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Analysis of thermal comfort in buildings under the conditions of using protective masks

The aim of the study "Analysis of thermal comfort in buildings under the conditions of using protective masks" was to conduct research on the subjective feelings of respondents in two types of protective masks (thinner and thicker) in real conditions in educational rooms of the Kielce University of Technology and in a climatic chamber, and then to modify the thermal comfort model (Fanger's formula) using an additional element taking into account the influence of protective masks on thermal sensations TSV. Chapter I describes the history of research on thermal comfort and describes the microclimate parameters influencing thermal sensations. Additionally, the same chapter analyzes the literature related to thermal comfort in protective masks. Chapter II discusses the Fanger model and the PMV and PPD indices. Trends in the use of artificial intelligence, among others, in predicting the thermal comfort model are presented. Chapter III summarizes the information collected from the literature, and Chapter IV presents the main objectives and theses of the work, based on the conclusions obtained from Chapter III. Chapter V describes the subject and scope of the research – buildings and the climatic chamber, then the research methodology, including the research procedure, environmental meter and anonymous survey questionnaire. In the next stage, a detailed analysis of thermal comfort in the tested rooms and the climatic chamber using protective masks was carried out. In the next step, the obtained TSV – PMV and APPD – PPD results were compared, and the PMV index was modified to take into account the presence of protective masks on the faces, and the PPD index was modified. Finally, in Chapter V, the obtained modifications of the indicators were verified and the significance of the introduced changes was confirmed by statistical methods. Chapter VI summarizes the discussed analysis of thermal sensations in masks and presents the final conclusions from the analysis and the modification of the PMV and PPD indicators. In general, it should be stated that the use of masks leads to an overestimation of thermal sensations compared to the situation when protective masks are not used (for the same operative temperature), and the modified values of the PMV and PPD indicators better reflect the actual thermal sensations in the conditions of using protective masks.

Key words: thermal comfort, microclimate, comfort indicators, PMV, PPD, protective mask, climatic chamber, educational buildings, metabolism