

Indoor Air Quality in a Cardiac Care Unit (CCU) under Different Ventilations

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Abstract

A proper ventilation offered warranty for a perfect indoor environment. Indoor air environment includes indoor thermal environment and indoor air quality (IAQ). In this paper a numerical investigation of the indoor environment in different ventilations was accomplished. The Cardiac Care Unit (CCU) in Al-Rifai hospital in Thi-Qar governorate was chosen to be investigated, and its thermal achievement and indoor air quality in the hot summer weather were simulated. For the numerical study, the fluent technique used to set up the physical and numerical model of CCU. An attention has been paid carefully to considerate the distributions of the temperature and the velocity fields, followed by an argument of two different ventilation patterns; up-in and up-out ventilation (UV) and displacement ventilation (DV). After making the comparison, it was noticed that the displacement ventilation (DV) is clearly super than that of the up-in and up-out ventilation (UV) due to improvement in the indoor air quality.

Keywords: cardiac care unit, displacement ventilation and up-in and up-out ventilation.

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1. Introduction

People spend about (70 % or above) of their time indoors. Therefore, they are aware well aware that the indoor air quality is more important than outdoor air quality. Thus, the quality of the indoor environments is closely relevant to people's health, comfort, safety, etc. The safety of a person's physical and cerebral health must be among the first considerations of the indoor design [1].

Indoor air environments include indoor thermal environments and Indoor Air Quality (IAQ), and a proper ventilation offered a major warranty for an excellent indoor environment. By providing the fresh air for indoor, expulsion polluted gas, decreasing the concentration of indoor contaminants, ventilation can develop indoor thermal comfort.

The different ventilation patterns and the airflow modes achieve to various results of exclusion and dilution of indoor contaminants, this is about people's feelings around air quality [2]. Effected by a variety of topical parameters, the distributive principles of the ventilation arrangement are more difficult to appear. The classical method is the simulation experiments. This approach, selected by the limited experimental conditions, needs material resources in addition to many financial resources. In other words, simulation of the airflow in a complex space for all properties is very challenging.

To simulate the indoor airflow, a visual method was recently used to show the results in the Computational Fluid Dynamics (CFD) field and this tool was very effective and important. Also, it can be an effective way to study the arrangement of the indoor ventilation and design with the appropriate efficiency of the air-conditioning room [3]. To describe fluid motion in a computer, the CFD is the most

useful numerical procedure that able to result reliably in differential equations.

The past ten years has been characterized by a more increase of all over the world by scientific database in indoor air environment. Since people spend about half a day of their time in the room, they are well aware that indoor air quality may be more important than the quality of outdoor air. Applications of heating, ventilation and air-conditioning (HVAC) systems are known to adjustment the indoor air quality by means of cooling humidification, dilution, and filtration of the outdoor air that will enter the occupied area. For example, a good use of the air filtration from the outside space may prevent environmental contaminants and microbes from penetrating into the conditioned buildings [4].

In this field some studies were achieved considering different ventilation modes [5-7]. A numerical comparison study was done by Yang Li [8] who targeted two kinds of airing modes, which are the displacement and the up-in and up-out airings. It was concluded that the displacement ventilation is more effectible on the indoor air quality than the up-in and up-out one. In addition, a numerical investigation has been accomplished by Son [9] on a thermal comfort. Two typical working places have been undertaking, which are a hospital operating room and an office. It was broached that a negative influence can happened by changing the inlet angle. Hakan [10] investigated the impact of (HVAC) locations. It has been proved that the one near the door has the best heat releasing. Moreover, 3D research on a for thermal comfort in a hospital operating room has been completed by Rosario [11]. The outcomes illustrated that an overall better performance