

## ECOLOGIC APPROACH TO THE RESTORATION PROCESS AT AREAS DEGRADED BY MINING OPERATIONS

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Donetsk Region belongs to the zone of the most Ukrainian critical ones in provision with water and the quality of water. The main reason of the water quality deterioration is anthropogenic pollution due to untreated water discharge by the region's industrial enterprises to water objects.

When worked-out mines are abandoned using the combined method then water pumping is continued from immersed underground workings at least 100 m deep to prevent the impoundment of surface plots settled. The pumped water shall be desalinated and clarified. Demineralization of these flows is the technical problem associated with considerable costs.

In accordance with the existing sanitary norms and regulations mine waters must be purified before their discharge to open water reservoir as they contain substances which concentrations exceed maximal values permitted for piscine.

Besides, for mining enterprises under liquidation the issue of restoration and topsoiling together with biodiversity at the abandoned areas of open pits and industrial grounds of closed mines is of primary importance.

In this connection we find prospective the biological water purification using higher aquatic plants that will form the humus part of the productive layer after cells' die-off and decompose. The restored space will be reformed to the labyrinth of channels filled with flows where hydrocoles grow on walls and bottom. The suspended substances of flows are partially deposited on the channels' bottom however the larger mass is captured by numerous developed micro-hairs of rhizomes thus being transferred to the bound state. It is due to mineral substances absorption by plants and protozoa that salts and suspensions content in the aquatic environment get reduced.

The productive layer is formed from the captured particles and died-off organs of hydrocoles to become the basis for biota development.

To provide the whole-year water purification, prevent the effective reduction of mine water discharge purification in winter period, and the water overheating in summer the authors propose the design of a tubular geo-thermal heat-exchanger installed in a borehole. It includes coaxially positioned pipes, the inside one being manufactured of low thermal conductivity material. The water is supplied to the heat-exchanger, to the gap between the outside and the inside pipe, due to hydro-dynamic flow strength while its output is provided via the cavity of the inside pipe. Geo-thermal power provides the stable maintenance of the water temperature on the outlet of the exchanger as well as in the channel on the level of +12...260 °C. Mine shafts can be used as heat-exchangers, supports as the outside pipe, and airlift water discharge as the inside pipe. Water withdrawal will be done from an immersed mine level.

So, the proposed technology allows the effective whole-year water flows' purification at mining enterprises as well as acceleration of the processes of productive soil formation at abandoned areas and industrial grounds of closed enterprises.

**Key words:** Higher Aquatic Plants, Biological Purification, Geo-Thermal Power