

AIR PURIFICATION WHILE GENERATING NANOPARTICLES IN THE ROOM

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INTRODUCTION

People spending time inside and outside buildings in urban areas are exposed to inhalation of chemical substances in the form of vapors and gases and suspended PM₁₀, PM_{2.5} and PM₁ dust in the atmospheric air. Unfavorable conditions inside buildings can result in serious health problems in humans manifested by Sick Building Syndrome (SBS). In order to ensure adequate indoor air quality, especially in urban areas, proper air purification from **nanoparticles** is required.

EXPERIMENTAL SET

The air purifier test stand in laboratory conditions was developed based on the recommendations of the ANSI/AHAM AC-1-2020 and AHAM AC-3-2009 (R2021) standards.

The recirculation air flow module together with the air parameter regulation module in the chamber consists of a duct fan (10) and a multi-stage air filtration system (pre-filter and HEPA filter) (11).

A **fan mixing** the air during the tests (12) was used in the chamber.

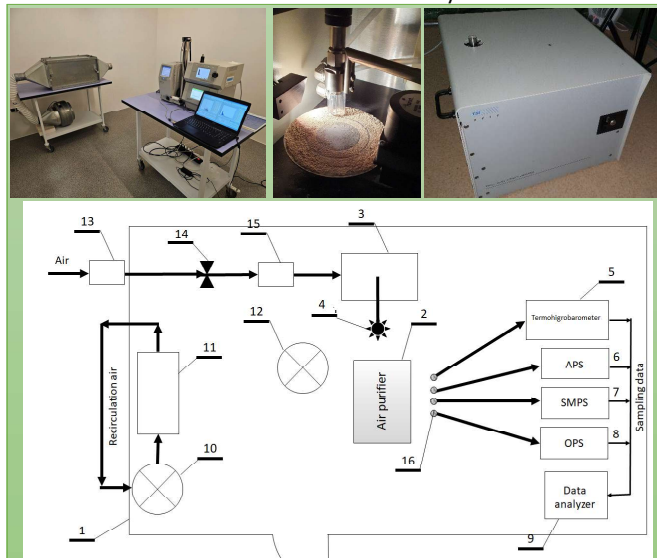
The air parameters (atmospheric pressure, temperature and relative air humidity) in the test chamber are recorded using a LAB-EL thermohygrobarometer with an LB 701 panel and an LB 725 probe (LAB-EL) (5).

Test aerosol generation module:

- generator SSPD Model 3433 Small-Scale Powder Disperser (TSI Inc.) (3)
- air is cleaned in a multi-stage filtration system (pre-filter, HEPA filter, oil filter) (13)
- air volume flow is regulated by a shut-off valve (14) and a flow meter (15)
- aerosol is generated and released into the chamber volume using a set of probes (4).

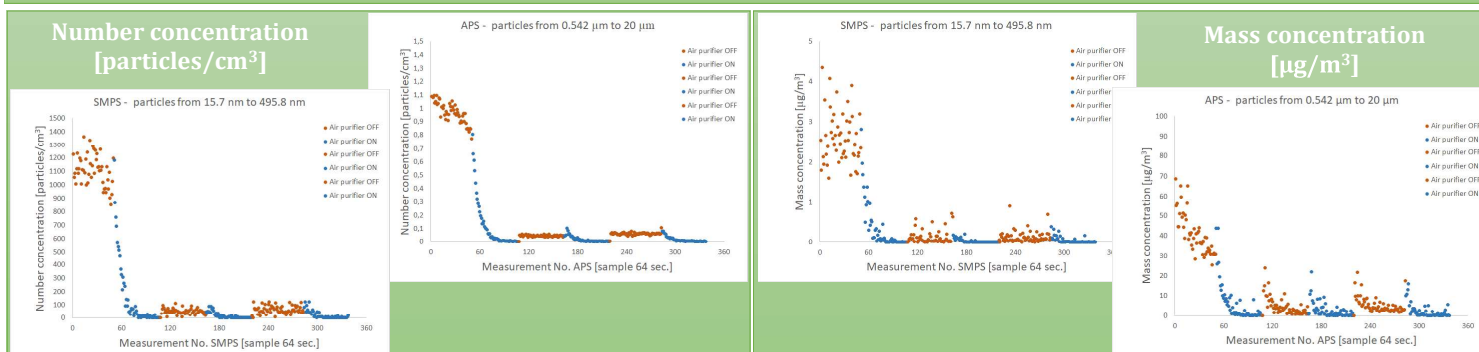
The concentration of test aerosols is measured using:

- SMPS particle size analysis system (TSI Inc.) to determine the number concentration, mass concentration and size distribution for 64 particle size fractions in the range from 2 to 700 nm (7)
- OPS optical counter (TSI) to measure the number concentration and size distribution in the range from 0.3 to 10 μm (8)
- APS spectrometer (TSI Inc.) to measure the aerodynamic diameter of particles in the range from 500 nm to 20 μm (6).



Recirculation air was collected from the interior of the laboratory chamber in which the measurement stand was located. Measurements were carried out for 5 hours, alternately turning on and off the air circulation every 60 minutes.

RESULTS



CONCLUSIONS

Starting the recirculation ventilation and air filtration system in the periodic mode in the laboratory chamber for particles with sizes from 15.7 to 495.8 nm resulted in:

- a decrease in the number concentration of particles to average values from 3.28 to 8.00 particles/cm³.
- a decrease in the mass concentration of particles to average values from 8.21·10⁻³ to 1.15·10⁻² μg/m³.
- emission of particles with an average geometric diameter of approx. 100 nm.

The test stand allows for the classification, testing and determination of the efficiency of air purifiers in laboratory conditions based on the recommendations of international standards.

ACKNOWLEDGEMENTS

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REFERENCES

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AHAM AC-3-2009 (R2021) Method for Measuring the Performance of Portable Household Electric Room Air Cleaners Following Accelerated Particulate Loading.