

Complex Coal Processing of Kazakstan Deposits

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ABSTRACT: This report reviews the uses of complex coal processing in Kazakhstan. Complex coal processing is necessitated by the deficiency of oil and gas, and methods of complex coal processing are reviewed - by the presence of various grades of coal with different organic parts, such as bitumen, resin, humus-wax, and chemical elements, including non-ferrous metals and rare earth elements.

1 INTRODUCTION

As it is known, about 30 groups and 44 subgroups of coal can be distinguished under the international classification of 1957 and the classification accepted in CIS countries. All these coals differ in their physical properties and elemental composition. Naturally, therefore, the methods of both use and processing vary: technological, energy, chemical, metallurgical, construction and other.

In conditions of deficiency of known oil and gas reserves (a projected 40-50 years of consumption) in comparison with coal (200-250 years), there is an especially urgent need to replace oil and gas with coal for power, in the chemical industry and in other areas. In particular, the world, including Kazakhstan, is passing to the use of substitutes of natural gas and synthetic liquid combustibles obtained by processing coal by gasification and hydrogenation (liquation). The production of petrol, fuel, jet and boiler combustibles from coal, by both direct liquation and synthesis, and gas obtained from coal by plasma-chemical methods, is most urgent.

Coal, like other mineral resources, in geochemical terms consists of a set or complex of minerals of other complex connections of chemical elements. In total, coal contains about 50 chemical elements, which form its organic and inorganic parts, water and volatile substances. The organic part contains bitumens and humic acids. Coal has also more than 30 microelements, equal to 5600 g/t of coal, costing about 230 dollars according to the prices of 1988 (Mironov, 1991; Yudovitch, 1989; Drozhzhin, 1952).

Now coal is processed and is applied in the following ways.

1. Coal was first used only as a combustible for municipal-household needs, then coal was used for burning in boiler installations, in the fire chambers of ships and trains, in reflective furnaces, etc.

2. The next stage of coal use was the production of electric power, and to the present day the main consumer of coal in Kazakhstan is the electrical power industry.

3. Now coal is widely used in metallurgy in the form of coke, half-coke and ferrous coke.

4. For almost one century, coal has been bricketted from chaff or coal dust in various countries of Europe, America and Asia. Dressing of coal by hardening, carbonization, pelletizing (granulation, bricketing) and thermal processing is one of the methods of processing and using complex coal (Tait & Antonova, 1985).

5. Coal, after processing, is used as an agglomeration (caking) combustible for obtaining iron-ore concentrates, carbonate filler, electrode items and foundry coke, and for the production of carbide, calcium and electric corundum.

6. Coal ashes in waste-free production are used for the production of construction materials, including lime, cement and brick.

7. Hard coal and anthracite are mainly used for the production of coal adsorbents and active coal.

8. In various branches of the chemical industry, coal is processed by gasification, extraction, supercritical dissolution of coal, etc. Thus, it enables the production of more than 50 basic chemical products (synthesis - gas, montan wax, paraffin, motor and jet combustible, mineral fertilizers, plastic, etc.) in addition to numerous derivative substances.

9. Out of the total known reserves of power sources, 80-90 % - is coal and only 10-20 % is pe-

troleum and gas (Zhukov et al., 1990). Therefore, the problem of replacing oil and gas with coal and products obtained from processing coal is urgent. So, for example, the gas obtained by coal gasification in ground and underground gas generators is used for production of (Zhukov et al., 1990):

- Substitute of natural gas (SNG).
- Synthesis - gas (S-G) for production of motor fuel and other products in the chemical industry.
- Fuel gases for technology and power generation.
- Restoring gas for metallurgical purposes.
- Carbonization of brown coal.

10. Use of coal instead of oil and gas is possible in the following ways:

- Burning coal instead of oil (black oil), for example, in boiler installations.
- Combination of energy of coal with other types of energy, for example, nuclear energy.
- Development of gaseous and thermal networks.
- Production of motor fuel from coal.
- Use of natural gas substitute to conserve natural gas and supplement its use.
- Use of synthesis - gas from coal instead of products of oils for the chemical industry.
- Production of motor fuel and chemical products from coal after petroleum resources are exhausted.

11. The following microelements are now extracted from coal: uranium, germanium, gallium, and vanadium. It is also possible to extract molybdenum, rhenium, silver, scandium and other rare earth elements (Mironov, 1991).

12. Water alkaline solutions from brown and stone oxide coal extract also contain humic acids and humates. Humus coals are used in agriculture in two ways (Soprykin, 1984): first, in the production of physiologically active preparations (PAP) for stimulation of growth of plants, increasing the productivity and efficiency of animal industries; second, in the production and application of organic materials.

In Kazakhstan, coal is used for the production of briquettes, absorbers, restoring agents, humus preparations for stimulation of plant growth and increasing the productivity of animal industries, and rare earth elements, non-ferrous and precious metals are extracted from coal and its ash. Coal ash is used for

the production of construction materials - cement, lime and bricks. Projects of coal gasification and hydrogénation have also been developed.

The benefits of complex coal processing are numerous. Coal gasification and hydrogénation produce cheaper and top-quality synthetic liquid combustible, which can replace oil in power, chemistry and in other areas. The production and use of coal bricks reduces losses of coal caused by the underburning of small coal pieces, and it also prevents self-burning.

2 CONCLUSIONS

The application of physiologically active preparations made of coal humus and microelements contained in coal now produces increased productivity in agricultural cultures of up to 30 %. The use of other products from coal results in low-waste and waste-free production and increases the level of environment protection.

The rational area of application for coal gasification and hydrogénation is the processing of brown coal, and also long-flame gaseous hard coals to synthesis - gas and synthetic liquid combustible with application in areas of production from local coals. Hard coal and anthracite are economically more expedient for use in traditional areas such as energy production, metallurgy, construction and in the chemical industry.

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