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A software for metal balance of the selective flotation

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Abstract: In this paper we present the software for metal balance of the selective flotation, specially made for SASA lead and zinc mine in Makedonska Kamenica, Republic of Macedonia. With small changes, it can be applied in other mines and for other metals or nonmetals. The software is Microsoft Access database and it is split into two files: one that contains the tables and one that contains the queries, forms, reports, macros, modules, and shortcuts to input access pages. This way, users who need to access the data can customize their own forms, reports, pages, and other objects while maintaining a single source of data on the network.

KEY WORDS: METAL BALANCE, SELECTIVE FLOTATION

1. Introduction

The SASA lead and zinc mine is located on the southeast slopes of the Osogovo mountain, 12km from Makedonska Kamenica, in northeast part of Republic of Macedonia. The mine didn't work for several years, but now it is privatized and restarted. After privatizing, the technological process is changed from bulk to selective flotation.

Processes of grinding and classification are performed in two parallel identical sections with overall capacity of 75t/h and flotation is performed in only one section. This changes request a development of new software for metal balance. For more information on SASA mine see (Orovceanov, D. et al. 1997).

2. The theory behind the software

Flotation process, originally patented in 1906, permitted the mining of low-grade and complex ore bodies which would have otherwise been regarded as uneconomic. The success in the selective flotation concentration process is the most important, and in industrial conditions the most common step in the flotation concentration of typical lead - zinc ores, is first of all seen, in obtaining qualitative selective lead and zinc concentrations adequate for further metallurgical treatment with high metal recovery in the concentrations.

For our software we use several data. We use feed mass Q and results obtained after
chemical analysis of concentration products. Their labels are presented in Table 1.

<table>
<thead>
<tr>
<th>Parameters used in formulas and obtained from chemical analysis</th>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb (%)</td>
<td>Zn (%)</td>
</tr>
<tr>
<td>Feed</td>
<td>Fp</td>
</tr>
<tr>
<td>Pb concentrate</td>
<td>PCp</td>
</tr>
<tr>
<td>Zn concentrate</td>
<td>ZCp</td>
</tr>
<tr>
<td>Tailings</td>
<td>Tp</td>
</tr>
</tbody>
</table>

Also we use this labels:
- $M_P$ - mass quota of Pb concentrate;
- $M_{ZC}$ - mass quota of Zn concentrate;
- $M_T$ - mass quota of tailing.

From presented data and labels we can obtain formulas (1) for mass quotas of Pb concentrate, Zn concentrate and tailing ((Wills, B. A. 1988) and (Krstev, B. 2002)):

$$M_P = \frac{(Fp - Tp)(ZCZ - Tz) - (ZCp - Tp)(Fz - Tz)}{(PCp - Tp)(ZCZ - Tz) - (ZCp - Tp)(PCZ - Tz)}$$

$$M_{ZC} = \frac{(PCp - Tp)(Fz - Tz) - (Fp - Tp)(PCZ - Tz)}{(PCp - Tp)(ZCZ - Tz) - (ZCp - Tp)(PCZ - Tz)}$$

$$M_T = Q - M_P - M_{ZC}$$

We use formulas (2) and (3) for recovery of Pb and Zn in Pb concentrate and Zn concentrate.

$$R_{PC} = \frac{PCp}{Fp} \quad R_{ZC} = \frac{ZCp}{Fp}$$

$$R_{PC} = \frac{PCZ}{Fz} \quad R_{ZC} = \frac{ZCZ}{Fz}$$

3. How program works

The software is Microsoft Access database and it is split into two files: rudnik_v4_be.mdb that contains the tables and MetalBalance.mdb that contains the queries, forms, reports, macros, modules, and shortcuts to data access pages. This way, users who need to access the data can customize their own forms, reports, pages, and other objects while maintaining a single source of data on the network. The program is starting with the second file, and then the main program window, which is switchboard form, occur (Figure 1).

![Figure 1. Main program window](image)

Program command can be activated in two manners: from main menu or with buttons from main program window. Main Menu consists of: Programa (Main program window), Vnesuvanje na podatoci (Data entering), Azuriranje na podatoci (Data modifying), Izvesti (Reports) and Za (About).

3.1. Data entering and modifying

Data entering is divided in two parts. First part is data entering for feed ore (Menu: Vnesuvanje na podatoci $\rightarrow$ Melenje i klasiranje or Main program window: Vnesanje na podatoci za prerabotena suva ruda) and form on Figure 2 occurs. Data are consist of number of section (1 or 2), number of working shift (1, 2 or 3), date, working hours and mass of feed ore in tones.

![Figure 2. Data](image)

The second is data entering for flotation (Menu: Vnesuvanje na podatoci $\rightarrow$ Flotacijska koncentracija or Main program window: Vnesanje na podatoci za flotacijska koncentracija), for which we use form on...
Figure 3. Data are consist of date, number of working shift and results obtained after chemical analysis of concentration products (Table 1).

Data modifying is performed in similar forms. Data modifying form for feed ore is accessed from menu - Azuriranje na podatoci -> Melanje i klasiranje or from the button Azuriranje na podatoci za prerobotena suva ruda in main program window. First you must specify section, working shift and date. Data modifying form for flotation is accessed from menu - Azuriranje na podatoci -> Flotacijska koncentracija or from the button Azuriranje na podatoci za flotacijska koncentracija in main program window, with first specifying working shift and date.

The software for metal balance of the selective flotation also give planning possibility. Planning form is opened from the menu - Azuriranje na podatoci -> Promena na planirani parametri or with the button Promena na planirani parametri and consists of month planning parameters (Figure 4).

3.2. Reports
Main purpose of this software is to free people from comprehensive and tiresome calculations and work for writing reports. This program offer four kind of reports (Menu: Izvestai or Main program window: Izvestai). The first report is List of data entered for feed ore in some time interval (Lista na vneseni podatoci za prerobotena suva ruda), see Figure 5.
The second report is List of data entered for flotation in some time interval (Lista na vneseni podatoci za flotacijska koncentracija), see Figure 6. The time interval is determined by first and final date.

Daily report (Dnevni izvestaj) is the third in line and it offers daily obtained data for technological parameters for grinding and classification and for flotation. This includes mass quotas of Pb concentrate, Zn concentrate and tailing; mass quotas of Pb and Zn in tailing and Pb and Zn concentrate; and Pb and Zn recovery in Pb concentrate and Zn concentrate. Data are presented by working shifts, summary, cumulatively and like percentage with planning values. Planning values are also presented (Figure 7).

The fourth report (izvestaj) and it a daily report but which is entered (Figure 8). In this monthly and others produced. Result summary.

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on. This includes Pb and Zn in tailing and Pb and Zn in Zn concentrate. Working shifts, like percentage values are also

4. Conclusion

In this paper we present the software for metal balance of the selective flotation, specially made for SASA lead and zinc mine in Makedonska Kamenica, Republic of Macedonia. With small changes, it can be applied in other mines and for other metals or nonmetals. Main purpose of this software is to free people from comprehensive and tiresome calculations and work for writing reports.

References