ENVIRONMENT ASSESSMENT AND MODELLING OF SALTS TRANSFER IN FOUR LAND RESTORATION SCHEMES IN THE COAL MINING REGION

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The mining district where the Western Donbas coal mines are emplaced has accumulated wastes in the form of tailings, heaps, dumps, and slurry deposits. Meantime, only small part of the waste from these sites is "recycled" in other areas such as road filling, dams and embankments construction. The environmental impact of these materials remains little-studied. The toxic salts mobility as a result of weathering processes has not been estimated and no data exist concerning the transfer of toxicants migration. Accordingly there is great concern rising from high concentrations of toxic salts in these sites. The land reclamation practices are of paramount importance to provide environmental and health regional safety. Moreover, the need for new technologies of natural resource extraction requires new, effective and low cost landscape restoration technologies to achieve a considerable abatement of toxic compounds migration. Main goal is to assess and model salts profile distribution in different artificial land reclamation trials. Objectives: a) to create long-term database of salts distribution for the last 30 years; b) to apply different mathematical approaches to create several numeric models of vertical salts migration; c) to check forecasts in conditions of Pavlograd land reclamation station of DSAEU. Numeric models of the salt transfer at mine dumps were created on the basis of the theory of physic-chemical hydrodynamics of porous media. All variants are solved with the boundary condition of Dankverts – Brenner on the earth's surface and 1 kind on the border of the unsaturated zone and full water saturation. Migration parameters were determined from the analytical dependencies. The solution of the forecasting tasks on the quantitative assessment of the effectiveness of remediation for different periods was performed by the Thomas method. The adequacy of the models is confirmed by comparing the results of forecast with model observations. Models were designed to quantify the migration of macro- and microcomponents in time and space. We considered the following four types: a) without reclamation; b) reclamation in rainfed conditions to grow crops; c) with irrigation system; g) with wild vegetation. The salts migration process case has been studied along artificial soil profiles for land reclamation. A case study is presented as mathematical exponent model. The first model represents the blade which is poured out without reclamation. The process of moisture transfer is infiltration. It provides a slow desalinization of the upper layers, stacked rocks with a speed of 1-3 cm/year, depending on the magnitude of the salinity. The second model shows the migration of salts on reclaimed spoil rainfed agriculture. The presence of evaporation creates a mode of upwards moisture transport. The negative consequence is the increased salinity of the bulk soil. The third model differs from the previous embodiment by the replacement of rainfed agriculture on a systematic irrigation with mine waters of low salinity. The model allows choosing the optimal salinity water for irrigation. A complex assessment of oxidizing-reducing conditions along reclaimed lands has been made. The mathematic modeling and long-term forecast of the water-salinization condition changes in the reclaimed lands has been completed. The calculations of the groundwater table dynamics for reclaimed minelands (without and with horizontal drainage for irrigation) were conducted. The fourth model involves the free growth surface of the blade natural vegetation with low transpiration and is characterized by the accumulation of salts on contact with bulk clay layer.

Key words: Coal Mining, Western Donbass, Salt Transfer, Land Restoration