The GIS Database and Coal Characterization for the Environmental Management in Tavantolgoi Coal Mine

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Mining processes has the possible influence to the environment such as the land and the water recourses surrounding the mine. A very few studies of this issue have been carried out in Mongolia, although a worldwide common sense is to protect the environment based on the data of materials from mines and the surrounding areas. It is important to consider the possibilities to affect to the environment using the property data of rock and soil materials. The GIS database is also useful to know how large area is suffering from the problems. The present study investigated that mineral and chemical properties of coal and soil samples and measured water chemistry on Tavantolgoi coal mine in Mongolia. The data are put into GIS database and consider each other.The mine locates in Umnugobi province 550 km to south from Ulaanbaatar, excavating energy coals and coking coals from the seams VIII and IV, respectively. Field observations of the environmental condition were made at the 2 open pits reaching to these coal seams in the mine and the surrounding areas. The GIS database is first created by digital and raster data such as sample information, geology and geomorphology, including a topographic mapwith a scale of 1:5000. The map projection of large area is converted into Geographic projection, and small area's map projection is converted into the UTM-WGS84, in which needed to calculate the distance and area. The pair of GIS topographic maps of 1960 and 2007 shows the scale-down of the saline lake areas but the enlarging playa near the mine. Samples from the coal mine areas for analyses were collected from the specific places from each open pit. The collected samples are 6 soil samples, 11 coal samples and 12 water samples. Mineralogy and chemical properties of coal and soil samples were determined using X-ray powder diffraction (XRD), X-ray fluorescence spectrometer (XRF-EDS), and Scanning Electron Microscope with Energy Dispersive Spectroscopy (SEM-EDS). The powdered samples were used for XRD analysis and pressed powder tablet were used for XRF-EDS analysis. Cut small specimens were prepared for SEM-EDS. The pyrite and siderite are detected from XRD. Soils contain ca. 60-70% of SiO2, 10-15% of Al2O3, 5-7% of FeO+Fe2O3 and ca. 3% of K2O. coal samples contains more than 20% of C and S, more than 4% of FeO+Fe2O3 and 20-30% of SiO2. The characteristics of the weathered coal samples are intermediate of coal and soil samples. The chemistry of the water samples were analyzed using Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES). The contents of Ca2+ and Mg2+ were 20-70 ppm and 12-18 ppm, respectively. The contents of Na+ and K+ were 60-160 ppm and 1-2 ppm, respectively. The values of Na+ and K+ much increased compared to the water quality data of the previous research paper in 1997.

The detected iron sulfide mineral, pyrite, in coal samples is not weathered at this moment, because the water near the mines does not contain iron and other heavy metals. If acids are produced during the mining processes, the pyrite will be leached and more sulfides will be produced, which affects to the environment surrounding the mine. Acid rains may also be occurred due to desulfurization, affecting serious damage to the environment. Thus, proper treatments of coals will be strongly desired for future mining plan. The increases in the Na+ content in surface and subsurface waters suggest that the desertification and salinification progresses in the wide area including the Tavantolgoi coal mine. Once the grass will be removed away from the land surface, the meadow will be damaged seriously. Thus, rehabilitation of the land surface will be also necessary to be planned. It is concluded that the Tavantolgoi coal mine is not suffering from environmental problems at this stage, however, it has possible damages on the land surface unless the environmental protection and rehabilitation planning.