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# DETERMINATION A DIAMETER OF THE SEDIMENTAL LAKE OF THE NEW FIELD OF THE LEAD AND ZINC FLOTATION TAILING DUMP IN LEPOSAVIĆ

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## Abstract

*Management of technological water at the flotation tailing dumps where tailings are deposited after the processing of polymetallic ore of copper, lead and zinc is perhaps the most important part of every polymetallic mine. Flotation processing of lead and zinc ore requires large amounts of water for flotation the lead and zinc minerals, where, after extracting the selective metal concentrates, the flotation tailings in the form of hydromix are transported to the flotation tailings dump. At the flotation tailing dump, a sand embankment is built from the sand of hydrocyclone, which limits the accumulation area of tailings, while the fine tailings particles are deposited in the accumulation area of the tailing dump, forming a beach next to the embankment and sedimentation lake. The sedimentation lake has a double function: the first is to enable the deposition of fine tailings particles with its size, and the second is to serve as an accumulation of technological water from where the water can be pumped back to the flotation plant if necessary and reused in the technological process of flotation the lead and zinc minerals.*

***Keywords:*** *flotation tailing dump, accumulation lake, technological water*

## 1. INTRODUCTION

The flotation tailing dump of the Mine and Flotation Plant "Kopaonik" - Leposavić at the Bostanište location was built in 1977, and since then it has been in a continuous operation for 47 years. After the filling the Old tailing dump to the elevation of K+477 m above the sea level, a new side-type tailing dump was designed and built in the extension of the Old tailing dump, upstream along the river Ibar. The designed height of the side embankment overhang is K+484 m above sea level with the accumulation elevation of K+483 m above the sea level.

At the beginning of 2019, the New tailing dump embankment was built from the hydrocyclone sand by directly embedding it in the embankment to the designed elevation of K+484 m above the sea level while the sludge height in the accumulation area reached the elevation of K+481 m above the sea level. This means that there is only 2 m of free volume left until the New tailing dump is filled, which means that by the beginning of autumn 2019, a new storage area must be provided for disposal the flotation tailings from the flotation in Leposavić, in order to ensure the continuity of the lead and zinc flotation operation and uninterrupted production of lead and zinc concentrates. A free

space for construction the New tailing field in Leposavić was found between the Old and New tailing fields, as shown in Figure 1.

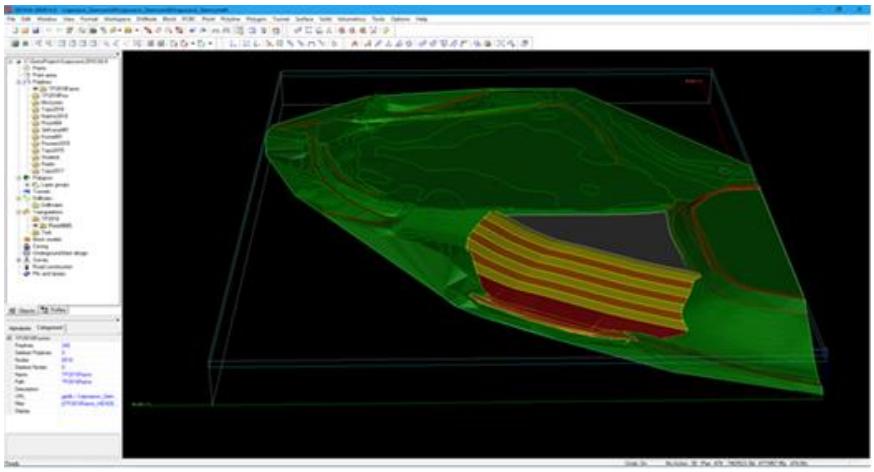

**Figure 1.** *3D view of the model of the Old and New tailing dumps and the New field between them*

## 2. DETERMINATION THE DIAMETER AND SIZE PF SEDIMENTATION LAKE OF THE NEW FIELD OF LEAD AND ZINC FLOTATION TAILING DUMP IN LEPOSAVIĆ

### 2.1 Technological bases for determining the radius of sedimentation lake:

- Tailings quantity 1187.00 t/day
- Physico-chemical characteristics of tailings
  - specific weight of solid 3150.00 kg/m$^3$
  - pulp density that is pumped to the tailing dump 1230.00 kg/m$^3$
  - solid content in pulp that is disposed at the tailings dump 24.00 %
  - water quantity 3922.00 m$^3$/day
  - $d_{50}$ 0.063 mm

Table 1 and Figure 2 show the grain-size distribution of tailings that should be disposed at the New field of the flotation tailing dump in Leposavić.

**Table 1.** *Grain-size distribution of tailings pumped to the tailing dump*

| **Size class,** (mm) | **Share,** (%) | **D,** (%) |
|---|---|---|
| -0.400 + 0.315 | 4.40 | 100.00 |
| -0.315 + 0.200 | 7.20 | 95.60 |
| -0.200 + 0.160 | 10.40 | 88.40 |
| -0.160 + 0.100 | 8.30 | 78.00 |
| -0.100 + 0.080 | 7.20 | 69.70 |
| - 0.080 + 0.000 | 62.50 | 62.50 |

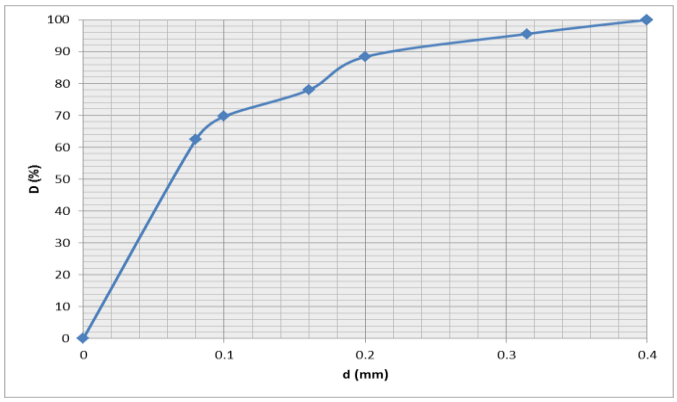


**Figure 2.** *Curve of grain-size composition of tailings pumped into tailing dump*

## 2.2 Determination the Radius and Size of Sedimentation Lake

In order to provide enough clean technological water that can be reused later in the technological process of flotation the lead and zinc minerals in the flotation in Leposavić, the minimum diameter of the sedimentation lake can be determined on the basis of the following parameters:

- minimum height of clean water in the zone of overflow collector (Hm) - 1.0 m
- particle size (d) - 0.0006 cm
- solid density - 3150 kg/m$^3$
- active height of the water column in the zone of overflow collector (Ha) – 0.50 m
- maximum water capacity at the entrance to the overflow collector - 163.42 m$^3$/h

The time required for settling of fine particles is determined according to the following equation:

$$t = \frac{Hm}{5450 * d * (\rho - 1)}$$

t = 21505 sec that is t=5.97 h

During this time, it is necessary to evacuate the following amount of water from the accumulation lake using the overflow collector:

136.42 * 5.97 = 814.43 m$^3$

Considering that the lake in relation to the pontoon pumping station is approximately semicircular in shape, the minimum radius of the lake will be:

$$Rm = \sqrt[2]{2 * \frac{814,73}{0,5 * 3,14}}$$

Rm = 32.22 m

The minimum radius should be: Rm = 32 m

## 3. CONCLUSION

A sedimentation lake of this size has the maximum volume of about 3560 $m^3$. Controlling the water evacuation height through the opening on the overflow collector at about 0.5 m, it is possible to regulate the amount of water in the sedimentation lake from the maximum of 3560 $m^3$ to the minimum of 1630 $m^3$ of water.

In this way, the sedimentation lake can be moved far enough from embankment in the area of tailing dump, which prevents the negative effect of water from the lake on the inner leg of embankment (such as shelling due to the effect of wind and waves, cutting of the embankment, etc.), which can reduce the stability of embankment within the limits prescribed by the law, basically in a stable condition.

## ACKNOWLEDGEMENTS

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