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Development of a Textile with Silica coating for environmental friendly control of insects in Agricultural production

Deliverable [19]: *[Characterization of screening materials: aerodynamic and optical properties]*

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Abbreviations:
ITA: Institut für Textiltechnik, Germany
UTH: University of Thessaly, Greece
ThraceNG: Thrace Nonwovens & Geosynthetics S.A.

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Summary

Screens have received a wide application in agriculture as a means of protection against biotic and abiotic parameters. Their use is related to the integrated pest management (IPM) since they are considered as an environmentally friendly approach contributing to the reduction of insecticides in a greenhouse. However, the installation of agricultural screens on the vent openings affects significantly the ventilation rate leading to non–uniform microclimate conditions in the interior of a greenhouse. The present study aimed to evaluate the aerodynamic and optical properties of several agricultural screens. The study focuses on the evaluation of three insect-proof screens of different mesh sizes (25, 40, 50 mesh). Three identical samples of the tested insect-proof screens were coated with SiO_2 nanoparticles, a well-established substance for its non-toxic insecticidal properties. For this reason, screens were placed in a subsonic wind tunnel to measure the levels of pressure drop concerning air velocity. Considering the pressure loss and the air velocity while knowing the dynamic viscosity of air, the air density, and the porous material thickness; air permeability (K_p) and inertial factor (Y) were estimated by using the motion equation of a fluid through a porous material expressed by the Forchheimer equation. Based on the results, air permeability and inertial factor were significantly affected by the presence of the porous material. It was indicated that the air permeability coefficient was increased as opposed to the inertial factor coefficient which decreased as porosity was increasing. Higher values of pressure drop were recorded for screens of the greater mesh size. Moreover, screens coated with SiO_2 nanoparticles showed a significant decrease in the light transmittance compared to the non-coated screens. However, a 25-mesh screen coated with silica presented higher light transmission values compared to a 50-mesh non-coated screen in the PAR and IR wavelength band. The results of the present study underline the aerodynamic and optical efficacy of insect-proof screens coated with silica nanoparticles and their further installation in greenhouse vent openings.

The deliverable is available upon request

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