https://doi.org/10.7250/CONECT.2026.101

INVESTIGATION OF ACOUSTIC–AERODYNAMIC BEHAVIOUR IN A NEWLY DEVELOPED APPARATUS FOR PARTICULATE MATTER AGGLOMERATION

Tautvydas JUKNEVIČIUS[1*], Aleksandras CHLEBNIKOVAS[2]

[1,2] *Vilnius Gediminas Technical University, Saulėtekio al. 11, Vilnius LT-10223, Lithuania*

[*] ***Corresponding author.*** *Email address: tautvydas.juknevicius@vilniustech.lt*

Abstract – With rising air pollution and air quality standards, traditional air-cleaning technologies are becoming outdated as newer technologies emerge. Fine particles size smaller than 2 µm can enter bloodstream through lungs. For these reasons, more research is being conducted on pretreatment technologies. One of the pretreatment technologies is acoustic agglomeration, in which fine particles are combined into larger agglomerates, with help of acoustic waves pressure. This study presents an experimental investigation of the acoustic and aerodynamic parameters of a newly developed agglomeration apparatus designed to enhance the agglomeration of different particulate matter fractions. The aerodynamic performance of the acoustic apparatus was evaluated through measurements of air flow velocity and pressure characteristics with controlled air input and output with the fan and ventilation chamber (air flow sources). Particle agglomeration efficiency was assessed for different particle size fractions ranging from 0.2 µm up to 10 µm. The proposed horizontal acoustic agglomeration chamber incorporates a built-in loudspeaker oriented at a 30° angle relative to the main airflow direction. Experimental tests were conducted under sound pressure levels (SPL) ranging up to 130 dB and across a wide frequency spectrum from 4 kHz to 14 kHz. The results demonstrate that acoustic excitation influences particle interaction mechanisms, leading to enhanced agglomeration for particles under specific operating conditions. The results show that 200–500 nm size particle number decreases while increasing the number of particles in range from 600 nm to 4 µm. The results obtained show that this apparatus is working and it is possible to integrate it as pretreatment technology to other cleaning technologies to increase their efficiency.

Keywords – Acoustic agglomeration apparatus; fine particles; pretreatment technology; sound pressure level

ACKNOWLEDGEMENT

This project has received funding from the Research Council of Lithuania (LMTLT), agreement No [S-MIP-24-88].