

“Impact of condensate in air-conditioning systems on secondary microbiological pollution of indoor air”

Project’s goal. The main goal of the project is to determine the impact of condensate periodically appearing in mechanical ventilation and air conditioning systems on secondary pollution of the air supplied to the office spaces. This goal is to verify the thesis that condensation as a source of multiplication, development and recovery from hibernation of both bacteria and fungi constitute one of the sources of pollution in mechanical Ventilation and air conditioning installations.

Tests’ description. The total number of bacteria and fungi in condensate (arising on the surface of the coolers in the air handling unit and in air conditioners in selected representative rooms) and in the scrubbers (external air, main supply channel and internal air) will be determined. Research will also cover drug resistance and virulence of bacteria and biodiversity of microorganisms collected from condensate, which will contribute to the estimation of the condensate’s impact on the health of room users.

Reasons why the topic was taken up. People spend a significant part of their lives in rooms tightly isolated from external conditions. That is why they have even greater requirements for better ambient air quality (including related to its microbiological conditions). The tightness of the rooms and the need to ensure the required indoor air quality (including its "freshness") has forced the widespread use of mechanical ventilation and air conditioning systems. Their operation is to transport appropriately treated external air or a mixture of external and circulating air inside most often metal channels of rectangular or round cross-section and to deliver it to rooms. The quality, including microbiological, of indoor air is significantly influenced by the composition of the external air drawn into the ventilation system. The relationships between pollutants entering the rooms from outside and sources of pollutants in rooms are generally known and it is not surprising that man is one of such sources (microbiological contamination, emission of heat and moisture). The need to ensure the right conditions for thermal comfort in rooms, especially during rising air temperature outside, is associated with the need to use long-term cooling of outside air or a mixture of outside and indoor air. This process corresponds to lowering the air temperature in the air handling unit through its contact with the cold surface of the exchanger. As a result, in the summer season, in the Polish climate, there is frequent condensation of water vapor from the air and its partial standing in a condensate tray mounted under the exchanger. Part of the microbiological contaminants contained in the treated air as a result of condensation goes into the water and stays in the condensate tray, in which, over time and due to the ideal conditions for the multiplication and development of microorganisms, they are concentrated. Together with the supply air, these microorganisms can enter rooms in an increased number.

As part of the research, the risk of secondary microbial contamination of air in the AHU and ventilator convectors coming from condensed water on heat exchangers will be determined. Species of bacteria and fungi that may threaten human health and life will be quantitatively and qualitatively determined. The research will be carried out using both classical methods and molecular biology. Research will also be conducted towards the antibiotic resistance and virulence of these microorganisms, which will facilitate the determination of their potential harmfulness to the health of room users. Research will be conducted in office rooms where people spend relatively most time. Condensate research as a microbial reservoir **has not yet been carried** out for our climatic conditions.