number of fields of human life for example the food processing field the air-conditioning sector and the conservation of pharmaceutical products. Refrigeration is available in the industrialized countries through the availability of electricity but is not readily available in the major part of the world. The greatest demand for cooling occurs when the solar radiation is most intense, thus making its use for cooling all the more attractive. In a tropical country, like India, the importance of refrigeration can hardly be over emphasized. Solar photovoltaic is best option to operate refrigeration in remote area, where electricity is not available. The refrigeration is required to preserve the lifesaving drugs and vaccines in the remote areas where the grid power is unavailable or limited to few hours [1]. To achieve refrigeration, a heat source is required to drive the refrigeration system. There are several sources of energy for production of refrigeration, the most important being gas, electricity and solar energy. Solar cooling is more attractive because the demand for cooling is generally the greatest at times of maximum availability of solar radiation and the cooling is far more need in hotter regions than in colder climate. Solar photovoltaic (PV) power system applications are increasing due to both technical and economic factors. Solar PV energy contributes to improved air quality and aids in the reduction of greenhouse gases that play a role in global warming. The heat transfer performance of various thermal devices may be augmented by active and passive techniques [2]. One of the passive techniques is the addition of ultrafine particles (called nano-particles) to the common heat transfer fluids so that the thermal transport properties of the prepared suspension (called nanofluid) will be enhanced as compared to the base fluid. Nano-refrigerants are a special type of nano-fluids which are mixtures of nano-particles and refrigerants and have a broad range of applications in diverse fields for instance refrigeration, air conditioning systems, and heat pumps. The effect of nano-refrigerant properties (such as nano-particle type, size and concentration) on heat transfer compared to pure refrigerant could improve the performance of the system.

Methodology

Refrigerant R-134a is commonly used as a working fluid in domestic vapour compression refrigeration system. Nano-materials are mixed with the different types of base fluids like water, oil, bio-fluids, polymer solutions and refrigerants. Here we used the alumina (Al_2O_3) nano-particles which were mixed with the refrigerant R-134a to prepare the required fluid [3] *i.e.*, nano-refrigerant (R-134a + 0.5% Al_2O_3 weight basis)[4]. The performance of the system was evaluated for 24 h of operation in controlled condition (at 25°C room temperature during January 2017) and in transient ambient conditions (during March 2017). A comparative study was carried out by using refrigerant R-134a (tetrafluoroethane) and nano-refrigerant (R-134a + 0.5% Al_2O_3) and following variables had been studied. The temperature of different points using temperature sensors connected to the data logger of the components of refrigerator like compressor inlet & outlet, condenser outlet, expansion device (capillary) inlet & outlet, evaporator outlet and cabinet temperature were taken during the test. The power to the refrigerator was supplied by the solar photovoltaic system (SPV) during day-time (sunshine hours) and battery back-up was provided during off sunshine hours which was charged by SPV system during sunshine hours.

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CURRENT APPROACHES IN SOLAR PV REFRIGERATION SYSTEM

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Accepted Date: 07/09/2016; Published Date: 24/09/2016

Abstract: *In this paper, a review has been conducted on different type's solar powered refrigeration systems and also presents the available technologies to provide cooling from solar energy. Solar refrigeration methods such as solar electric method, solar mechanical method, and solar thermal methods have been discussed.*

Keywords: *Solar System, Electric Method*

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