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GENERAL DESCRIPTION OF FUSHUN OIL SHALE RETORTING FACTORY IN CHINA

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This paper deals with the information concerning Fushun Oil Shale Retorting Factory which is the only working shale oil plant in China nowadays. Sixty Fushun-type retorts (gas generators) were built in 1992 and they are operating successfully for producing shale oil from Fushun oil shale with the Fischer assay about 7-8 %. The factory has made profits due to the low cost of oil shale as the by-product of open-pit mining of coal.

Preface

In China, shale oil commercial production began in 1930 in Fushun Refinery No. 1, 1954 in Fushun Refinery No. 2, 1963 in Maoming Refinery. However, these three refineries switched over to crude oil refining and stopped the production of shale oil recently.

National Planning Committee of China decided to build a new oil shale retorting factory under the Fushun Bureau of Mines. This plant was called Fushun Oil Shale Retorting Plant and was successfully put into operation in 1992. The capital costs of this plant amount about 350 million yuan. The annual production of shale oil reaches 60,000 tons. The general description of the flow sheet of this factory is given.

1. Pretreatment of Oil Shale

Pretreatment - crushing and screening - is necessary to meet the demands on the size of shale at its charging to the retort. The flow chart of oil shale crushing and screening is shown in Fig. 1.

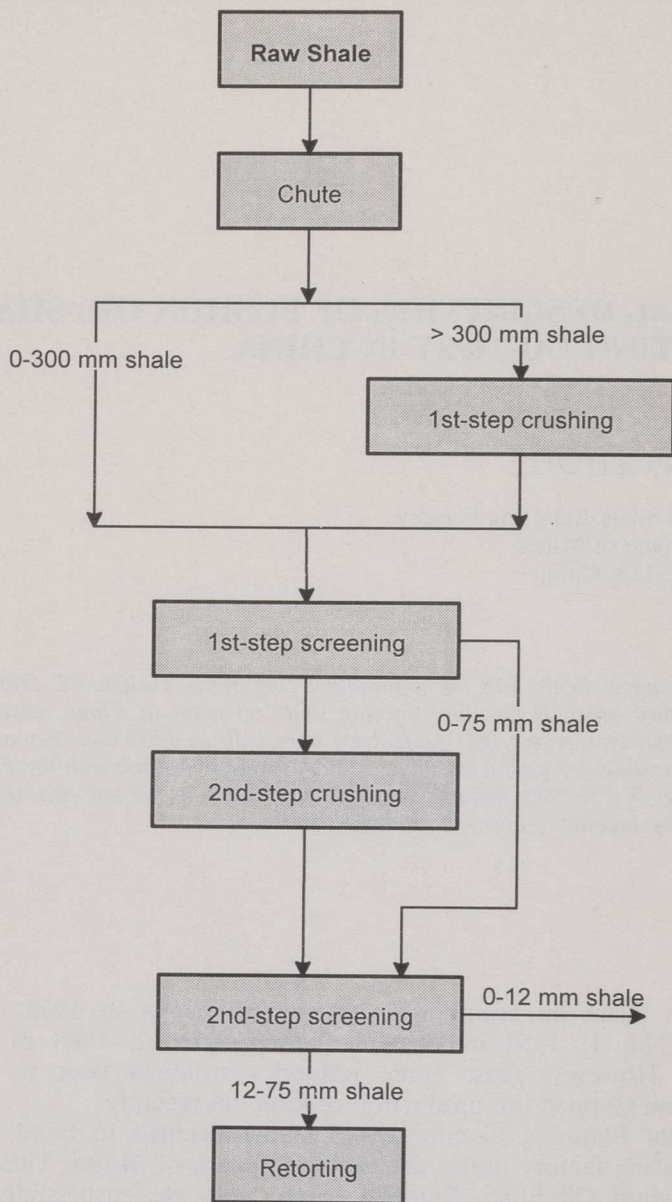


Fig. 1. Flow chart of oil shale crushing and screening

The annual capacity of this pretreatment system is about 3 million tons of oil shale. After two steps of crushing and screening of mined raw shale two fractions are obtained. The 12-75 mm fraction is to be charged to the retort, the 0-12 mm fraction is to be used as fuel for fluidized-bed combustion. The yield of the 12-75 mm fraction is about 75 % of raw shale.

2. Retorting of Oil Shale

Three blocks (60 Fushun-type retorts) have been built and operated, each with the capacity of 100 t oil shale per day. The Fushun-type retort is shown in Fig. 2. The retort has two sections: the upper one is the pyrolysis zone, the lower - the gasification zone. Oil shale with the oil content of about 7-8 % (Fischer assay) is fed in from the top (1), oil shale is dried and pyrolyzed in the pyrolysis zone by hot gas ascending from the gasification zone and by hot recycle gas. The vapours (gaseous products) evolved and mixed with the heat carrier gas are removed from the top of the retort through the exit pipe (2) and the gas-gathering cone (3). Hot recycle gas is fed in through the mixing chamber (4) and the gas inlet (5). Semicoke formed due to the pyrolysis of oil shale comes down to the gasification zone through the arch (6). It contains about 5 % fixed carbon, and is gasified by the wet air. As a result of gasification shale ash is formed and is discharged through the water seal (7), after accumulation in the shale ash trough (8) at the bottom of the retort. Air-containing steam needed for gasification of semicoke is fed in through the air duct located in the centre of retort bottom. The maximum temperature of pyrolysis is about 500 °C, the temperature of gasification reaches about 800-1000 °C.

The gas-vapour product leaving the top of the retort is cooled and washed by water in three cooling towers placed in a series. Shale oil condensed in cooling towers is collected as a product, and the

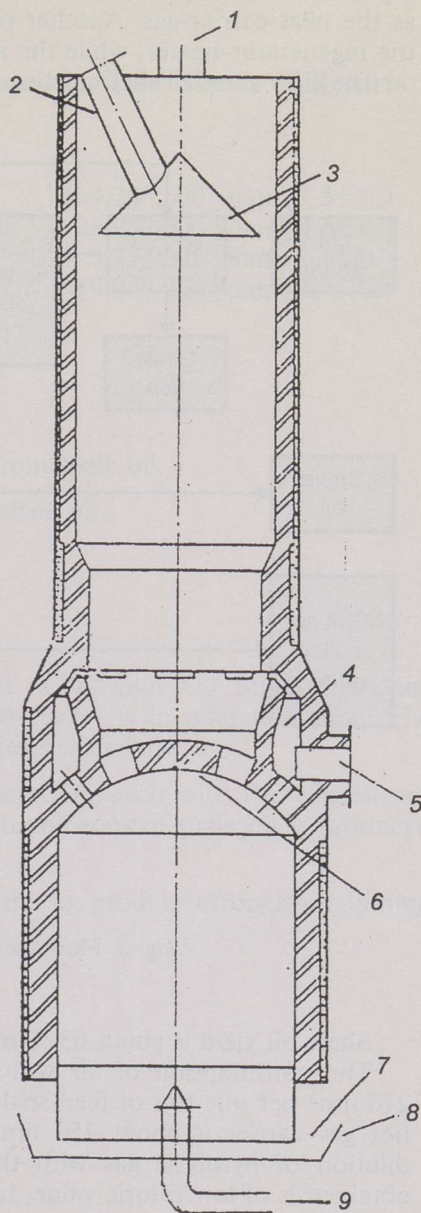


Fig. 2. Fushun-type retort (100 ton/day): 1 - charger; 2 - exit pipe; 3 - gas-gathering cone; 4 - mixing chamber; 5 - recycle gas inlet; 6 - arch; 7 - water seal; 8 - shale ash trough; 9 - air duct

non-condensed gas is divided into three parts. One part is directed to a regenerator-heater, heated to about 600 °C, and recycled to the retort (5) as the heat carrier gas. Another part of the gas is used as the fuel gas for the regenerator-heater, while the remaining gas is used as boiler gas.

The flow sheet of the retorting system is shown in Fig. 3.

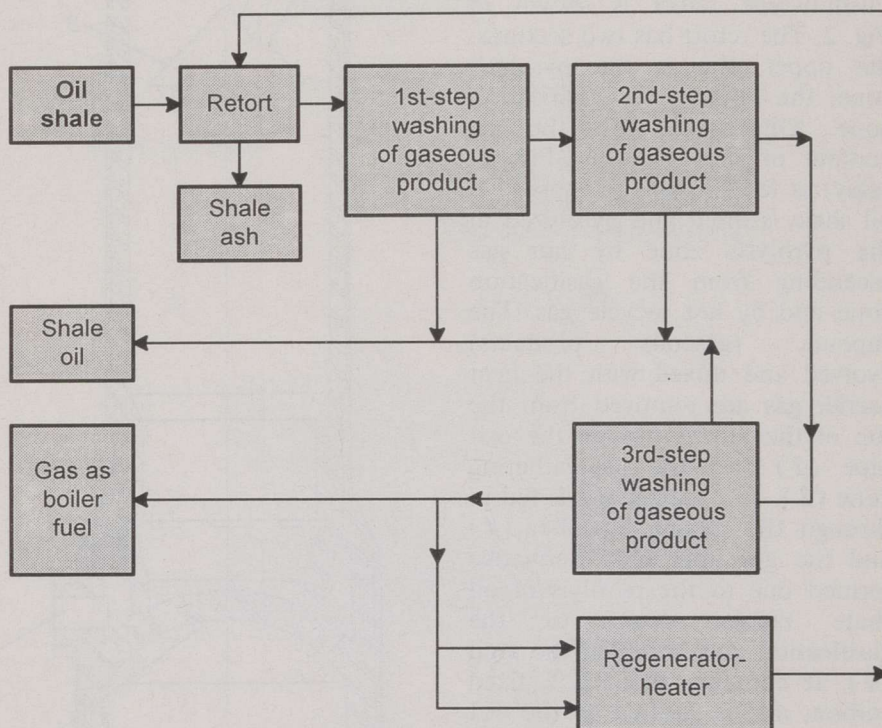


Fig. 3. Flow sheet of the retorting system

Shale oil yield is about 63 % of the Fischer assay oil.

The consumption of air with the saturation temperature of 80 °C is 210 nm³ per one ton of feed shale. The consumption of recycle gas as the hot gas carrier is about 250 nm³ per one ton of oil shale. Due to the dilution of pyrolysis gas with the gasification gas, the gaseous product obtained is of low caloric value, but it can be used as boiler fuel.

3. Waste Water Treatment

Waste water from the cooling tower is directed to waste water treatment system by passing through two successive purification ponds, the first pond being for the settling of shale oil and the second being the flotation pond.

After treatment water is recycled to the cooling tower and therefore only little water is discharged from the system.

4. Technical and Economic Data Based on Two Blocks of Retorts (40 Retorts) in 1994

1. Annual shale oil selling cost: 54,280,000 yuan (R.M.B.)
2. Annual production expenses: 26,000,000 yuan (R.M.B.)
3. Annual taxes paid: 9,230,000 yuan (R.M.B.)
4. Annual net profits: 19,050,000 yuan (R.M.B.)

5. Development Plan

1. Production of sprayed carbon black from shale oil.
2. Production of liquid light fuels from shale oil.

6. Conclusion

1. In China, only one shale oil plant - "Fushun Oil Shale Retorting Factory of the Fushun Bureau of Mines" - is in operation now. The plant was built in 1992, and it operates successfully.
2. Sixty Fushun-type retorts are in operation, each with the capacity of 100 tons oil shale per day. Sixty thousand tons of shale oil is produced annually.
3. Due to the low cost of oil shale as the by-product of open-pit mining of coal, the factory has made a profit.

Presented by Qian Jialin

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