A REVIEW ON THERMAL EFFECT IN WARE HOUSE WITH DIFFERENT PROPOSED CONFIGURATIONS AND TECHNOLOGIES

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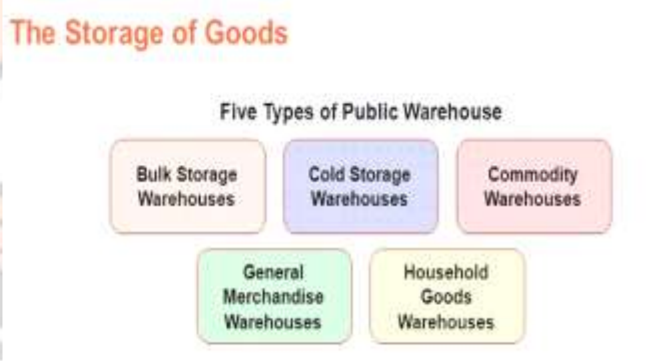
Abstract

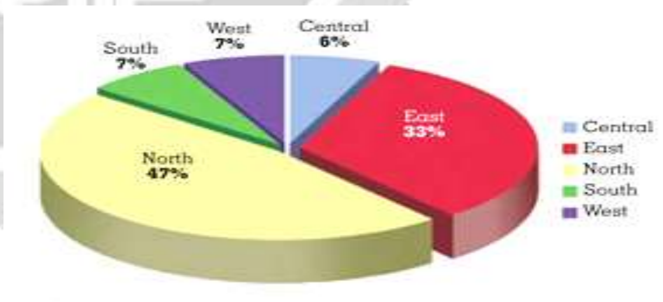
The optimum nozzle angle and velocity enhances the thermal effect in ware house. This paper shows types of the HVAC model and the advantages and disadvantages for each application of them, and it finds out that the gray-box type is the best one to represent the indoor thermal comfort. But its application fails at the integration method where its response deviated to unreal behavior. It was analyzed that nozzle angle with constant velocity at each position of duct enhances the thermal effect inside ware house.

Keywords— *HVAC, Nozzle Angle, Warehouse, Literature*.

I INTRODUCTION

A cold storage is a commercial facility where perishable food items such as fruits, vegetable, medicines, etc. are stored for a longer duration under controlled temperature to prevent them from decaying. Cold stores are an integral aspect as it minimizes the loss that can occur in the post-harvesting period. Two important factors i.e., preservation temperature and relative humidity have a great impact on the product quality. Within the cold store, in order to preserve the quality of the perishable items, there has to be homogeneity in the temperature distribution which is being directly governed by the air flow pattern. The design of air distribution system allows the air flow field to cool or warm the refrigerated enclosure in a controlled manner while keeping fixed moisture content. Other factors that affect the performance of a cold store are refrigeration system, air supply mode, air flow field distribution, frosting characteristics, heat insulation performance.





Cold stores are the place wherever biodegradable product keep under control temperatures for the purpose to maintain the quality. Protection of food item can be done beneath frozen temperatures. For many alternative merchandise conditions aside from temperature could be needed. A cold storage may be a place where the assorted things like vegetables, fruits, medicines, etc. are kept to defend them from obtaining spoiled and to increase its preservation amount.

II. Previous research works

Hoang et al.2(2000) proposed an analysis of air flow in a cold room by using computational fluid dynamics. Their model was based on steady state incompressible, RANS equation and RNG version of K-ε model. For discretization finite volume method was used. The error was 26% between calculated and measured velocity air inside the cold room. The air flow pattern which was responsible for the degradation of quality of the product was investigated. Reynolds stress models are interconnected with commercial CFD code this was more widely validated and considered as a improved model. And this proved a scientific way for simulation of cooling and storage problem.

Xu et al.12(2002)analyzed to improve the quality of stored potatoes by using computer modeling. The made a model with the help of CFD software (CFDS-CFX4) to find out the modification to air distribution that would improve the uniformity of air flow

.Potato was treated as porous resistance material. On the basis of air flow analysis in lateral ducts & air tunnel they concluded that significant saving is achieved in potato storage. With increase in speed & storage capacity they found that CFD model be come more complex there for produce simple model give quick response and would be cost effective.

Xie et al.11 (2006) proposed a 2-D mathematical model of cold storage [4.5m (l) X 3.3m (w) X 2.5m (h)]. Using CFD, air flow pattern of cold store was analyzed and concluded that several design parameters such as stack mode of foodstuffs, corner baffle and fan velocity largely affected the flow and temperature field.

Hoet al.3(2010)studied the distribution of the air velocity and its temperature in a refrigerated warehouse. The cold room which was under study had products stacked on pallets and a ceiling type cooling unit was installed in front of the array. Upon numerical analysis of steady state air flow on a 3-D model, it was concluded that as velocity of the blowing air increased uniformity in the temperature distribution and a better cooling effectiveness was achieved.

Akdemiret al.1(2013) studied on two different cooling systems and determined the distribution of ambient temperature and relative humidity in them. Cold store-II which included air conditioning system had better air distribution than the cold store-I which had classical cooling system consisting of compressor, condenser and evaporator as the cold air got distributed from th e evaporator only.

Sakareet al.8 (2014)designed cold storage structure for thousandtonnes potatoes. They calculate Heat transmission through walls, Heat transmission through ceiling, Heat transmission through floor, Heat transmission through door: Equipment load Cooling down to freezing point: Heat evolved in storage: Heat of respiration: and Human occupancy and gave an overview for designing of compressor, condenser, throttling device and evaporator.

Praneethetal.7 (2015) conducted a CFD analysis to investigate the airflow and temperature fields within the coldstore and they conclude that: 1. Air gap should be provided between the racks to reduce the chances of formation of hot spots.2. The positio n of the inletand outlet optimized that it should be in line with the air gap between the crates of the racks, also for uniform temperature and uniform air inlets should be provided at top and bottom of the racks within the cold store.3. Multiple inlets are provide d to reduce temperature variation and results into uniform temperature and uniform airflow, all these are difficult to achieve with single inlet.4. rack length of 500mm shows temperaturevariation of about 0.30C to 0.40C when compared to that of 1000 mm which provides better results with lesser temperature variation of 0.10C over the surface of the racks in which food produce are stored.

Jaiswalet al.4 (2015) conducted a study to investigate the influence of wind velocity and estimate the temperature distribution and relative humidity with the help of CFD. It was concluded that when evaporator with air flowing horizontally was a better arrangement than evaporator with air flowing vertically downwards due to proper heat exchange between cold air and the products.

Kaoodet al.6 (2016) used CFD technique to optimize air distribution systems in refrigerated rooms. The present work studied how change in no. of evaporators and their positions affected the velocity and temperature distribution inside a large refrigerat ed store. It was concluded that use of staggered design and large no. of evaporators gave better air flow.

Jaydeep et al.5(2016) in their examination, they accentuated over the four different arrangement of the evaporator area with first situated in the back mass of cold stockpiling second locatedin the all divider center in straight position third is found inall divider in 40° lower tendency and 25° left or right inclinedangle and forward is situated to all divider center position to 25°lower slanted and 25° left or right slanted .In this every one of the four model the ideal arrangement isperformance of temperature circulation is relies upon themass stream rate of air and evaporator area. In thispresentation are demonstrate the model-4 is better temperature distribution execution contrast with another three models.

Shukla et al.9 (2016) conducted a study to analyse the velocity and temperature distribution for axial flow evaporator and mix flow evaporator arrangement in a cold storage. For three dimensional modelling steady state analysis is done for air flow distribution and temperature distribution. After seeing all results they concluded that both temperature and velocity distribution for same initial boundary condition mix flow cooling coil is better when compared with axial flow cooling coil arrangement.

Sularno et al.10 (2018) conducted experimental and numerical investigation of cooling performance of a cold storage in a pharmaceutical industry and concluded that arrangement that is parallel to the fan of cold room and V shape bottle layout has given a good cooling performance (it takes 1480 minutes to reach a stable temperature at the setpoint) and an optimum temperature distribution was achieved (with temperature difference of 0.58°C).

D. Singh and P. Mishra 11 (2021) - this investigation demonstrates that An air diffuser is the mechanical device that is designed to control the characteristics of a fluid at the entrance to a thermodynamic open system. Diffusers are used to slow the fluid's velocity and to enhance its mixing into the surrounding fluid. Swirl diffusers can create better air mixing to enhance indoor air quality and help achieve compliance through Air Change Effectiveness measure. Swirling vanes are used in air diffusers to create swirling outflow jet, so that more rapid mixing with ambient air can be achieved. The Air Change Effectiveness calculation depends strongly on the flow characteristics produced by the diffuser outlet that vary considerably between different modeling set ups. Proper calibration and correct definition of performance related parameters are important to affect the radially diffusing flow pattern.

This study demonstrates the common approaches, identifies the critical design parameters, analyses and discusses the differing outcomes in terms of flow pattern, air distribution

Daniel et al. 12 (2021) reviewed about the VAV terminals to provide a measured quantity of conditioned air to a space, in response to a control signal from a thermostat or room sensor. This air may be tempered with a reheat coil, plenum air, or both. The means and selection of parameters for this reheat leads to much of the complexity and questions in selecting and specifying VAV terminals. To avoid problems, selecting the reheat design parameters requires an understanding of the limitations of the reheat coil (hot water or electric) and the means of air distribution.

III. CONCLUSION

The velocity is increased in effective nozzle angle. Thus, low velocity could be imparted to achieve effective thermal enhancement inside ware house. Effective velocity inside the warehouse is found thus optimum temperature is achieved in less time. The temperature increased in the region where the air was stationary.

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