ANALYSIS OF QUALITY INDICATORS FROM SLURRY DECANTERS

FLORIN FLAVIUS ȘOICA[1], ANGELA EGRI[2], ALEXANDRA STANIMIRESCU[3]

Abstract: In the coal preparation plant situated in Vulcan, a part of raw coal extracted from the mining units in the ”ValeaJiului” is being processed. The small grit coal from circulating waters is concentrated with cyclone batteries and recovered and drained with the help of special screens. The fine tailings from residual water aredirected into the slurry decanters and the water is purged using reagents. For appropriate dosing of the reagents, weekly samples of water containing tailings are collected form the slurry decanters. In the following we will analyze and interpret the indicators obtained from the processing of these samples.

Key words: press filters, separation plant, water treatment plant ash, residual material, sampling, statistical analysis.

1. INTRODUCTION

The Petroșani Depression is the largest depression in the country, has a tectonic origin and expandsto east-west direction 43-45 km and widens 3-9 km on the courses of the two main affluentsof ”Jiu” river.

The sedimentary complex of the basin belongs to the Upper Cretaceous, the Upper Oligocene and the Miocene and is transgressively and discordantly disposed over the palaeo-mesozoic crystalline formations.

In the productive formation, of oligocene age, at the beginning there were identified about 20 layers of coal. The useful substance in the deposit is made up of coal with compact and relatively homogeneous composition. The coal of the Jiu Valley, which is superior to most of other coal found in our country, is a hard type coal.

[1]*Ph D. student, University of Petrosani*
[2]*Associate Professor, Ph.D.Eng, University of Petrosani*
[3]*Ph D. student, University of Petrosani*

The shift to the systematic exploitation of coal in this basin, on an industrial scale, was only made at the end of the 19th century.

Coroeşti coal preparation plant is the third coal preparation plant built in the Jiu Valley, located in the eastern part of Vulcan, on the right bank of the West Jiu, in the Coroeşti settlement area - from where its name comes [1].

Coroeşti coal preparation plant was founded on June 1, 1963, and in 1969-1971 it was modernized, the changes being claimed by the necessity of producing increased quality energetic coal.

Later, between 1978-1981, the following were added:

- a wagon rollover machinery for unloading the train wagons full of coal
- a raw coal sorting line
- a siloingstation for the washed coal by building two silos of 8,000 tons each, one for special coal, called coke and one for energy mixes
- waste water treatment plant(press filters) with the purpose of retaining and evacuating or commercializing the tailings from waste water and cleaning the water for recirculation in the washing section [2].

The coal processing plant was initially designed for a capacity of 4 million tons per year approved by Decree 176 / 13.05.1978. The plant operated with two washing lines and a spare one with a capacity of 330 tons per hour on a line (with an effective work time of 18 hours).

In 2003, the upgrade, refurbishment and modernization plan was implemented with the help of the integrated ITOCHU-KOPEX project, resulting a new separation plant(the commissioning held on 31.03.2003) and a new washing plant (the commissioning held on 30.05.2003). The refurbishment of the water treatment plant was done in two stages, two sets of filters were put into operation with the separation plant and the other two with the washing plant.

Due to the poor state of the existing machinery and the modernization of the C the refurbishment of waste water treatment plant was absolutely necessary.

The waste water treatment plant was equipped with new automatic displacement filters (4 sets), new slurry water pumps, new clean water pumps, high pressure pumps(to tighten the filter plate) and an automated preparation and dosing station for reagents [3].

2. METHODOLOGY AND RESULTS

During the course of this study, for the observation of the technological parameters of the residual water treatment phase, several water samples were collected from the plant feed pipeand the solid phase concentrations (g / l) and ash content were determined. Also laboratory tests were conducted in order to check reagent consumptions and performance [4].

The old recipe for polyacrylamide (PAA) and calcium chloride purification reagents has been replaced, the new recipe that includes two of the most effective types of clarifying reagents currently used worldwide, namely ZETAG 7195 coagulant and MAGNAFLOC 919 as a flocculant [5].

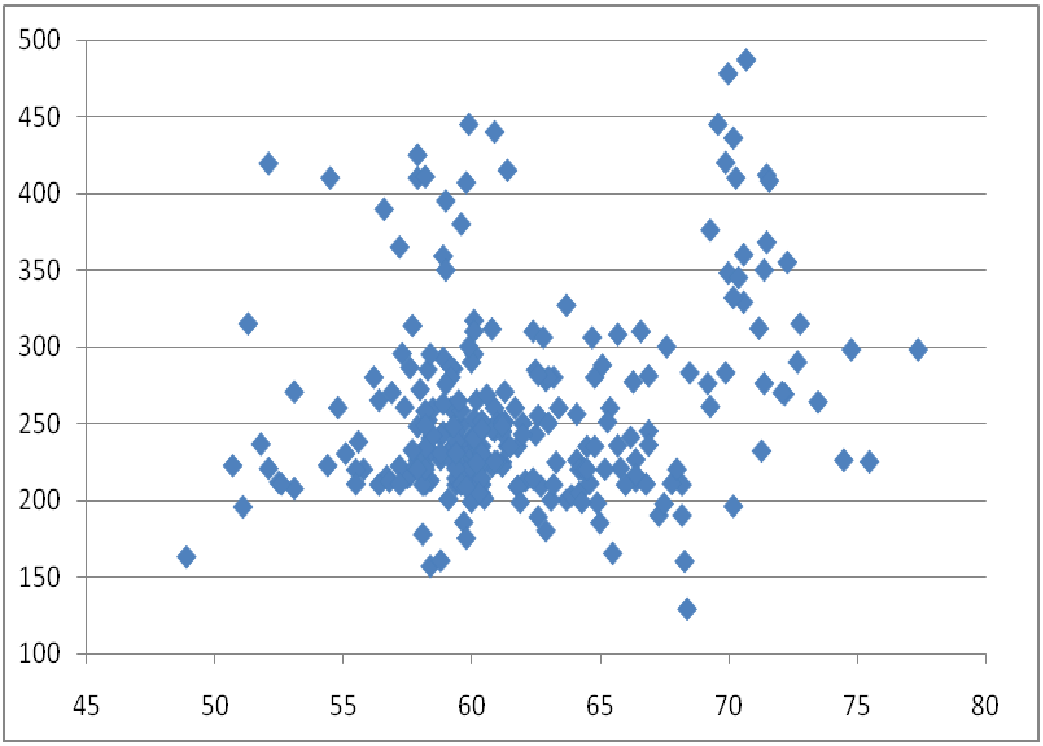

Fig.1 Graphical representation of the obtained results

In the laboratory tests, the same reagent consumption was used as at industrial scale, respectively 0,25 ml / l Zetag concentration 5% and 0,615 ml / l Magnafloc concentration 0,2% corresponding to specific consumption of 10 g Zetag / m3 clean water and 1.23 g Magnafloc / m3 of clean water.

The effectiveness of the cleansing tests has been established by determining two basic parameters, respectively the rinsing speed and the turbidity.

Between January 2011 and December 2016, 266 samples of water from the slurry decanters were collected and sent to the Coal Quality Laboratory.

Following specific tests, the residual material and ash content were determined (Figure 1).

In the figure above, the X-axis of the graph represents the ash content (A) expressed as a percentage, and the Y axis represents the concentration of the residual material (C) in the water sample expressed in g / l.

In the studied period, the ash content ranged from 48.9% to 77.4% with an average of 61.5% (Figure 2), while the concentration of residual material in the decanter ranged from 129 g / l to a maximum of 487 g / l, with an average of 257.72 g / l (Figure 3).

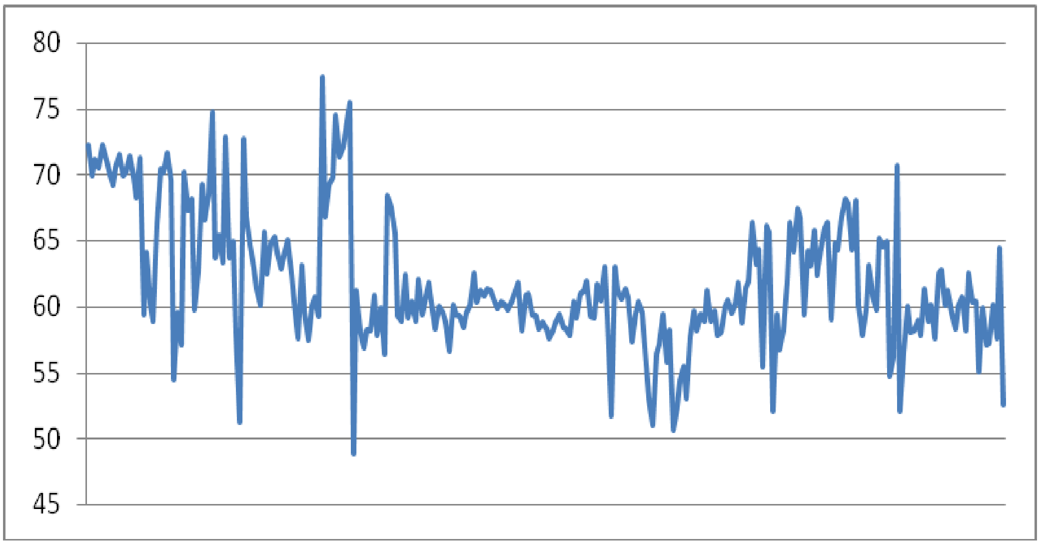

Fig. 2 Variation of ash content (%)

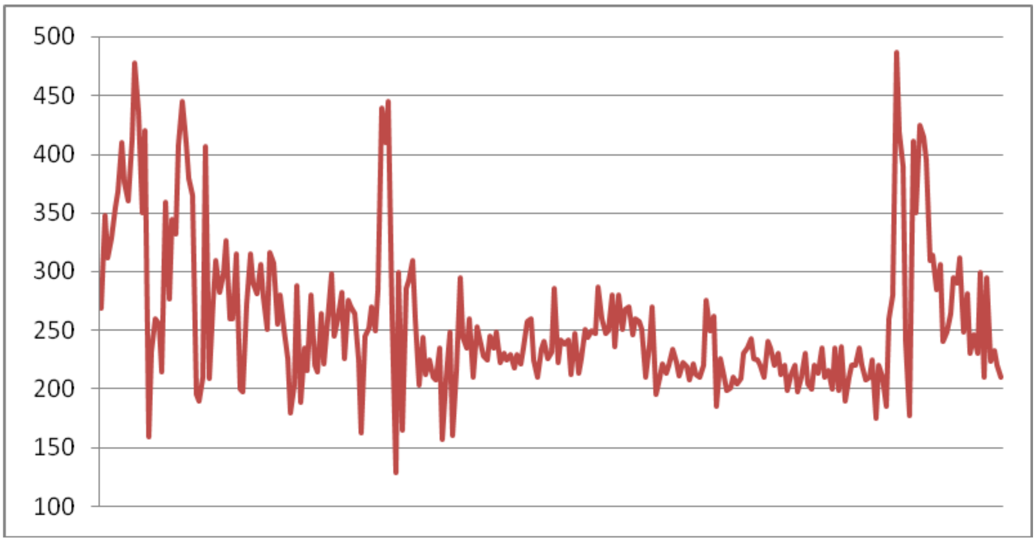

Fig. 3 Concentration variation (g / l)

Next, we calculated some benchmarks in order to perform aobjective statistical research,as shown in Table 1 and Table 2.

Table 1 **Ash and concentration deviation**

	Min	**Max**	**Medium value**	**Mean linear deviation (absolute)**
Ash (A)	48,9	77,4	61,84	3,9145
Concentration (C)	129	487	257,72	45,9914

Table 2 **Ash and concentration dispersion**

	Dispersion	**Coefficient of variation**
Ash (A)	25,0013	8,0844
Concentration (C)	3893,859	24,2118

The charts above where made using Microsoft Excel, based on the collected data. Also in order to obtain an eligible variation law we used the trendline function of MS Excel, which implements mathematical regression (linear, exponential, polynomial, etc.) [6].

After interpreting these datawe can conclude the following results:

- the series of values describing the variation of ash is very homogeneous with a small standard deviation

- the series of values describing the concentration variation is homogeneous (coefficient of variation <35%)

We then searched for a variation law that best describes the relation between the two indicators using the regression functions and we obtained the following results:

$$y = 2{,}825\mathrm{x} + 83{,}002;\ \mathrm{R}^2 = 0{,}0512 \tag{1}$$

$$y = 139{,}26 \cdot e^{0{,}0095x};\ \mathrm{R}^2 = 0{,}0471 \tag{2}$$

$$y = 170{,}19 \cdot \ln(x) - 443{,}7;\ \mathrm{R}^2 = 0{,}0472 \tag{3}$$

$$y = 0{,}2866 \cdot \mathrm{x}^2 - 33{,}433\mathrm{x} + 1222{,}2;\ \mathrm{R}^2 = 0{,}0766 \tag{4}$$

3. CONCLUSIONS

As a result of the calculations, the dosing of the reagent for the sedimentation of the tailing, respectively the cleansing of the water in the decanter was optimally achieved, obtaining a series of homogeneous values (in the case of variation of the residual material concentration) and very homogeneous (in case of ash variation), but there were cases when water suspensions exceeded 300 g / l reaching almost 500 g / l. To avoid these situations, it is necessary to increase the frequency of sampling, constant monitoring and supplementation of the operating hours of recirculation pumps, screens and cyclones in order to recover more slurry from decanters.

After the mathematical analysis of the interdependence between ash content and tailing concentration, using mathematical regression, it was not possible to define a reliable variation law. The highest degree of confidence was obtained for the polynomial regression function, with a value of 0.0766. This value represents a low degree of confidence, which is why we can say that the variation of the ash tailing is not dependent on the tailing concentration in the decanter, or reverse.

REFERENCES

[1]. **Handra A. D., Popescu F. G.,** *Creşterea eficienţei energetice în mineritul de suprafaţă*, Editura Universitas, Petroşani, 2011, pag. 116, ISBN 978-973-741-170-9.

[2]. **Sârbu R.**, *Prelucrarea datelor experimentale şi optimizarea proceselor* (Processing of experimental data and process optimization), University course, University of Petroşani.

[3]. **Sârbu R., Bădulescu C.**, *Tehnici şi tehnologii de procesare a resurselor minerale* (Techniques and technologies for processing mineral resources), University course, University of Petroşani.