NEUTRALIZATION EFFECT OF THE FLY ASH AND COAL DUMP WASTES

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Acidic and/or alkaline wastes, or wastes that change their pH level over time, create an increased danger to the environment and human population. These wastes can be formed due to activity of all basic branches of industry (agriculture, energy, metallurgy, food, chemical, mining, production and processing of petroleum products, etc.).

One of the most serious problems causes the waste from the mining industry and coal extraction in the form of waste heaps and waste dumps. The presence of light-dissolving salts (mainly chlorides) as well as pyrites (up to 5-10%) in the coal dumps of the Western Donbass, for example makes it impossible to plant greenery or use dumps for agricultural purposes without significant cost for their reclamation. As a result of oxidative processes, sulfuric acid is formed, which leads to a strong acidification of the environment and migration of acidic components at significant distances beyond the mining objects, pollution of surface and groundwater sources by sulfate and hydrogen ions. The pH after the end of the oxidation process of sulfides may reach 1.3-2.0.

The most optimal solution of the problem connected with acid formation in abandoned coal dumps is their neutralization by alkaline wastes to normalize the pH level. The method of neutralization needs a volumetric determination of the concentration of acids and alkalis in solutions.

The main purpose of this work was to determine the neutralization potential of aqueous extracts from industrial wastes with alkaline pH values for their subsequent use as possible addition for acid wastes from mining and coal processing.

The subjects of the research were samples of coal dumps of mine Pavlogradska (experimental plot without reclamation), selected from a depth of 30–45 cm. The age of the dumps is about 60 years, which indicates the duration of the weathering processes with the formation of sulfuric acid and leaching of metals (pH of the water extract were from 2.65 to 3.32). As a neutralizer the fly ash of the Prydniprovska Thermal Power Plant was used (pH of the water extract was 10.63 ± 0.04). To establish the point of equivalence the method of potentiometric titration was used (end point of pH = 7.0, titrants: 0.1 N solutions of HCl and NaOH). For pH measuring the water extracts of fly-ash and coal-dump waste were made in the ratio of 1:10 (waste-water). Titration was carried out in three replicates.

During titration experiments it was established that 0.52 ml of HCl was spent on the neutralization of the fly ash with an initial alkaline pH of 10.63 to a neutral pH of 6.80. Neutralization of acid rock with an initial pH of 3.32 to 6.84 required 2.06 ml of NaOH. A point of equivalence was found as 1.0 ml (both for HCl and NaOH needed for neutralization of the water extracts of fly-ash and coal-dump waste correspondently), at which the pH was only 4.32. The desirable end point of titration was not achieved, which proved a high potential for acid formation in the conditions of coal dumps and necessity to use an increased amount of fly ash. A study on the determination of the optimal ratio of ash-rock showed that the neutral value of the solution (pH 6.95) of the ash-rock mix was observed at the dilution of 3 parts of the fly ash extraction to one part of the rock dump extraction (dry weight).

For investigation the toxic properties of the water extracts of fly-ash and coal-dump a growth test (germination capacity, length of stem and primary root) on the basis of *Sorghum sudanense* seeds was used. It was established that the most optimal substrate for plant cultivation is the ratio of fly ash:coal dump rock (dry weight) as 3:1.

Thus, neutralization of the coal dump wastes with acidic values of pH can be possible on the basis of the fly ash use creating favorable conditions for phytoreclamation of the abandoned coal dumps.

Key words: Coal Dumps, Fly Ash, Acidity/Alkalinity, Toxicity Bioindication