

## SUMMARY

This work presents the methodology and results of the research on the hard coal enrichment process and recovery of coal from wastes generated during hard coal processing, carried out using a large-scale underpressure pneumatic separator – a device designed and constructed in frame of an international project.

As part of the research, measurements of pressure value inside the separator, as well as air flow velocity in the suction zone were carried out in order to determine its operating characteristics in relation to set operating parameters of the main fan. A series of experiments with the use of raw coal materials from various mines of the Polish Mining Group (PGG) were carried out to investigate the impact of the device operating parameters and feed characteristics on the output yield value of the sucked fraction (coal product) and physicochemical properties of the separation products. Samples of separation products as well as feed material were subjected to sieve analysis and laboratory tests to determine their ash content and calorific values. Some of the raw coals, constituting the feed material, were additionally subjected to a densimetric analysis.

In order to analyze impact level of individual process parameters, a mathematical model was developed, based on equations describing the dynamics of body movement in the fluid. Based on the data on the feed grain material properties and the parameters of the device, it allows the prediction of the trajectory of movement, velocity and acceleration of individual particles as a function of time. This allows to estimate output yield values and physicochemical properties of the products of the enrichment process for a given feed material at specific sorter operation parameters.

On the basis of detailed technical documentation describing the construction of the device, a numerical model simulating the process of dry separation was developed. The collected measurement data regarding the separator operation characteristics and the results of the experiments carried out were used to validate the model. The model allows analysis of the impact of individual process parameters on the quality and yield of the products. Due to the possibility of modifying the body of the model, it also allows for the analysis of the impact of design changes in the device on the process of separation. The results of such simulations can be the basis for making design changes in order to optimize the process.