Abstract

Mining is an important branch of industry in terms of economy, energy security and access to natural resources. However, in ecological terms, it is one of the most destructive human activities, and it generates large emissions of greenhouse gases, which are considered the most important factor intensifying climate change and the observed global warming. In particular, the opencast mining has a strong environmental impact. The influence of opencast mines on the environment is mitigated by environmental reclamation. The reclamation phase after the completion of mining processes makes it possible to remedy the effects of rebuilding the new ecosystem, thereby restoring the natural appearance of the environment. Moreover, the restored ecosystem allows for the intensification of carbon sequestration in the soil mitigating the mine's carbon footprint and indirectly limiting the progress of climate change.

The aim of the doctoral dissertation is to analyze the potential, mechanisms and dynamics of carbon sequestration in post-mining soils reclaimed with the use of various remediation techniques. The aim is also to characterize the impact of the applied remediation technique on the carbon sequestration process, description of the mechanism and dynamics of carbon sequestration in soil layers in areas with varying degrees of remediation. The utilitarian goals are: to determine the best reclamation practice of post-mining soils for the process of carbon sequestration in the soil and limiting the impact of mining activities on climate change, as well as providing a tool for monitoring the vertical stabilization of organic carbon in reclaimed post-mining soils..

The research was carried out in the areas covered by the recultivation works of two opencast mines: a limestone mine and a lignite mine. Two different reclamation approaches were used in the mines. In the limestone mine only the embankment was used, while in the lignite mine reclamation was supported by the application of sewage sludge. The research for each of the mines covered four areas with different degrees of reclamation.

The conducted research led to the development of an indicator model to characterize the penetration of stable forms of C in the soil into deeper soil layers for reclaimed post-mining soils, which can be helpful in making decisions on mitigating climate change, reducing the carbon footprint of mines, as well as in assessing the effectiveness of soil reclamation.