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PHYSICAL, CHEMICAL, AND BIOLOGICAL ASPECTS OF INDOOR AIR IN UNIVERSITY CLASSROOMS

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Abstract – Nowadays there is a challenge to provide a good indoor air quality because of the energy crisis, distance working and climate changing circumstances in premises. The aim of the study was dedicated to biological, chemical and physical parameters of air quality, such as temperature, the concentration of carbon dioxide (CO_2), particulate matter (PM2.5 and PM10), and their fluctuations in a university classroom during ongoing classes. Measurements were taken for three days (November, 2022) in two different size rooms with natural ventilation using devices such as: *SAS SUPER ISO 100* (microbiological sampling), *Aranet4* (temperature, concentration of CO_2), *PCE-PCO 1* and *PCE-RSCM 16* (PM2.5 and PM10). In total, 52 microbiological samples were collected from university classrooms over three days and further cultured on different growth mediums. Students' activity, windows opening and closing times were recorded during the study. The colony forming units per cubic meter (CFU/m^3) overall fluctuated between 174 and 934 CFU/m^3, with fungi making up the majority. The CFU/m^3 for fungi grown on *Sabouraud agar* was 24–610, for bacteria grown on *Trypticase soy agar* (TSA) 42–476, and for bacteria grown on *Mannitol salt agar* (MSA) 42–254. The study concludes that according to guidelines, the recommended amount of microbiological contamination should be less than 500 CFU/m^3. The indoor temperature for smaller rooms exceeded the allowed indoor air temperature of 25 °C after on average 50 minutes, while for the largest it remained below 25 °C level. The highest concentration of CO_2 for the first day was 2689 ppm, for the second day – 1970 ppm, and for the third day – 2131 ppm. Performing the ventilation for 20 minutes on average decreases the CO_2 concentration to 499 ppm. According to guidelines, CO_2 concentration should not exceed 1000 ppm in premises, but this level was reached on average after 25 minutes following window closure and the ongoing class. Natural ventilation alone was found to be insufficient for ongoing classes and effective during breaks, but other pollutants such as PM2.5 and PM10 enter the room in this way. The main findings reveal the tendency of both PM2.5 (on average 400 μg/m^3) and PM10 (on average 35 μg/m^3) to increase rapidly in crowded spaces during the classes, which require a constantly running air ventilation and purification system. However, there is a lack of regulations or guidelines regarding the maximum concentration of PM and microorganisms CFU in indoor air in public places.

Keywords – Air quality; indoor; outdoor

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