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1. Background

The collection of papers presented in this Special Issue is a complement of the Special Issue CATENA: Reclamation of mining site soils, part 1 (CATENA 136, 2016, 1-2), and the continuation of the outcome of the Symposium C3.5-3 “Management and reclamation of mining site soils” given at the 20th World Congress of Soil Science held in ICC Jeju, Korea from June 8-13, 2014 by the International Union of Soil Sciences (IUSS) and the Korean Soil Science Society (KSSS). Soils are essential for the environment at the biosphere-lithosphere interface. They are a naturally limited resource, and their quality can be affected by mismanagement of mining, smelting and ore processing activities. Tailings, spoil heaps and waste dumps are a source of hazardous substances that imply a serious risk for crops, livestock and human health. Therefore, more suitable, affordable and innovative technologies for the management and reclamation of mining site soils, are increasingly needed.

The subject of this Special Issue is very important, because the application of knowledge of soil chemistry, physics, engineering, biology and ecology to the reclamation of these damaged mine site surrounding soils and downstream waters is essential. This special issue contains the most recent findings and “state of the art” methodology, and includes fourteen papers written by authors from twelve countries: Australia, China, Iran, Italy, Jordan, Korea, Nepal, Poland, Serbia, Spain, UK and USA. This collection of papers is focused mainly on six topics: 1) environmental problems in coal mines and coal power plant surroundings, 2) microbial activity in mining site soils, 3) phytoremediation, 4) some types of restoration of mining areas, 5) rice and mining activities and 6) removal of heavy metals and organic compounds.

2. Research topics

2.1. Environmental problems in coal mines and coal power plant surroundings

Five papers are concerned with this topic:

Park et al. (2015) presents a practical testing approach to predict the geochemical hazards of in-pit coal mine tailings and rejects. Sequential leaching of coal tailings and rejects was proposed as a simple test method that can be applied easily on site. The leaching kinetics of salts was well described by a new variant of the shrink core model, and the samples that required monitoring corresponded with the hazard group of samples attained through the use of principal component analysis. The results suggested will help to better characterize and classify coal mine tailings and rejects for in-pit disposal.

Seo et al. (2016) developed a process for recovering dissolved metals from acid mine drainages (AMD) from Samma-Teajung coal mine, Samcheok, Gangwon province, Korea by sequential selective precipitation with control of pH. The authors used two process schemes: only neutralization and neutralization after oxidation with hydrogen peroxide. They found that

oxidation before neutralization increased the recovery of dissolved Fe and Al in AMD with high purity of precipitates.

Zhen et al. (2015) assessed the effects of vegetation and physicochemical properties on solute transport in reclaimed soil at the Heidaigou opencast coal mine site on the Loess Plateau, China. They used the miscible displacement technique to obtain breakthrough curves of NO_3^- transport in undisturbed soil columns from the soil profiles from four sites. The authors found that with increasing the bulk density and by selecting fine-textured soils they could reduce the average soil pore water velocity and the dispersivity coefficient, thus extending the solute penetration time.

Ćujić et al. (2016) studied the concentration of heavy metals (HM) in soils around the largest coal fired power plant, Nikola Tesla, situated in western Serbia. The soil status was assessed using several indices and their spatial distribution was analyzed using ordinary kriging. Correlations between HM and soil properties were determined by hierarchical cluster analysis. Geostatistical analysis showed the highest concentrations of HM in predominant wind directions.

Weber et al. (2015) investigated properties of soil materials derived from fly ash 11 years after reclamation and revegetation. The authors mixed fly ash with biosolids or clay, which together with the revegetation improves the soil substrate structure, root penetration and increase of water storage. Also results a neutralization of the reaction, a decrease of salinity level and improvement in physical properties (i.e.: genesis of granular soil structure).

2.2. Microbial activity in mining site soils

Three papers deal with this topic:

Wahsha et al. (2016) developed an early warning management tool for monitoring mining site soils by measuring microbial community biomass and enzymatic activity versus heavy metals (HM) and soil properties. The authors showed that changes in the activities of soil microbial community can precede some detectable changes in soil chemo-physical properties. It supported the utility of this tool for monitoring soil pollution with HM.

Ko et al. (2016) investigated the influence of indigenous sulfate reducing bacteria (SRB) stimulation on arsenic immobilization in a paddy soil in the vicinity of an abandoned Au-Ag mine near Sanyang, Korea. The stabilization efficiency increased with depth likely due to formation of more reducing conditions. The results indicated that As could be immobilized by the stimulation of indigenous SRB.

Han et al. (2015) assessed the ecotoxicity of acid mine drainage (AMD) receiving streams at an abandoned mine site in Korea. The authors researched the eco-toxicological correlations between chemical properties of water and sediments collected from the AMD. The toxicity of stream water showed a relatively strong correlation with the pH and dissolved metal concentrations of water implying the toxic effects of stream water on its stream biota.

2.3. Phytoremediation

Two papers in this Special Issue refer to the third topic:

Bini et al. (2016) reported past and current studies on serpentine soils and serpentinophytes from different outcrops in central Italy. They concluded that the information brought by soil

scientists and ecologists may achieve combining soil and vegetation features of metal-enriched sites including: 1) the presence of metallophytes or serpentinophytes, 2) presence of a lithological unit such as polymetallic sulphide ores or serpentinite and 3) presence of environmental features which may indicate a zone favorable to the connection between soils and vegetation.

Wan et al. (2016) investigated on the soil quality in four mining sites in Hunan Province, China, with serious heavy metals pollution. The authors found that *Pteris vittata* L. and *Viola principis* H. de Boiss were two potential multi-metals extractors. *Pteris vittata* was an As hyperaccumulator and accumulator of Pb and Sb. *Viola principis* was an Cd, Pb and As hyperaccumulator.

2.4. Some types of restoration of mining areas

Two papers are concerned with this topic:

Jordan et al. (2016) designed technosols for rehabilitation of two limestone quarry spoils in Sierra Callosa, Alicante (Spain) using their own spoils and biosolids. This experimental procedure was controlled using percolation columns containing the spoils and biosolids. This mixture was periodically irrigated to simulate short duration rain. In the leachates ion mobility, pH and electrical conductivity were determined. The good correlations obtained for these parameters can help to establish indicators of environmental quality of leachates over time. Significant nitrate concentrations may imply a risk for the contamination of aquifers. Yang and Cattle (2016) investigated the effectiveness of remediation with cracker dust as capping material for Pb-rich soil in the mining town of Broken Hill, Australia. They found that this type of remediation has been generally effective but a small number of cracker dusted sites were found to have Pb-enriched surfaces. It is suggesting that the efficacy of cracker dust is curtailed where fluvial transport of Pb-rich sediment and/or mixing of the applied cracker dust with the underlying Pb-rich soil occurs.

2.5. Rice and mining activities

Kwon et al. (2016) estimated the concentration of As, Cd, Cu, Pb and Zn (HM) in paddy soil and polished rice contaminated by mining activities in 4 abandoned mining areas of South Korea. They concluded that Zn was confirmed as a higher pollutant which occurs by mining activity in the surrounding farmland. Also polished rice samples showed higher concentration of As and HM than the natural background. Regular rice consumption in these areas can cause health problems for local residents.

2.6. Removal of heavy metals and organic compounds

Sigdel et al. (2016) proposed a methodology with powdered activated carbon impregnated alginate beads (ABPAC) towards concurrent removal of Cd and benzene from water. The authors investigated sorption of Cd and benzene by ABPAC in both single and binary contaminants systems. Their study demonstrated the capability of ABPAC for simultaneous removal of Cd and benzene from the aqueous phase.

3. Conclusions

All the papers described above cover important aspects of fundamental and applied research and provide advances in relation to existing knowledge.

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