



Research article

Prediction of reclamation time of fresh coal mine overburden spoil through different soil quality indicators using artificial neural network

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Abstract

Coal mines are unfavorable habitat for the growth of microorganisms and revegetation due nutrient deficiency, heavy metals toxicity and pyrite contamination. So, assessment of soil parameters in different age series coal mine overburden spoil provides better understanding for mine spoil reclamation and the implementation of appropriate strategies is needed for the pace and progress of restoration by using minimum datasets and valuable parameters. Hence, the artificial neural network is essential to validate the concept. About 9 mine spoil parameters were selected in order to develop the QSAR equation based on brute-force method and genetic function approximation for the prediction of mine spoil reclamation required for the fresh coal mine overburden spoil to reach the mean soil features of the nearby native forest soil. The training and the test sets with statistically best fitted with $R^2= 0.994$ and $R^2_{LOO}= 0.881$. The predictive ANN model with 9- 7- 1 structure was predicted as the best model which illustrated the time period required for the mine spoil genesis across the sites. The standard error for the proposed model was estimated to be 0.001, which can be used as an indicator of the robustness of the fit and suggested that the predicted years for the mine spoil reclamation across the sites based on the model is reliable. The validity of the developed model was confirmed with the highest calculated value of the squared correlation coefficient determination ($R^2= 0.975$) and lower root mean square error (RMSE= 0.28), which revealed good predictability. Hence, OB_0 shall take ~ 39.277 years to reach the mean soil features of the nearby native forest soil depending on the variability in physico-chemical properties, enzyme activities, microbial community structures and fungal PLFA biomarkers as the sensitive and reliable indicators influencing the mine spoil reclamation in different age series coal mine overburden spoil overtime.