Mineralogical characterization of tremolite asbestos-containing soils

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Asbestos-containing soils occur mainly at ultramafic rocks and hydrothermally altered carbnate rocks in S. Korea. Remediation of asbestos-containing soils is considered a high priority by the Korean Government because these soils, if left untreated, represent a hazard to the environment and human health. The objective of this study was to show a priori physicochemical and mineralogical characterization of asbestos-contaminated soil can direct the development of remediation strategies.

Two sites (Seosan and Jaecheon, S. Korea) at abandoned asbestos mines were selescted for soil and mineralogical characterization. Parent rock of the two sites is hydrothermally altered carbnate rocks in S. Korea. At each site, samples were taken at soil surface. Soil preparation consisted of sieving air-dried soil through a 2-mm sieve. The sieved soils (< 2-mm) were used for soil characterization and mineralogical analysis. Following particle size fractionations, mineralogical characterization was investigated by TG-DTA, XRD, PLM, SEM and EDS analyses. Point counting was used to quantify asbestos in the whole soil and size fractionated samples.

The soil color of the both sites was dark red (Seosan site) and dark brown (Jaecheon site). The soil texture of the Seosan and Jaecheon sites was loam and sand, respectively. XRD analysis showed mineral assemblages of the Seosan and Jaecheon site were tremolite-talc-vermiculite-quartz-diopside and tremolite-talc-vermiculite-quartz-dolomite, respectively. XRD, PLM, SEM and EDS analyses showed that the needle-shaped tremolite was observed at both soils. Size fraction between 425 ㎛ to 2㎜ of the Seosan and Jaecheon soils contained 1.5 % and 2 % asbestos, respectively. Therefore, the soils of the both sites were designated as asbestos-containing materials (greater than or equal to 1%) according to the criteria of the U.S. EPA. TG-DTA showed that tremolite asbestos at both soils were transformed to diopside with the temperatures about 1,100℃. These results indicated that thermal treatment of asbestos-containing soils was effective for phase transformation of the asbestos in soils.

Mineralogical and geochemical characteristics of the Korean coal ashes from the perspective of the coal and combustion types

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Fly ashes produced from 9 coal burning power plants in Korea were investigated to see the changes in mineralogical and geochemical characteristics according to the coal types and combustion methods. Our results indicate that the mineralogical and geochemical features of the fly ashes are more dependent on the combustion methods than the coals used. Five and two out of the nine investigated plants were originally constructed to burn bituminous (or subbituminous) coals and anthracite coals, respectively, by applying pulverized coal firing system. The remaining two plants burn anthracite or bituminous coals together with fine sand-sized limestone grains using the fluidized bed combustion method. According to the SEM and XRD investigation, it was revealed that spheres, mullite, and glasses were absent and sometimes illite, a clay mineral, was present in the fly ashes produced from the plants of the fluidized bed combustion method due to the low combustion temperature (800 - 850 °C). These ashes particularly contains calcite and anhydrite phases due to the co-combustion of limestone grains. The high temperature phases such as mullite and glass were observed in all the ashes of the pulverized coal firing plants. However, their contents were generally higher in the fly ashes of the pulverized anthracite coal burning plants. This is due to their higher combustion temperatures (1200 – 1500 °C) than those of the bituminous or subbituminous coal burning plants (1200 – 1300 °C). The chemical composition of the ashes also reflected the combustion methods.

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