3D Correlation IAQ in a Conference Room †

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† Presented at the 9th Innovations-Sustainability-Modernity-Openness Conference (ISMO'20), Bialystok, Poland, 20–21 May 2020.
Published: 15 July 2020

Abstract: The work presents an attempt to understand how three basic air pollutants in a room have an influence on indoor air quality. The aim of the study is to analyze the air quality in a conference room, determining whether (and if so, which) correlations occur among air pollutants in a room where the only sources of pollution is people. The air temperature, relative humidity and carbon dioxide concentration in the air in the room were analyzed. When analyzing the correlation among the measurement results, it should be clearly stated that the impurities that come only from people are correlated with each other.

Keywords: IAQ (indoor air quality); correlation; indoor air pollution; temperature; CO₂ concentration; humidity

1. Introduction

Central heating and refrigeration appliances are designed to maintain the desired temperature—the parameter that is most identified by people [1].

When conducting field tests, a correlation analysis of relative humidity and CO₂ concentration was encountered [2]. Increasing attention is paid to the study of humidity in relation to the thermal comfort of a room [3,4]. The relation between indoor air temperature and relative humidity has already become the standard [4–6].

The relative humidity of air is the ratio of the current absolute humidity (absolute humidity is the measure of water vapor or moisture in the air, regardless of temperature) to the highest possible absolute humidity (which depends on the current air temperature).

Research results [5] show that humidity has a significant effect on people's physiological responses and subjective thermal perceptions.

2. Materials and Methods

The research was carried out in a temperate climate, in a city where the outside air is very clean. During the measurement, the carbon dioxide concentration in the outside air ranged between 360 to 400 ppm, and it has not changed over the years (2011 [7], 2015 [8], now [9]). The research was conducted for 15 consecutive sessions which took place once a month. The conference room under examination has no constant ventilation. In the analyzed room, the only HVAC (heating, ventilation, air condition) systems that were installed were central heating and cooling apparatuses. Due to this, the measurement conditions were stable. The sessions lasted for two hours without interruption. There were 60 people in the hall, which had a cubic capacity of 924 m³. Measurements of air parameters were made with a Testo 435 meter, the parameters of which are given in the literature [7,9].
3. Results and Discussion

Figure 1 shows the correlation of all three measured values: air temperature, relative humidity and carbon dioxide concentration in air in the conference room.

The findings in the analysis of the results of the measurements are as follows: the air temperature in the room was too low (16–19.2 °C), the relative humidity was within normal limits (39.9–44.3%), the carbon dioxide concentration ranged from 890 to 2007 ppm, exceeding the recommended values of the recommended standards [100].

When analyzing the correlation of measurement results, it should be stated that the impurities that come only from people and do not have additional impurities are correlated with each other. In the presented measurement series, the HVAC system was activated, subsequently dehumidifying the air in the room. In the analyzed room, the relative humidity of the air continuously increased, and it is possible that the heat gains from people were so high that they stopped the work of the HVAC.

![Figure 1. Correlation of carbon dioxide concentration, air temperature and relative humidity in the analyzed conference room.](image)

The relation between relative humidity and carbon dioxide concentration is very significant when controlling both natural ventilation [11,12] and mechanical ventilation [1]. This dependence can also be used in systems that count people.

4. Conclusions

The correlation among all three air quality parameters examined in the presented experiment indicates a very strong connection between these parameters.

In a room where people are the only source of pollution and there is no air exchange, all the parameters analyzed are strongly correlated with each other.

The approach outlined in this document may be used for the regulation of HVAC systems in other rooms, i.e., in those where there is no air exchange system and the only source of pollution is people.

This research is a reference source regarding the impact of humidity on temperature, thus contributing to meeting the targets of ensuring a comfortable indoor thermal environment and providing regular maintenance to improve energy efficiency.

Acknowledgments: The study has been executed with resources of the WZ/WBiS/4/2019 statutory work financed by the Ministry of Science and Higher Education in Poland. Thanks to the members of the Faculty of Civil and Environmental Engineering for their contribution to the publication.

Conflicts of Interest: The author declares no conflict of interest.
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