

WIESŁAW S. BLASCHKE\*, LIDIA GAWLIK\*\*, STANISŁAW A. BLASCHKE\*\*\*

## Coal preparation technology in Poland

### Key words

Coal preparation plant, steam coal, coking coal, mining wastes recovery

### Abstract

The paper presents, in the synthetic way, the basic types of coal preparation plants that work in Poland. The technological scheme of coking coal preparation plants is described as well as two typical schemes of steam coal preparation plants. Some attention is paid to operating in coal preparation plants sections of preparation and desulphurization of coal fines. The technologies of coal recovery from flotation tailing ponds and recovery of mining wastes are also mentioned.

### Introduction

Hard coal is a basic energy resource in Poland. Its production goes on in two coal basins: Uppers Silesian Coal Basin and Lublin Coal Basin. Coal in deposits is of very good quality, but during exploitation some waste rock from roof and floor are won together with coal and get into run of mine coal.

The main user of coal in Poland is power industry. About 95% of electricity is produced from coal (61% from hard coal and 34% from brown coal). Steam hard coal exploited in mines where ash content is lower than 25% is not washed and is directed straight to be burned

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\* Prof. D.Sc. Eng., \*\* Ph.D. Eng., \*\*\* M.Sc. Eng., Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, Krakow, Poland.

in boilers adjusted for usage of such coal. The other steam coal is directed to coal preparation plants, where the grains of gangue are removed (Blaschke W., Gawlik 1999; Blaschke W., Gawlik 1993).

For electricity and heat production about 45 million tonnes of steam coal a year is used. The second huge hard coal user is coke engineering, where about 11 million tonnes of coking coal is used. Traditionally all coking coal is washed.

About 18—20 million tonnes of coal a year is exported. The exported coal is the washed one.

In the eighties there worked 105 preparation plants in Poland. After the system changes in the Polish economy (started in 1989) many of coal mines were gradually closed (Blaschke W. 2001; Blaschke W., Gawlik 2001; Blaschke Z. 2000). Together with coal mines many of coal preparation plants were also closed. Now there exist 48 coal preparation plants that belong to 8 companies (some of them are coal mining companies, the others are independent coal preparation companies).

### 1. Technologies of coking coal preparation

Coking coal (type hard) is exploited in 4 mines equipped with coal preparation plants. Coal washing is conducted in three sections that differ in size of grains in feed. Grain sizes above 20 mm are washed in dense media. Grain sizes 20—0.5 mm are washed in jigs. Grain sizes below 0.5 mm are floated. Schematic diagram of the process is shown in Figure 1 (Kowalczyk, Strzelec 2004).

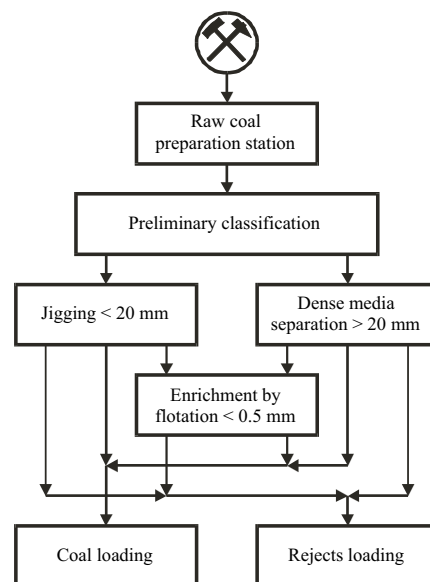


Fig. 1. Schematic diagram of the coking coal preparation process

Rys. 1. Uproszczony schemat procesu wzbogacania węgla koksowego

## 2. Technologies of steam coal preparation

Steam coal is exploited in 32 coal mines. In some of the mines there exist two coal preparation plants. There are few different schemes of preparation that depend on the quality of the feed and especially the content of waste rock (Bieńko 2004; Blaschke Z. 2001; Gawliński 2004; Kurczabiński, Łój 2004; Nycz, Zieleźny 2004).

The first scheme is shown in Figure 2, where the schematic diagram of the coal preparation process is given. The grain sizes  $+200$  mm are separated from raw coal and are directed to the Bradford crushers, where the waste rock  $+65$  mm is separated. Remaining feed is classified. Depending on the ash content it is possible to achieve unwashed  $10(6)-0$  mm class of coal, that is a saleable product and/or entire  $65-0$  mm class is washed on jigs. The concentrates from jig are separated into  $65-20$  mm and  $20-0$  mm grain sizes and these

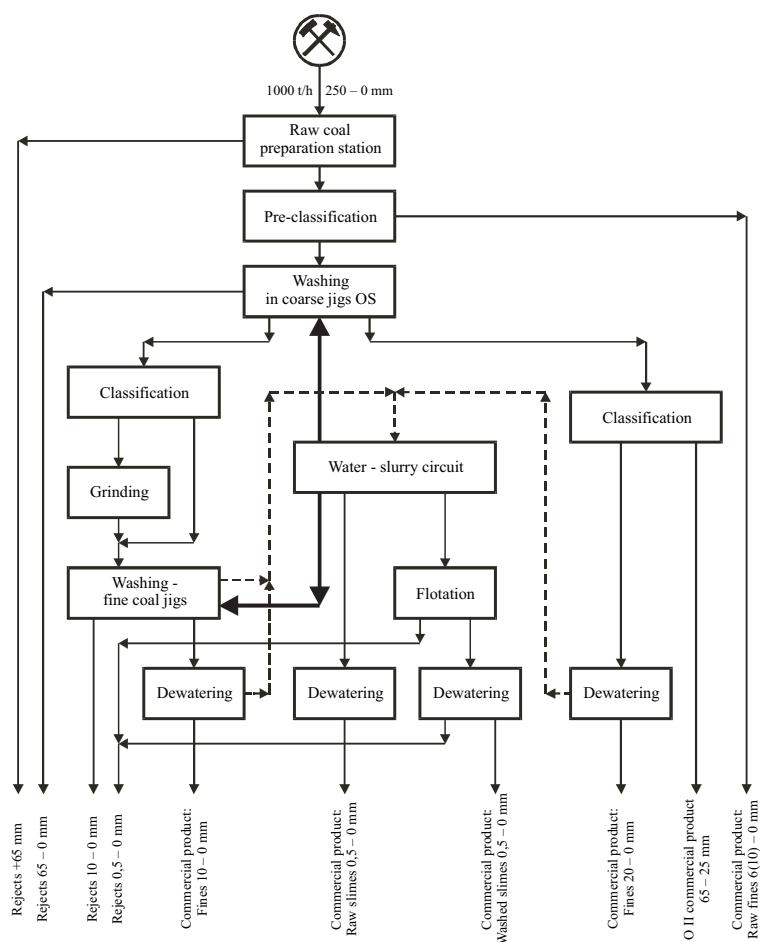


Fig. 2. Scheme of steam coal preparation process (variant I)

Rys. 2. Schemat procesu wzbogacania węgla energetycznego (wariant I)

became saleable products. Middlings from the jig are crushed to below 10 mm sizes and are washed in fines jig. The products are dewatered. Grain sizes of coal below 0.5 mm are recovered from the water in the flotation process.

The other variant of coal washing scheme is shown in Figure 3. The class 200—20 mm, separated from the feed, is washed in three-product dense media separator. The solid medium is magnetite. The concentrate is separated into two grain sizes 200—30 mm and 30—20 mm, which are saleable products. The middlings are crushed and added to 20—0 mm class extracted from the feed. The grains below 1.5 mm are extracted from that mixture. These are not washed but are added to the concentrate from two-product jigs, where the class 20—1.5 mm is washed. The product separated from the washeries water is treated as tailings. It frequently is used in fluidized bed boilers.

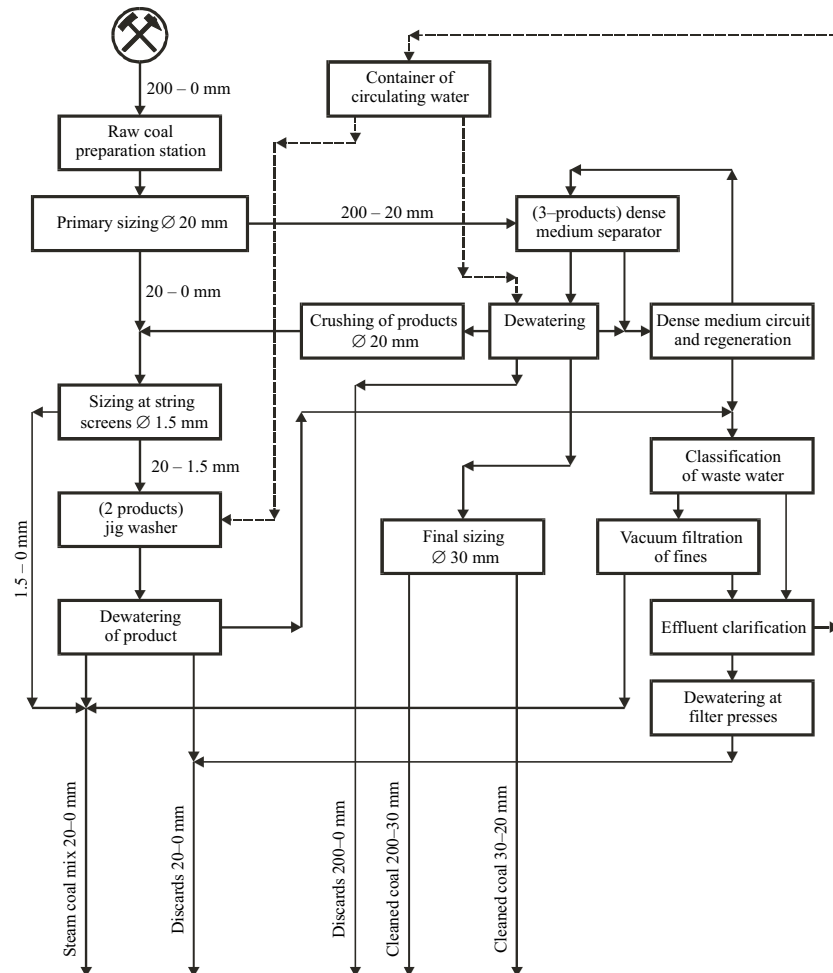


Fig. 3. Scheme of steam coal preparation process (variant II)

Rys. 3. Schemat procesu wzbogacania węgla energetycznego (wariant II)

### 3. Technologies of preparation and desulphurization of fines

Coal exploited in Eastern part of the Upper Silesian Coal Basin is characterized by high sulphur content. For the preparation of coal fines the following scheme is applied. Raw coal is separated into classes 200—30 mm and 30—0 mm. Large size is directed for washing as it is given in Figure 3. From the class 30—0 the class 30—2 mm is separated and washed in tree-product jigs. The middlings are crushed and turned back for the washing. From the 2—0 mm class the slimes below 0.1 mm are separated. The class 2—0.1 is washed on spirals. Middlings are washed in different set of spirals. The technological scheme of the process is shown in the Figure 4 (Poznański 2004).

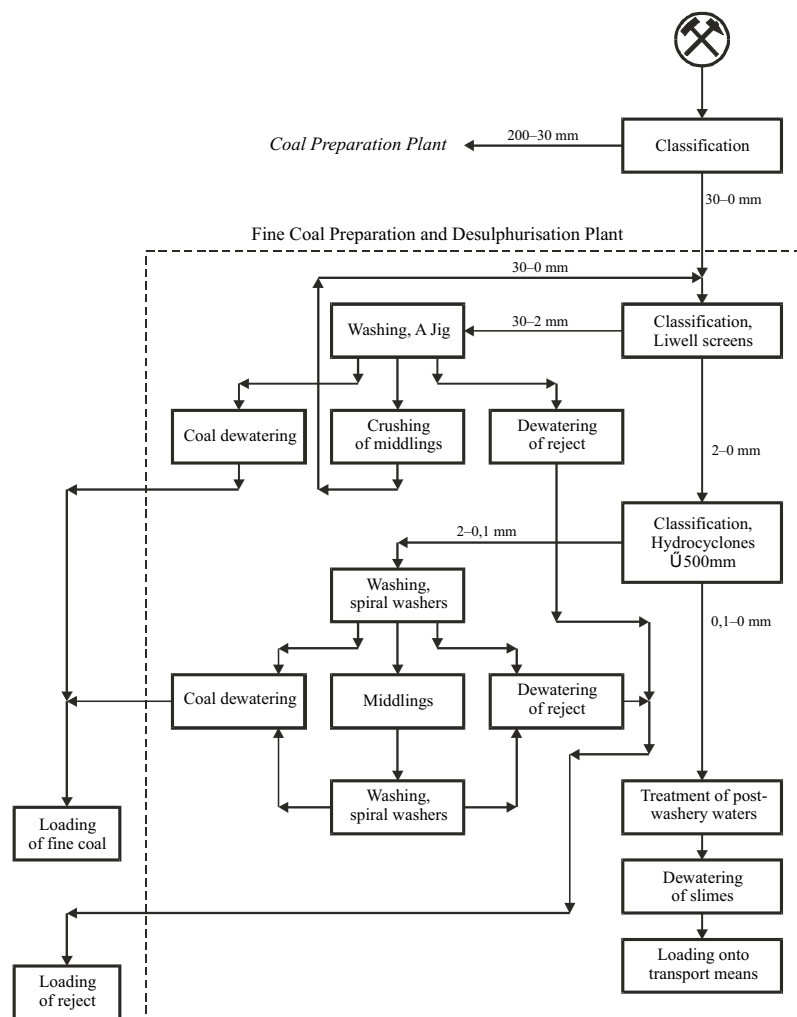


Fig. 4. Technological scheme of preparation and desulphurization of steam coal fines

Rys. 4. Technologiczny schemat wzbogacania i odsiarczania miałów węgla energetycznego

#### 4. The technology of coal recovery from flotation tailing ponds

For many years the flotation tailings of coking coal were stored and treated as wastes. They were put into ponds. The research show that the material gathered there is the coal that can be a good product for energy production. One plant for recovery the coal from the ponds have been built. The exploited wastes are divided into +3.0 mm and 3—0.3 mm classes. Large grains are used, without preparation, for land reclamation. Small grains are floated. Two stages flotation are done. Concentrates are sold to power plants. The process is economically viable. The schematic diagram of the preparation of flotation tailing wastes is shown in Figure 5 (Dziwok, Grzesik 2004).

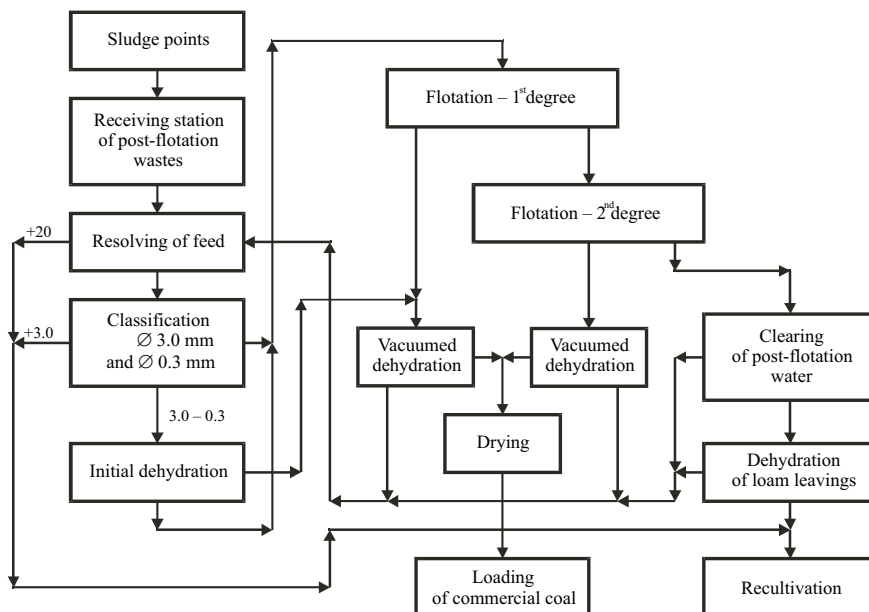


Fig. 5. Scheme of coal recovery from flotation tailings pond

Rys. 5. Schemat odzysku węgla z osadników odpadów flotacyjnych

#### 5. The technology of post mining wastes washing

In former years the post mining wastes as well as large sized wastes from steam coal washing were stored together in heaps. As a result of inaccurate washing processes (the Chancea washeries with sand were used) many coal grains got into wastes. Polish – Hungarian enterprise “Haldex” deals with the recovery of that coal. They operated six coal preparation plants in the former years. The enterprise have already washed 144 million tonnes of the wastes. The technological scheme of the preparation plants is shown in Figure 6 (Kucharzyk 2004). The process goes on in hydrocyclones with dense media. The medium is water and stone. All received products are saleable.

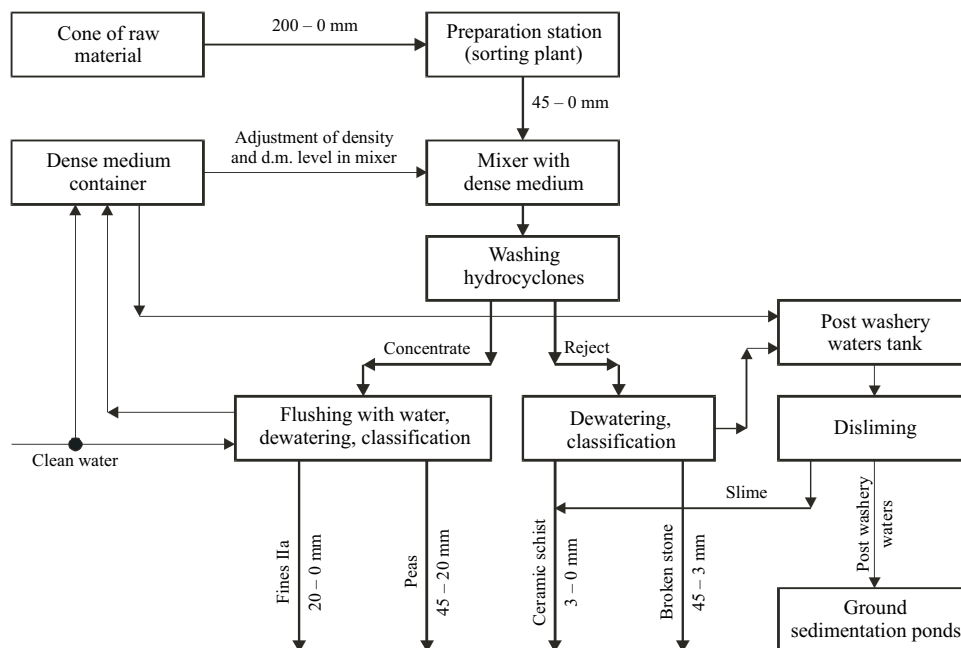


Fig. 6. Scheme of coal recovery from mining wastes

Rys. 6. Schemat odzysku węgla z odpadów węglowych

In recent years the preparation processes in classical preparation plant working in coal mines have been improved, so less coal grains goes into wastes. For that reason the process of new heaps recovery is not economically justified. Now only two Haldex preparation plants still work on mining heaps. The other serve services of coal preparation for those mines where there is lack of fines preparation sections.

#### REFERENCES

- Bieńko W., 2004 — Lubelski Węgiel “Bogdanka” S.A. — Process engineering of the coal preparation plant. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Blaşchke W., 2001 — Influence of economic reforms in Poland on the role of coal preparation. Colloquium International Coal Preparation Practice, Witbank Civic Centre.
- Blaşchke W., Gawlik L., 1999 — Hard coal and brown coal in Poland’s energy policy. Mineral Resources Management, Vol. 15, Issue 4.
- Blaşchke W., Gawlik L., 2001 — Coal preparation in Poland in the view of economic reform. Mineral Resources Management, Vol. 17, Issue 4.
- Blaşchke Z., 2000 — Coal preparation in Poland: Present practice and perspectives. Proceedings of the American-Polish mining symposium: Mining in the New Millennium Challenges and Opportunities, Balkema, Rotterdam, Brookfield.
- Blaşchke Z., 2001 — Hard coal preparation in Poland. Journal of the Polish Mineral Engineering Society, Vol. II, No 1 (3).

- Błaszke Z., Gawlik L., 1993 — Optimal quality of coal concentrates for power industry. Proc. Intern. Symp., Energex'93 the 5<sup>th</sup> International Energy Conference. Seoul, Korea, Mineral Resources Management, Vol. 11, Issue 4.
- Dziwok M., Grzesik M., 2004 — Post-flotation waste enrichment plant of „POLHO” Company. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Gawliński A., 2004 — A technology of coal beneficiation at a coal preparation plant of “Budryk” Mine. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Kowalczyk J., Strzelec G., 2004 — Jastrzębie Coal Company — output quality and coal processing. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Kucharzyk P., 2004 — “Haldex” Polish Hungarian Joint Stock Company — technology of coal preparation plants for mining wastes. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Kurczabiński L., Łój R., 2004 — Mechanical coal preparation in the mines of Katowice Coal Holding S.A. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Nycz R., 2000 — Current condition of coal preparation in Poland. Journal of the Polish Mineral Engineering Society, Vol. I, No 2.
- Nycz R., Zieleźny A., 2004 — Kompania Węglowa S.A. — coal beneficiation technology and quality of production. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).
- Poznański Cz., 2004 — Coal preparation an the plants belonging to Southern Coal Concern. Journal of the Polish Mineral Engineering Society, Vol. V, No 2 (13).

WIESIAW S. BLASCHKE, LIDIA GAWLIK, STANISIAW A. BLASCHKE

#### TECHNOLOGIE PRZERÓBKI WĘGLA W POLSCE

##### Słowa kluczowe

Zakład przeróbki węgla, węgiel energetyczny, węgiel koksowy, odzysk węgla z odpadów

##### Streszczenie

W artykule w sposób syntetyczny omówiono podstawowe typy zakładów przeróbki węgla jakie funkcjonują w Polsce. Opisano schemat technologiczny zakładów przeróbki węgla koksowego oraz dwa typowe schematy zakładów przeróbki węgla energetycznego. Zwrócono uwagę na działające w zakładach przerobczych sekcje wzbogacania i odsiarczania miałów węglowych. Wspomniano również o odzysku węgla z osadników odpadów flotacyjnych oraz odzysku węgla z odpadów węglowych.