Whittle (Nothumberland, İngiltere) Kömür Havzası'nın Drenaj Jeokimyası ve Çevresel Etkileri

Drainage Geochemistry and Environmental Impacts of the Whittle Collieries Area, Northern UK

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ÖZ

Bu çalışma Whittle kömür havzasında yer alan Fe-Mn pasif arıtma sistemi civarında bulunan asidik maden drenajlarının cevresel kirlilik problemlerini ortaya çıkarmayı amaçlamaktadır. Bu amaçla, yüzey sularının, farklı tane boyutundaki dere sedimentlerinin (<75; <106; <150; <180 µm) ve bitkilerin (alg ve yosun) ana ve iz element içeriklerini (Ca, Mg, Na, K, Fe, Mn, Al, Zn, Si, As, Cd, Co, Cr, Ni, Pb) belirlemek için ICP-OES (inductively coupled plasma, optic emission spectrometer); su örneklerinin F, Cl, SO_4, Br, PO_4 ve NO_3 içerikleri ise IC (ion chromatography) ile analiz edilmiştir. Minerallerin belirlenmesi için SEM (scanning electron microscope) ve aynı bölgenin kimyasal bileşimini belirlemek için EDS analizleri sadece <180; <106 tane boyutlarında yapılmıştır. SEM görüntüleri XRD (X-ray diffractometry) analizleri ile desteklenmiştir. Bu çalışma, Whittle kömür havzasında kurulan pasif arıtma sisteminin, yeraltı sularındaki Fe ve Mn derişimini azaltmada etkili olduğunu göstermektedir. Ancak HB 8, HB 9 ve HB 11 nolu lokasyonlarda sırasıyla Fe (2 mgL^{-1}), Fe (10 mgL^{-1}) ve Mn (3.7 mgL^{-1}) değerlerinin yüksekliği sızıntı suların etkisini kanıtlamaktadır. HB 13 nolu lokasyonda Cd, Co, Fe, Mn, Cu, Ni, Cr değerleri diğer element dağılımlarına gore daha düşüktür ve bu lokasyondaki büyük alg kümelerinin elementlerin dağılmasında etkili olduğu görülmektedir. As, Pb ve Si ise Hazon Burn Nehri boyunca farklı alg türleri tarafından tüketilmiştir. Cl ve SO_4'ın tüm su örnek lokasyonlarında temel değerlerden yüksek olduğu belirlenmiştir. Kuvars, kil mineralleri (kaolen ve klorit) ve feldispat grubu mineraller (plajiyoklas ve alkali feldispat) dere kumlarında hakim mineral topluluğudur. Bitkilerin varlığı, adsobsiyon süreçleri, nehir suyunun bir başka nehir suyu ile karışması, maden yataklarından sızan sular, pasif arıtma sistemi civarındaki dere kumlarının ve nehir sularının bileşiminde hızlı değişliklere sebep olabilirler.

Anahtar Kelimeler: analiz metodları, ICP, EDS, SEM, XRD, Whittle kömür havzası

Abstract

This study aims to arising environmental pollution problems of the acid mine drainage at Fe-Mn passive treatment system area in the Whittle coalfield. Therefore, inductively coupled plasma, optic emission spectrometer (ICP-OES) analysis were made determination of major and trace element contents (Ca, Mg, Na, K, Fe, Mn, Al, Zn, Si, As, Cd, Co, Cr, Ni, Pb) of the surface waters, in different fractions (<75; <106; <150; <180 µm) of the riverbed sediments and plants (algae and moss). F, Cl, SO_4, Br, PO_4 and NO_3 contents of water samples were analysed by ion chromatography analysis (IC). The imaging capabilities of the scanning electron microscope (SEM) coupled with the elemental analysis provided by energy dispersive spectroscopy (EDS) were used to acquire both chemical and physical information in the different media (<180; <106 µm size fractions sediments and algae). X-ray diffractometry (XRD) analysis was made to determine mineral compositions of the sediment samples.

It is observed that the passive treatment system is the most effective to decreasing of the Fe and Mn concentrations in the groundwater in the Whittle coalfield area. However their concentrations have changed in different sample locations in surface waters such as in the HB 8, HB 9 and HB 11 locations respectively Fe (2 mgL^{-1}), Fe (10 mgL^{-1}) and Mn (3.7 mgL^{-1}), in which has been affected from seepage waters.

Cd, Co, Fe, Mn, Cu, Ni, Cr are lower value than other elements in HB 13 where algae have made up of large quantity, As, Pb and Si have been depleted in different algae species along the downstream too. Besides, Cl and SO_4 are above background levels in the whole sample locations. Quartz, clay minerals (kaolinite and chlorite) and feldspar group minerals (plagioclase, alkaline feldspar) dominate the mineral suite in the sediment samples. The effects of plants, of adsorption processes, and of mixing with tributaries and seepage waters may be cause very quickly alter of the composition of the river waters and riverbed sediments in the passive treatment system areas.

Key words: analysis methods, ICP, EDS, SEM, XRD, Whittle coalfield

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