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# SUMMARY OF THE DOCTORAL DISSERTATION

In the first phase, heat recovery tests were carried out in a façade ventilation device under laboratory conditions using a climatic chamber, which allowed the simulation of stable external and internal conditions. The device, equipped with a reversible fan and a heat exchanger chamber controlled by automation, was tasked with exchanging air in the room through alternating cycles of supply and exhaust at specified durations. Three types of heat exchangers were examined, which were filled with various phase change materials. The air exchange in the room was examined through alternating supply and exhaust cycles at specified durations, under various external temperatures to estimate the efficiency of the façade ventilation device in terms of heat recovery capability. The efficiency of the device was determined based on the temperature efficiency of heat recovery for 144 combinations of settings. The best efficiency results of 76.29 % were achieved by a solution using a heat exchanger built from cylinders with an external diameter of 10mm and a wall thickness of 1mm filled with jojoba oil during one-minute work cycles.

In the second phase, experimental tests were carried out under real conditions for combinations of variables, which in laboratory conditions showed the best efficiency.

In the next stage of the work, two 3D unsteady-state simulation models were developed using Ansys Fluent v. 22, intended for simulations using the numerical fluid mechanics technique, CFD. Validation was carried out using experimental data. Two approaches to simulating the operation of a heat exchanger filled with jojoba oil during one-minute supply and exhaust cycles using a heat exchanger with cylinders with a diameter of 10 mm were developed and compared. Method A involved modelling the material filling the heat exchanger by appropriately modelling its physical parameters, taking into account the heat of phase change, directly in the Ansys Fluent program. Method B involved creating an external UDF script, which aimed to define the changing temperature on the cylinder walls in the heat exchanger, taking into account heat accumulation by the phase change material. The study supplements the existing scientific knowledge regarding the application of phase change materials in façade ventilation devices and computer simulations of these solutions.

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