3C2. Coal Slurry Production Technology

Outline of technology

1.Outline of coal slurry

Since coal is a solid material with some problem, requiring more complex handling than a fluid does, environmental measures against dust, and spacious land for a coal yard, its slurry form has been noted as a means to make heavy oil-comparative, clean use of coal. Coal slurry fuel is found as COM (coal oil mixture) prepared by adding heavy oil to coal to give slurry, aside from CWM (coal water mixture), a mixture of coal and water. COM, a combination of coal and heavy oil convenient for burning, was earlier than CWM to be technically reviewed but failed to prevail after all, rather bottlenecked by the necessity of heavy oil.

CWM is a mixture of water and coal, raising no problem of spontaneous firing or dust scattering and can advantageously be handled as an easy-to-treat liquid. Conventional coal slurry using no additive can be piped but, due to its water contents of about 50%, is poor in long-run stability, requiring dehydration before firing.

High-concentration CWM can now, as a result of studies on the particle size distribution of coal and a dispersant and other additives development, be kept fluid as well as stable even if less water is added and, therefore, directly burnt without being de-watered. Only a slight amount of additives added realize stable coal-water slurry in which coal particle of a certain size distribution are uniformly dispersed with their weight concentration of about 70%.

2.Characteristics of high-concentration CWM

Typical characteristics of high-concentration CWM (Chinese coal CWM) are shown in (Table1) below.

(Table 1) Characteristics of High-Concentration CWM

Coal concentration (wt%)	68~70
Higher heating value (kcal/kg)	5,000~5,200
Lower heating value (kcal/kg)	4,600~4,800
Apparent consistency (mPa-s)	1,000
Specific gravity(-)	1.25
Ash content (wt%)	6.0
Sulfur content (wt%)	0.2
Grains of 200 mesh or less (%)	80~85

1) Coal type

As a general trend, high-carbonization, low-inherent moisture (about 5% or less in approximate analysis), and less-oxygen content (about 8% or less in ultimate analysis) coal is suitable for high-concentration CWM.

2) Additives

Additives consist of dispersants and stabilizers. A dispersant functions to disperse coal particles into slurry, using electrostatic repulsion effects or steric repulsion effects and sodium sulfonate of naphthalene, polystyrene, polymethacrylate, polyolefine, and the like is used here. Additives including CMC and xanthan gum are used to prevent coal particles in slurry from settling for stabilization.

3) Particle size distribution

For higher concentration/stability of CWM, pulverized coal sizes should preferably be distributed over a wide range rather than sharply distributed. Ordinary particle sizes used are roughly as shown in (Table 2).

(Table 2) Grain Size Distribution of High-Concentration CWM

Maximum grain size	150~500 μm
Average grain size	10~20 μm
Grains of 74 μm or less	80% or more
Fine grains of several micrometers or less	Around 10%

4) Rheological characteristics

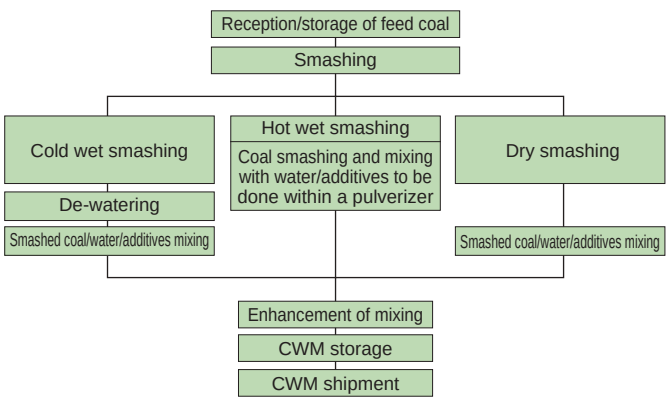
CWM's fluidity has characteristics of a non-Newtonian fluid but can be construed as a near-Bingham fluid's. The fluidity characteristics also changes, depending upon, such as the coal kind, concentration, additive, and flow state. The apparent viscosity is roughly 1,000mPa-s (at room temperature and shear speed of 100/s).

5) Heating value

The heating value depends upon that of coal used. An average lower heating value is 4,600-4,800kcal/kg.

3.Manufacturing process of high-concentration CWM

Production of high-concentration CWM can be achieved by pulverizng coal into a particle size distribution suitable for CWM, selecting correct additives (a dispersant and stabilizer), and appropriately blending coal, water, and additives to manufacture high-concentration, low-viscosity, high-stability, and good-quality CWM. A block flow of CWM manufacturing process is shown in Fig.1.



(Fig.1) CWM Manufacturing Process

Coal Water Mixture (CWM)