

Mining & metallurgy

Optimizing coal flotation process improves capacity

Raw coal changes and quality requirements in China have meant that coal preparation plants are looking to improve their washing processes and flotation equipment. By doing this, one coal mine increased efficiencies of its clean coal filter press, recovery of flotation technique and coal slime content, improving its processing capacity.

Anhui University of Science and Technology and the Coal Preparation Plant of Renlou Coal Mine optimized the original flotation technical process effectively according to features of coal quality and flotation equipment. The optimized flotation technical process could adapt to underground coal quality changes at any time. It possesses high promotion and application values especially to difficult-

to-filter coals, coals with high content of fine particles and flotation system with poor filter effect.

Modernized mine

The coal preparation plant of Renlou Coal Mine, Wanbei Coal Group, is a modernized mine-type coal preparation plant. It was originally designed with 1.5

million tons/year washing production. It outputted 2,804,510 tons raw coal in 2013 and 2,546,802 tons in 2014, which were 86.9% and 69.7% higher than the design capacity. Due to raw coal quality changes and market requirements, it attempts to wash all raw coal.

This will increase flotation recovery and makes recovery of flotation clean coal and flotation tailing disposal more difficult. As a result, the coal slime content is relatively low (37~39), lower than the company requirement (>40). Meanwhile, the second-stage pressure increases, which will influence raw coal washing directly. This plant adopts the technical process of jigging, flotation, tailing filter pressing^[1-3].

There are three XJX-12 flotation machines, two GP160-8 filter separators and one clean coal filter press. Concentrate pulp is produced by the filter separators and the clean coal filter press, while filtrate is sent to the tailing disposal system by a filtrate pump. The original flotation production technical process is as shown in Figure 1.

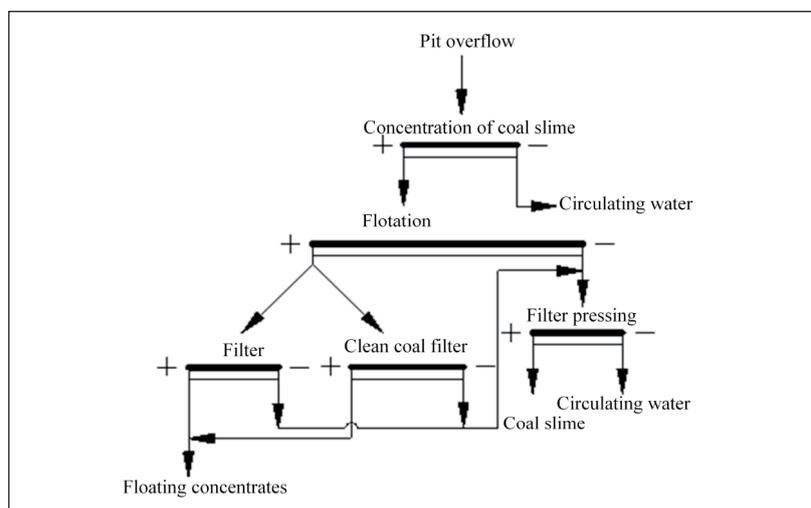


Figure 1. Primary flotation production process flow chart.

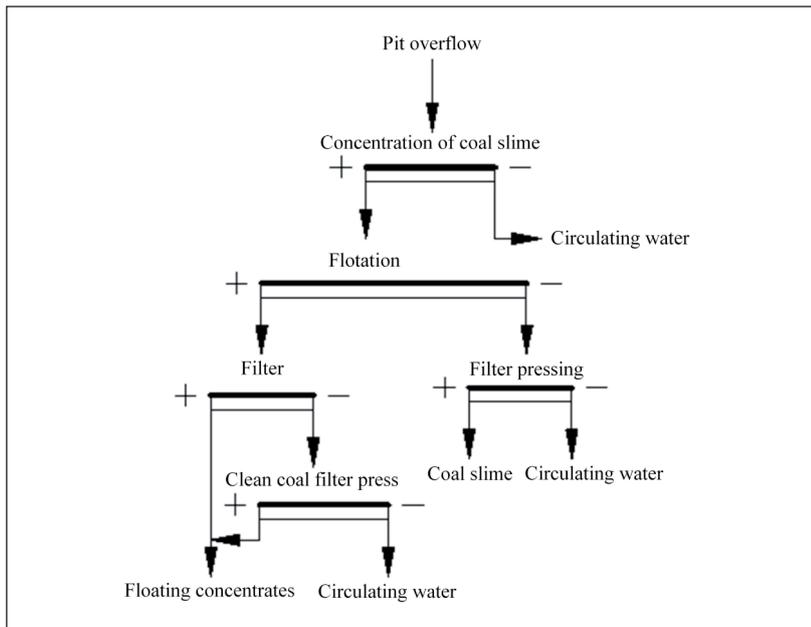


Figure 2. Optimized flotation production process flow chart.

Challenges

The disk filter requires overflow free in the overflow launder when recovering clean coals^[4], otherwise, flotation clean coal will enter into the filter pressing system directly, thus reducing the coal slime content. If the filter separator runs under material shortage, its vacuum degree will decrease, influencing its processing capacity and increasing the water content in flotation clean coal. The filter driver is to control the liquid level of the filter separator mainly by adjusting the electrohydraulic valve opening. Because of unstable raw coal quality, overflow free and material-sufficient operation of the filter separator are impossible in practical.

During production in the clean coal filter, the filter cake of clean coal couldn't bond strongly, but is separated into several parts due to the bigger grain size of input materials (than coal slime). It is adhered onto two pieces of filtering plates and could not fall off automatically, even under the involvement of manual operation. Such difficult unloading increases labor intensity and often causes sharp materials that threatens safety of equipment and operators significantly.

Batch production

Since the filter separator makes batch production, material shortage during practical normal production is common due to the small concentrate barrel. Such material shortage will cause

overflow from the concentrate barrel, influencing the production capacity of the filter separator and huge loss of flotation clean coal.

In the original design of the filter separator, filtrate will be sent to the filtrate pool and then to the filter pressing system by a filtrate pump. Since the filtrate from the clean coal filter is clean water which will enter into the coal slime water system directly, secondary processing of the coal slime water is needed, which is a waste of electricity and materials.

"Material shortage during practical normal production is common."

Due to design and troubleshooting of filter separator, the filter cloth or filter plate is often to be damaged, making abundant concentrate pulp into the filtrate system directly. Based on multiple actual measurements, the filtrate concentration often maintains at 50-70g/L. Direct entrance of filtrate into the filter pressing system will cause huge loss of flotation clean coals and reduce coal slime content.

Due to small grain size of the slipped filtrate and the low content of products recovered by the high-frequency sieve in the filter pressing plant (<10%), a lot of extreme fine particles will directly

prolong processing time of single filter separator in the filter pressing system, while the coal slime content is still very low. To promise the coal slime content, backwater of the gangue sieve is sent to the second-stage of filter pressing directly. Under special circumstances, clean water is added onto the gangue sieve, resulting in mass entrance of fine silt into the filter pressing plant. This will further intensify processing difficulty of coal slime water and influence washing production significantly^[5].

Solutions

Based on the cooperative study of Anhui University of Science and Technology and the Coal Separation Plant of Renlou Coal Mine, an optimized flotation production technical process was proposed.

The optimized production technical process: in the optimized flotation technical process (Figure 2), the concentrate pulp is produced in two procedures successively rather than the previous synchronous production by filter press and filter separator. The concentrate pulp is recovered completely by the filter separator. When a single filter separator is adequate to meet production, it is maintained overflow all the time.

Filtrate and overflow from the filter separator flow the filtrate pool and then are sent to the concentrate barrel of the filter press by a filtrate pump. Finally,

they are pumped into the filter press by an input pump. The difference between the installation height of the filter press and the height of the coal slime concentrate pool is about 1.5 m. Filtrate from the filter press flows to the coal slime concentrate pool through the newly installed pipes and serves as the circulating water for coal washing.

Installation of concentrate box and level controller of the concentrate barrel: To solve problems caused by batch production of filter separator, a 16 m³ concentrate box is designed and installed at the east side of the filter press tail (to right of picture in Figure 3). It is connected to

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