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Coal preparation in Czech Republic

Key words

Coal processing, brown coal, bituminous coal

Abstract

The aim of the paper is to describe the situation concerning brown and hard coal preparation in Czech Republic. This paper gives the details of the brown coal preparation process in the North Bohemian Brown Coal Basin and the hard coal preparation process in the Ostrava-Karvina Coal Basin.

Introduction

Both the hard (bituminous) and brown coal are mined in the Czech Republic.

Hard (bituminous) coal

Hard coal occurs mainly in the Upper Silesian Coal Basin. About 15% of the resources pertaining to this region is located in the Czech Republic while the reminding part belongs to Poland. The major fault, called the Orlova fault, divides the Czech part of the Upper Silesian

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Coal Basin into the western section (the Ostrava part), which is older and of paralic character of sediments and coal seams, and the eastern section (the Karvina part), which exhibits limnic character of the sediments as well as of coal. The western part consists of several tens of thin coal seams of high grade coking coal, whereas the eastern part is characterised by abundant thick seams containing mixed coking coal and high volatile steam coal. Hard coal is characterised by a carbon content of more than 73.4% and less than 50% of volatile matter. The calorific value exceeds 24 MJ/kg on the dry basis.

Mining depth in the Ostrava part of the basin reached about 1,000 m. This fact as well as complex and unfavourable mining and geological conditions in the region caused that it was extremely difficult to achieve profitability. Consequently, the Ostrava mines were gradually abandoned. The majority of mines in the eastern part have enough reserves which can be extracted with much lower costs. However the coal in the eastern part is of low grade, as far as coking properties are concerned.

Relatively large reserves of coal have been verified south of the original Upper Silesian Coal Basin, particularly near Frenstat pod Radhostem, where carboniferous sediments are buried under Miocene sediments and the Beskydy napes. Here, the coal would be extracted from the depths of 800 to 1,300 m under difficult geological and mining conditions. As the deposit is situated on the border of protected landscape area, there can arise conflicts of interests with Beskydy protection in case of mining.

Hard coal production in Czech Republic reached 17 028 thousand Mg in the year 2000. In the Czech part of the Upper Silesian Coal Basin, two mining companies cover the whole production and processing of coal: the OKD Ltd. (Ostrava-Karvina Mines) and CMD Ltd Companies (Czech Moravian Mines).

Brown coal

In the North Bohemian Brown Coal Basin, brown coal of tertiary age is mined by open-cast mining in giant coal opencasts. The coal seam in the central part of the basin is approximately 30 m thick and it is formed by three coal benches. Mined coal is prepared in two central preparation plants according to customers' quality requirements (caloric value and grain size). Prepared coal is used in the centralized production of power and heat. A part of the produced coal, especially high quality screened ranks are sold in the retail sector.

In the North Bohemian Brown Coal Basin, three mining companies cover the whole production and processing of coal: the MUS Ltd. (Brown Coal Most), SU Ltd. (Sokolov Coal Mine) and SD Ltd. (North Bohemian Mine).

In the next chapter preparation of bituminous coal from the Paskov locality and brown coal from the Most locality are described.

1. Preparation of bitumenous coal from the Paskov locality

In the mine the longwall exploitation method is used, in compliance with the Czech Mining Office decree, as the method considerably decreases the risk of rock bursts and gases outflow. Prior to extraction, working face gateways are driven, which provide more exact information on the conditions expected in the working face under extraction.

By wet screening on separating vibrating and arch screens the extracted coal is divided into the following grain size fractions:

1. **Coarse-grained 18—200 mm**, which is separated in heavy-liquid three-product separators DREWBOY type. Coarse-grained tailings are rinsed and dewatered on vibrating separators LDG. The dewatered product is disposed onto the dump D. The coarse-grained intermediate is crushed in the hammer crusher and then added to fine-grained raw coal. Coarse-grained washed coal is dewatered to get it ready for dispatch. The heavy medium for suspension is magnetite, which is recovered on drum-type magnetic separators.
2. **Medium-grained 0.5—18 mm**, which is separated in jigs — type OM-18 into three products. Washed coal is dewatered in centrifuges Siebtechnik HGS 1,300 and transported for dispatch. Intermediate product is dispatched for power purposes and tailings (after dewatering) are disposed onto the dump D).

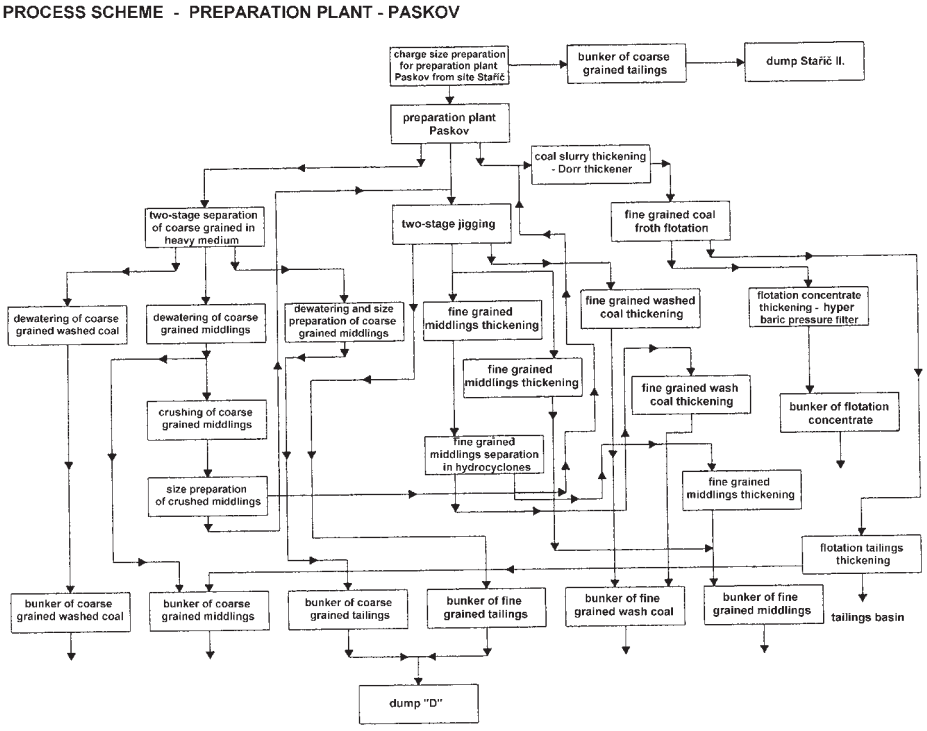


Fig. 1. Technological scheme of the Paskov preparation plant

Rys. 1. Schemat technologiczny zakładu przeróbczego Paskov

3. **Fine-grained < 0.5 mm**, which after thickening in two Dorr's thickeners is processed by flotation in flotation machines — type Denver. A mixture of wash oil (non-polar liquid hydrocarbons) and higher alcohols are used as a flotation agent, which serves as a frother to create stable supporting froth in the flotation process. The flotation products are coal concentrate (it is dewatered by hyperbaric pressure filtration and then dispatched) and flotation tailings (thickened in "tailings" Dorr thickener and then hydraulically transported to the sedimentation basin Pilik 3).

   The technological scheme of coal preparation plant Paskov is shown in Figure 1.

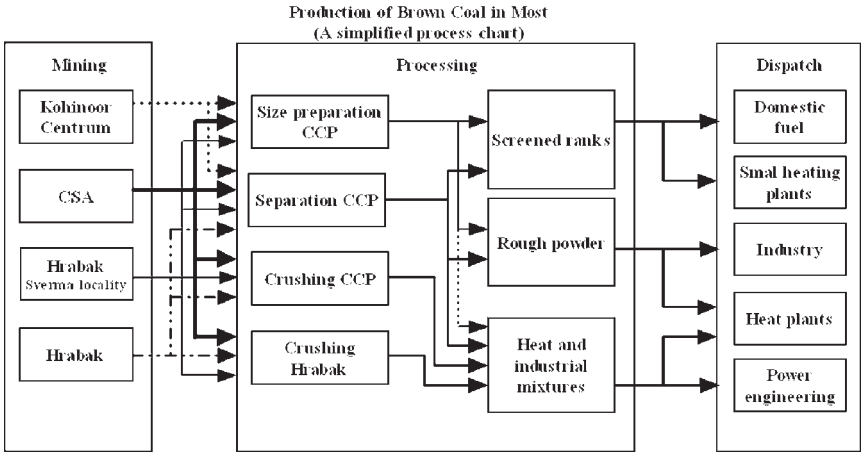
2. Preparation of brown coal from the Most locality

Production of brown coal in Most goes on in four mines: Kohinor Mine, CSA Mine, Hrabak Mine and Hrabak-Sverma Mine. The simplified technological scheme of coal preparation plant Most is shown in Figure 2.

Selectively mined coal of 0—750 mm grain-size is transported into sublevel bins, where coal is stored basing on the quality as Pc coal — low ash, and Pb coal — high ash. Prior to storage in sublevel bins coal is crushed to 0—250 mm grain size and transported by belt conveyors to coal separating plant of Pc and Pb ranks.

Domestic hammer mills of KDV 135, PJD hammer mills, Grundlach roller mills and Pensylvania disintegrator are used to crush feed coal.

The coal separating plant of Pc ranks is equipped with bar screens as well as cascade screens, shaking screens and Trizomat shaking screens. Separation limits are set for 10, 20, 40 and 100 mm. Screened oversizes of 100—250 mm are crushed in a hammer mill and



CCP — coal cleaning plant

Fig. 2. Simplified technological scheme of the Most preparation plant

Rys. 2. Uproszczony schemat technologiczny zakładu przeróbczego Most

screened again. Final products, screened ranks, are stored in bunkers from which coal is loaded and dispatched to customers by road or rail.

The coal separating plant of Pb ranks has the same technological equipment and arrangement as the Pc coal separating plant. The transport routes are set to enable the transfer of products and intermediate products onto a rail loading bunker from where sale of final Pb ranks is executed or intermediate products are transported for heavy medium separation.

Heavy medium separation takes place in SM separators (Stami-Carbon). The separating system is in a double-cut version (a large and a small washing unit). However, separation is carried out as single-cut with suspension density of 1.4—1.45 g/cm^3 with an average output of 200 t of feed per hour. Before the feed accesses into the separation system, grain-size fraction of 0—10 mm is separated, which is treated as a mixture for heat production. To prepare the separation suspension, leachant (residue post Ni ore leaching from Albania) is used as a weighting agent. Suspension density in the separator is kept automatically by a Regula control system. To reclaim the suspension, hydrocyclone units are applied. The sludge management and disposal complex makes use of external settling ponds where sludge water is re-pumped. After sludge particles have settled, the clarified water is used to prepare fresh suspension, for spraying and in the wet dust suppressor operation. The heavy medium separation plant is equipped with five sections, but only two or three sections are operated to fulfil requirements of users.

In the preparation complex, there exist a separate crushing plant that produces the mixtures of steam coal for heat production. Batches of a homogenous quality and grain size of 0—500 mm are stored into sublevel bins. Leaving the bin, coal is crushed by hammer mills down to 0—150 mm grain size. From the intermediate product, grains between 0—20 mm are separated and the oversize gains are crushed in a disintegrator down to 0—10 mm. The product is transported by belt conveyors to loading bunkers. Before loading, in the loading bunker it is possible to implement the technological process of dry doping of the coal ranks by limestone.

The production of mixtures of required quality for heat production and industrial purposes is ensured on a mass scale in the homogenization plant. Feed coal from the plant is crushed to a required size and mixed from individual quality ranks of feed coal in order to obtain desired quality composition of heat mixture. Also heat mixtures that are dry-doped by limestone are made. Industrial and heat mixtures are dispatched by rail. A part of heat mixtures is belt-transported directly to the power or heat plant.

All the technological procedures and transport junctions are equipped with dust suction to eliminate flue dust. To eliminate flue dust, wet dust suppressors are applied. The isolated and dewatered coal dust from the suppressors is added into heat mixtures. With regard to health and safety regulations, it is not possible to operate the preparation plant without putting on the flue dust suppressors.

The annual processing capacity of the brown coal preparation complex of “Komorany Preparation Plant” reaches 9.5 to 10 million tonnes of feed in dependence on sales possibilities and demand. The production of screened ranks is 1.1—1.3 million tonnes per year, and

TABLE 1

The historical development of saleable coal production in the Czech Republic since 1876
(in thousand tonnes)

TABELA 1

Historyczne dane dotyczące rozwoju produkcji węgla handlowego w Republice Czeskiej od 1876 roku
(w tys. Mg)

Saleable production	Hard coal			Brown coal			Total in CR
	Ostravsko--Karvinsky Coalfield	other coalfields	total	North-Bohemian Brown Coalfield	Sokolov Brown Coalfield	total	
1876	1 500	3 050	4 550	4 250	530	4 780	9 330
1900	5 770	4 030	9 800	14 670	2 690	17 360	27 160
1930	10 670	3 690	14 360	14 780	3 610	18 390	32 750
1950	13 720	3 780	17 500	19 830	6 260	26 090	43 590
1960	20 868	5 530	26 398	39 080	14 600	53 680	80 078
1970	23 856	4 339	28 195	54 520	19 890	74 410	102 605
1980	24 689	3 512	28 201	66 700	20 450	87 150	115 351
1990	20 840	2 350	23 190	60 700	11 850	72 550	95 740
2000	13 855	1 000	14 855	39 510	6 692	46 202	61 057
2004	13 272	30	13 302	37 984	6 064	44 048	57 350

Until 1950 the production of small mines in other regions of the CR is included.

TABLE 2

Quality of coal in 2004

TABELA 2

Jakość węgla w 2004 roku

Mining company	Sort	Calorific value Q_i^r [MJ/kg]	Moisture W_i^r [%]	Ash content A_d [%]	Sulphur S_t^d [%]
CMD	UVPK	28.85	10.20	7.10	0.60
	CUE	21.52	7.90	29.60	0.53
OKD	UVPK	29.00	9.50	6.90	0.49
	CUE	25.20	7.90	18.90	0.42
MUS		13.10	27.30	33.60	0.70
Kohinoor		15.90	31.20	19.00	0.60
SD (Tusimice) (Bilina)		11.20	33.45	33.50	1.45
		14.86	26.82	24.23	0.57
SU		13.47	37.91	20.61	0.95

UVPK — hard coal suitable for coking.
CUE — hard coal for power purposes.

the heavy medium separation processes 1.4—1.6 million tonnes of feed per year. The highest volume is represented by heat and industrial mixtures, i.e. approximately 7.3 million tonnes per year. Other capacities for brown coal preparation mined in the North Bohemian Basin are technologically analogous in terms of capacity and technological equipment.

Conlusion

In conclusion of this paper we follow the historical development of saleable coal production in the Czech Republic since 1876. It is shown in Table 1. The quality of coal in the year 2004 is shown in Table 2.

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PRZERÓBKA WĘGLA W CZECHACH

Słowa kluczowe

Przeróbka węgla, węgiel brunatny, węgiel bitumiczny

Streszczenie

W referacie opisano aktualną sytuację w zakresie przeróbki węgla brunatnego i kamiennego w Czechach. Podano szczegółowy opis procesów przeróbki węgla brunatnego w Północnobohemskim Zagłębiu Węgla Brunatnego oraz węgla kamiennego w Ostrawsko-Karwińskim Zagłębiu Węglowym.