MODERN METHODS FOR RECULTIVATION OF TAILING DUMPS

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ABSTRACT. Lands resulting from the flotation tailings and disposal of tailing have no biotic potential, so it is necessary to apply modern methods for remediation for these lands to have a particular purpose. To have a successful recultivation, it is necessary first to remove the water from the tailing dump. Dewatering can be done by several methods depending on the application/usage of the terrain after recultivation. The process of dewatering can be performed by application of geotextile with woven grid, and then adding burden on tailing dumps or by preparing vertical piles and adding of the burden. If at site where tailing dump is situated, buildings are foreseen to be constructed it is necessary the tailing dump to meet the geo mechanical conditions. During the recultivation of tailing dumps it is best if flotation tailing is completely isolated from humus material by placing geosynthetic materials (geotextiles, geomembrane, drainage geocomposite, geogrid). Hence, before applying humus geosynthetic materials are placed, and isolation of tailings, stable conditions, erosion protection are accomplished. For more successful emergence of vegetation on the slopes of tailing dumps modern material Biomac S/C can be used, material made of coconuts and straw merged with polypropylene network which material is used for the recultivation in Republic of Macedonia and excellent results are achieved.

Keywords: dewatering, geosynthetics, vegetation

INTRODUCTION

Land arising of deposited tailing material, due to the high content of harmful components, represents a wide range of potential problems for the near and distant environment. These lands have no biotic potential and their impact on the environment to be kept to a minimum it is necessary remediation to be performed so they can be used again.

Recultivation is a set of measures for the rehabilitation of the productivity of damaged land and improving the conditions of the environment. There are two types of remediation:

- Technical and
- Biological recultivation.

Before the process of rehabilitation begins, first water need to be drained from flotation tailing dump, so with certain procedures drying of tailing dump to be performed.

METHODS FOR DEWATERING OF TAILING DUMPS

The terrain raised from the flotation material can have different purposes: land for agriculture, forestry, construction of facilities, construction of roads, etc.

Regardless of the purpose of the field it is necessary to perform removal of water from the ground.

One way of dewatering of tailing dumps is extrusion of water by adding freight, while the second way is setting vertical drainage and adding burden on tailing dump (in some cases several meters in height) in order extrusion of outstanding waters.

For tailing dumps with a small height first on flotation liquid mass high strength geotextiles with large woven network (Figure 1) has to be set, then sandy material (Figure 2) has to be set, which is compact and thus extrusion of water is performed and solid ground is created. In case you need a significant solid ground, you can put a few more layers high strength geotextiles in combination with sand and thus reinforcement of the ground is performed.

Placement of high strength geotextiles is in manner that, first rolls of geotextile merge with each other and are associated with tube. On geotextiles large knitted network that spans with geotextile is placed. Steel wire rope passes through the pipe over which pulling of the prepared segment with machine is performed.

Fig. 1 Setting of getextiles with high strength with geogrid

Fig. 2 Setting sandy material and extrusion of water

At tailing dumps with greater heights the situation is more complex. Satisfying geo mechanical conditions for higher tailing dumps, first drainage has to be performed (Figure 3, Figure 4), and then making piles- drains and filling them (piles of geosynthetics) with sandy material (Figure 5).

Depending on the required load capacity on the surface of the ground different methods of making piles are applied as: vibration during the drilling for compacting of material, by adding sand under pressure, reinforcement with iron bars and filling with liquid concrete.

At what distance piles will be placed depends primarily on land use and the required load capacity on the ground. After manufacturing of piles high strength geotextiles will be placed on flat terrain, geo grids for additional stabilization of the terrain will be placed on the slopes.

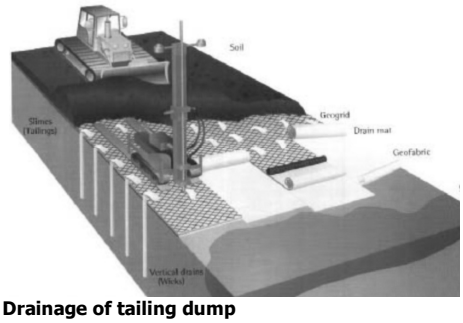

Fig. 3 Drainage of tailing dump

Fig. 4 Drainage of tailing dump

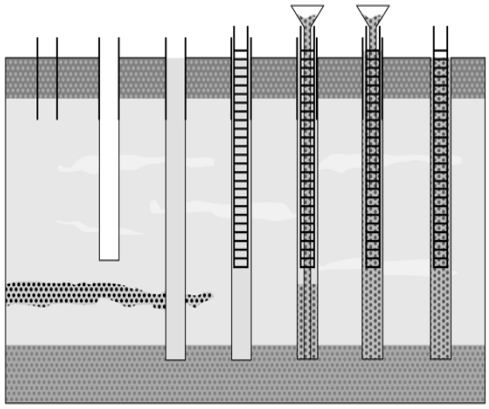

Fig. 5 Present of sheme on making of piles

RECULTIVATION OF TAILING DUMPS

Technical recultivation is important phase of the rehabilitation process and requires considerable financial resources.

Technical remediation is performed before biological and it includes measures for the preparation of the land area, isolation of flotation tailing and measures to rebuild the humus layer. To have efficient technical recultivation, it is necessary over the tailing material geosynthetic materials to be placed, such as: geotextiles, geomembranes, drainage geocomposites, geogrids and then humus material with thickness 30÷70 cm (Figure 7) to be spread.

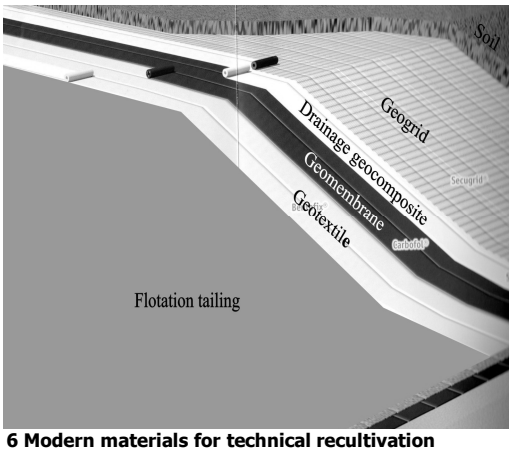

Fig. 6 Modern materials for technical recultivation

Fig. 7 Erosion control with geogrid

With the application of geosynthetic materials complete isolation of tailing material is performed and terrains that have a stable and secure areas and slopes are formed. Biological remediation is the continuation of technical remediation, rehabilitation which includes a set of biotech, agro-technical, irrigation and other measures in order to perform recovery of the fertility of the area of the new created situation on the ground. Biological remediation depends on the future land use, as well as climatic and pedological conditions of the area.

Biological remediation can be oriented to the creation of artificial forests, crops, ornamental communities or recreation centers. Regardless of the future purpose with this process a fertile land and resistant plant cover must be formed, with reproductive capacity similar to the indigenous land and plant species in the vicinity.

Through recultivation by reforestation for a certain time significant results will be accomplished, with the full and permanent restoration or rehabilitation of disturbed ecosystems. Given that recultivation by afforestation except to allow permanent recovery and revitalization of land, is also expected to get some forest ecosystems which will have multiple purposes. These forests despite the protective function, in the future is predicted to have economic and aesthetic decorative function.

During the selection of seeds from grasses it is preferable to choose grasses that have greater adaptability to climatic conditions. For this purpose, you can make a choice of mixture of seeds. Seasonal grasses play an important role in agricultural and horticultural arrangements. Grasses produce pasture for livestock and also prevent erosion of land that is not suitable for agricultural crops, but can be an environment for wildlife and contributes to the restoration of land.

For more successful occurrence of vegetation on the slopes on tailing dumps, modern material Biomac S/C can be used. Biomac S/C is biodegradable cover made of a mix of totally biodegradable fibers bonded during manufacture.

Fibers are placed on a layer of cellulose and reinforced with polypropylene network. Biomac S/C consists of a mixture of straw and coconut fiber. It is produced in rolls and is very easy to be set (Figure 8). Placement of rolls is performed in a way that adjacent rolls are overlapping for about 10 cm. Reinforcement of Biomac S/C is usually performed with iron or wooden anchors (Figure 9).

Fig. 8 Biomac S/C for more effective recultivation

Fig. 9 Strengthening of Biomac S/C

Maintenance of the processed slopes on this way is considerably smaller compared to classical methods of recultivation. Biomac S/C as cover of slopes gives temporary protection from erosion until vegetation on slope is recovered (Figure 10). With this cover plants shall be provided with favorable moisture and food from the fertilizer that is produced by decay of coconut fibers and straw.

In very dry periods performance of irrigation of the areas covered by Biomac S/C in order to achieve greater capacity for greening will be required. For a period of 2 to 3 years cover Biomac S/C will be decayed, and it is long enough for the ground to be cover with grass.

This material has already been used for the treatment of slopes in the Republic of Macedonia excellent results have been achieved.

Fig. 10 Phase of growing grass with Biomac S/C

During recultivation of slopes to prevent surface erosion geocomposite material can be used (Figure 11). Geocomposite is a light and flexible alternative and it is designed to provide development of strong vegetation for permanent erosion protection on the slopes.

He is in the form of a network created with open structure of polyamide fibers combined into cross-sections, with 90 % of their volume is free and filled with humus and seed for grass, with this grid material vegetation is easy for growing (Figure 12).

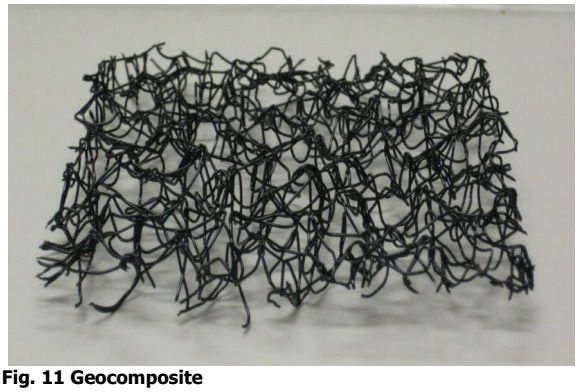

Fig. 11 Geocomposite

Fig. 12 Phase of growing grass with geocomposite

CONCLUSION

With the application of modern methods for recultivation at tailing dumps, significant benefits to the surrounding terrain are achieved, primarily it restores the occupied land, surrounding area is protected from air pollution, environmental conditions are improved and afforestation is enabled.

By the implementation of recultivation in the future livestock, forestry, agriculture would have benefits. Also, in terms of utilization of these recultivatied areas it is possible construction of roads, buildings, etc., if geomechanical conditions are meet.

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