Study on Coal Quality Variation Law of 5# Coal Seam in Lower Coal Group of Dafeng Mine

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ABSTRACT

In order to reduce the waste caused by the exploitation of 5# coal seam in the lower coal group of Dafeng mine. We systematically studied the coal quality change law by Surfer and CAD software to draw coal quality (moisture, ash, volatile matter, sulfur content and calorific value) contour map. The results show that moisture changes along the syncline axis was more obvious in general, ash, volatile content were the highest in the center, sulfur content gradually reduced from the beginning of the edge to the center, calorific value was the lowest in the center.  

INTRODUCTION

Dafeng mine, located in the north of the Helan-mountain in The Ningxia, north by Baijigou coal mine and south by the Rujigou Coal mine, is a part of Ruqigou coal mine [1]. It is a kind of scarce coal with important economic value in China [2]. Underground pit mining, small coal production, spontaneous combustion and other reasons caused a huge waste of Dafeng mine [3]. The study on the distribution and variation of coal quality has a profound significance to the development and utilization of different coal types and coal quality [4-7]. Systematically study on coal quality variation can not only reflect the regulation of changes in coal mining area in the process of coal mining in the original design, analysis stability factors of coal quality, but also provide a theoretical basis for the reasonable coordinate mining of Taixi Coal Mining and coal production quality, ensure the stability of coal products.

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quality. So as to realize the balance control of coal quality in production, to meet the market demand for this special type of coal, to provide beneficial reference for the healthy development of similar enterprises [8-12].

EXPERIMENT

Dafeng mine coal bearing strata in Jurassic Yanan group (Jy). By the end of 2010, Dafeng mine upper coal group mining area had been completed, the lower coal group has already been started mining [13]. The 5#coal seam in lower coal group of Dafeng mine is the main coal seam, and drilled hole sampling 27 in this coal seam. Coal samples were analyzed According to GB/T 212-2008, GB/T213 - 2008, GB/T214-2007 and other relevant national standards, and relevant data was obtained. We used Surfer and AutoCAD software to draw the coal quality (ash, volatile, calorific value, etc.) contour map by combining the coordinates of the Dafeng mine were provided by “preliminary design of continuous work of the lower coal group of Dafeng mine from Ningxia coal mine design and Research Institute Company with limited liability” and collated experimental data according to the corresponding coordinates. Studied on coal quality change law of 5#coal seam in lower coal group of Dafeng mine based on a variety of contour maps.

RESULTS AND DISCUSSION

Moisture Variation Law of Coal

Moisture content analysis results of the 5#coal seam showed that the lowest was 0.28%, the highest was 1.25%, and the average moisture content was 0.66%. As can be seen from the figure 1, 5#coal seam moisture content change in the mine is more obvious, moisture content was slightly higher in the north east, northwest, southwest of mine field. Ultra low moisture coal (Mad≤0.50%) in well field accounted for 8 percent of the mine field, mainly distributed in the northeast of the mine near the border. Part of the intersection of northwest and synclinal axis, small areas around the X and X-1 exploration lines in the southwest corner. Most of mine field's area is low moisture coal. The medium moisture coal accounted for 8 percent of the mine field, distributed in the local area of the West and 3 auxiliary exploration line intersects, southwest and synclinal axis intersection area.
Moisture Variation Law of Coal

Ash analysis results of the 5# coal seam showed that the ash content of raw coal was not very significant, the lowest was 6.90%, the highest was 29.75%, and the average ash content was about 11.29%. As can be seen from the figure 2, ash content in most areas in 5# coal seam was between 10.00%~20.00%. The ash content gradually increased from the beginning edge of to the center in the mine field, to the center, ash was the highest area of intersection between synclinal axis and auxiliary 2 exploration line. Taking the center as the coordinate axis, the variation of the ash from the north to the south is relatively slower compared with the change of the ash from the east to the West, and the ash on both sides of the north and south was slightly higher than the East and west. medium ash coal with higher ash content (20.00%≤Ad≤30.00%), accounting for about 5% of the area of the whole mine field, mainly distributed in a part of region of approximately circular shape of the area of the intersection between the oblique axis and the auxiliary 2 exploration line. Ultra low ash coal with lower ash content (Ad≤10.00%) accounted for about 40% of the area of the whole mine field, was mainly continuously distributed in The area of northerly direction of the center direction and south east direction, but not much to the North, south east direction was along the east side of the border extended to the south of the border, were also partially distributed in the area of north west and south west. The rest area was low ash coal (10.00%≤Ad≤20.00%).
Volatile variation Law of Coal

Volatile analysis results of the 5# coal seam showed that the volatile of raw coal was not very significant, the lowest was 5.63%, the highest was 11.92%, and the average ash content was about 7.63%. As can be seen from the figure 3, volatile components was gradually increased from the north to the South, most of the coal mine belongs to anthracite. Volatile was gradually increased from the beginning of the edge to the center, to the center, was the highest. Taking the center as the coordinate axis, the change of volatile components in the north and south was relatively slower compared with the volatile changes in east and west, and the volatile of the north and south sides was slightly higher than the east-west direction. Bituminous coal (Vdaf ≥ 10.00%) accounted for about 7% of the area of the mine, Mainly distributed in the area of the central, northeast and northwest, approximate circular region of the intersection of 2 exploration line and synclinal axis of the center of the mine field, northeast area was located in the vicinity of VII exploration line, northwest area was located in the northwest corner of mine field 1, VII exploration line around. WY2 (3.50% ≤ Vdaf ≤ 6.50%) accounted for about 15% of the total area, was mainly distributed in the area of west, south and southeast of mine field, the parts of southeast and west were located at the Intersection between the 2 exploration line and the boundary, area of south located in X-1, IX exploration line near the syncline axis. The rest area was WY3 (6.50% ≤ Vdaf ≤ 10.00%).

Figure 3. The spatial variation of volatile of 5# coal seam of Dafeng mine.
Sulfur Variation Law of Coal

Sulfur content analysis results of the 5# coal seam showed that the change of raw coal sulfur content was not significant. And the minimum value was 0.18 percent and the maximum value was 0.64 percent, and average value 0.31 percent. As can be seen from the figure 4, St.d of 5# coal seam increased gradually from south to north. Sulfur content gradually decreased by the field edge to the center of the mine center. Sulfur content of mine center was the lowest. Mine center was set as labels, Sulfur content change of north and south was relatively slower relative to the east to west. The ash content of south and north side is significantly less than that of east-west direction. Low-sulfur coal (0.50%≤St.d≤1.00%) in well field accounted for 8 percent of the mine field. It mainly distributed in northwest corner and exploration line of east by north. Others are special low-sulfur coal.

![Figure 4. The spatial variation of sulfur of 5# coal seam of Dafeng mine.](image)

Calorific Variation Law of Coal

Calorific value (Qgr,d) analysis of 5# coal seam showed that raw coal calorific value changed less significant. The highest, lowest, and average value were 24.12 MJ/kg, 33.63 MJ/kg, 31.20MJ/kg, respectively. As can be seen from the figure 5, the variations of Calorific value of 5# coal seam was obvious. Calorific value gradually decreased by the field edge to the center of the mine center. Sulfur content of mine center was the lowest. Coal of medium to high calorific value (24.30 MJ/kg≤Qgr,d≤27.20MJ/kg) accounted for 3 percent of the mine field, which distributed in No.2 prospecting line and syncline axis intersection area. Coal of high
calorific value \( (27.20 \text{ MJ/kg} \leq Q_{gr,d} \leq 30.90 \text{ MJ/kg}) \) accounted for 30 percent of the mining field, which mainly distributed in midwest, northwest, northeast and southwest of the well field. The southwest is located near to IX-1 exploratory line and northeast is located to the region of VII exploratory line. Others are high calorific value coal.

Figure 4. The spatial variation of sulfur of 5# coal seam of Dafeng mine.

CONCLUSIONS

Following conclusions of coal quality change and distribution in 5#coal seam in lower coal group of Dafeng mine based on the analysis of the contour map were obtained: (1) As a whole, moisture of coal changes along the syncline axis was more obvious, moisture was highest in the area of intersection of South border and west direction, synclinal axis in the mine field. Moisture was lower in local area of the northeast, northwest, and southeast of the mine field. (2) The change of ash was most obvious in the middle of the mine field. The ash gradually increased from the beginning of the edge to the center, reached the highest in the center of the mine field. (3) Volatiles gradually increased from the south to north, from the edge to the center, it reached the highest in the center of the mine field. The volatile changes of the north South tend to be slower than that of west east, and the volatile of the north south is slightly higher than that of the west east; (4) The sulfur content increases gradually from the south to the north, starting from the edge to the center it was gradually reduced, and sulfur content reached the lowest in the center of mine field;
(5) The changes of calorific value was more obvious in mine near the center, and the calorific value gradually reduced from the beginning of the edge to the center, to the center, it reached minimum.

REFERENCES

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