Kossge International Symposium on Soil & Groundwater Environment
October 27-28, 2005 Mayfield Hotel, Seoul, Korea

Assessment of Water Pollution by Acid Mine Drainage Index for Tributary Inflow Okdong Stream in Korea

Kim Hee Joung[1] · Jae E.Yang[2] · Yong Sik Ok[2] · Hae Ik Rhee[2] · Jae-Young. Lee[3] · Byung KII Park[4] · Sung Ho Kong[4] and Sang Ho Jun[1]

[1]Department of Environmetal Science, Kangwon Natinal Unicersity
[2]Divison of Enviormental & Biological Engineering, Kang National Univesity
[3]Department of Environment Eng. University of Selul
[4]Department of Chemical Engineering, Hanyang University

Abstract

In order to investigate the extent and degree of heavy metal pollution affected by mining activities of the SangDong abandoned mine, sampling of stream waters has been undertaken up to 20km downstream from the mine at 0.5 km ~ 1.0 km intervals. Water samples were analyzed using ICP-ASE for Cu, Mn, Al, Fe and Zn. Physical and chemical properties of waters (pH, DO, COD, Conductivity, SO_4^{-2}, etc) were also measured. The pH values of water samples ranged from 3.0 to 8.0, the DO levels were in the range of 4.1 ~ 9.2 mg/l, Conductivity range of 38.1~1698.0 uS/cm. Acidity and conductivity were very high in mine wastewater site. Heavy metals were in the ranges of Fe 16.0 mg/l ~ 5757.0 mg/l, Mn 3.0 mg/l ~ 3061.0 mg/l, Al 1.0 mg/l ~ 81.0 mg/l, Cu 24.0 ug/l ~ 8,034.0 ug/l, Zn 282.0 ug/l ~ 64,045.0 ug/l. For the most part heavy metal concentration were very high at flow in abandoned coal mine discharged water. Water quality in the Okdong stream have been polluted by mining activites. Pollution induction important factor for Okdongcheon stream is upper stream out flow acid coal mine drainage. Heavy metal concentration of the acid coal mine drainage is, in average 2 times (Cd, Cu) and 1000 times (Fe) higher than that of the mine wastewater. As a result of AMDI(Acid Mine Drainage Index) evaluation, the coal mine west water showed lowest acid mine drainage value indicating the worst acid mine drainage quality.

Key words : Coal mine discharged water, coal mine drainage, abandoned mine, AMD index

Introduction

Mining activity can range from scarcely perceptible to highly obstructive and the nature of the impact can vary widely depending upon the mineral worked, the beneficiation process, the method of mining, and characteristics of mine site and its surrounding hydrogeology. These are recognized as the most serious water pollution situations to be associated with mining and are thought to of large risk to the aquatic environment (Koryak et al., 1972, Down and Stocks, 1978, Clark and Crawshaw, 1979, Kelly, 1988, UNEP, 1991). Acid Mine Drainage (AMD) from the abandoned mines and tailing dams contaminated the Okdong stream located in the middle Eastern part of South Korea. However, since the industrialization have been accelerated, many kinds of chemicals are used and various pollutants are emitted in the environment. Temporal and spatial comparisons of acid mine drainage contaminated waters are difficult because of the complex physico-chemical nature of the pollutant (Chio,1999). Acid Mine Drainage Index (AMDI) was employed to assess the effects of acid mine drainage from the abandoned mines on the surface water quality. The study is focused upon the degree of contamination of surface water by toxic metals and water quality affected by AMD. Management strategies for the prevention of contamination in aquatic environments by toxic metals and for the development of treatments for abandoned coal mine waste water is strongly required in this region. We investigated AMDI of waste water from abandoned coal mine, Sangdong metallic mine, tailing dam, and surface water in Okdong stream areas to identify the source of metal loads in the Okdong stream watershed, to base the management options for the prevention of soil and water qualities from the abandoned mines.

Materials and Methods

Description of the study area

The study area is located in the taebaeksan metallogenic province, in the middle eastern part of South Korea. The representative geology of catchment area situated in the Sangdong region consists of Pre-Cambrian metasediments, granites (south part) dverlying the Choseon Supergroup of Cambro-ordovician age (middlle part) and the Hongjom formation upper Carboniferous (northern part) (Kim et al., 1988, Kim et al., 1989). Tributaries to the north drain largely the Carboniferous rock as well as several coal mining areas and Sangdong mine, tailings dam area mainly consists of Jangsan quartzite, Myobong slate and the great limestone series, the latter within which the tungsten-molybdenum mineralisation occurrs. Limestone and Pegmatites are in the middle and low part(Okdong abandonded coal mine) of the studyed area.

Summary & Conclusions

Water quality of the Okdong stream was degraded by the acid mine drainage from abandoned mines. Degree of AMD influence was higher at abandoned coal mine than at abandoned metallic mine. Discharged water from the abandoned coal mine had higher levels of heavy metals and low pH. Acid Mine Drainage Index (AMDI) predicted the water quality significantly as influenced by the abandoned mine. Results demonstrated that acid mine drainage should be neutralized in order to enhance the water quality and to preserve the ecology of the Okdong stream. Drainage and wastes from the abandoned coal mine were major components for water and soil contamination. Management options such as neutralization of drainage, revegetation, or confinement of wastes are suggested to prevent further contamination.