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論 文 要 旨

THESIS SUMMARY

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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Huge amount of coal fly ash (FA), produced from coal-fired power plants, is now a serious environmental and social problem in arid-/semi-arid areas owing to rich coal sources. In these areas, desertification and following soil productivity degradation is also a significant problem. Soil water holding materials are strongly demanded to use limited water sources effectively. This study tried to apply coal FA as soil water retention agent. Conventional water holding capacity (WHC) are measured by liquid water loss at certain pressure and samples are always hydraulically saturated before measurement. On the other hand, major pathways of soil water loss in arid-/semi-arid areas are evapotranspiration by plants/grasses and physical evaporation under unsaturated condition even after rainfall. Because WHC is not appropriate to simulate water loss in these areas, an original method, water retention capacity (WRC), to measure water evaporation resistance in soil system was suggested. This study reports the effect of raw and treated FA amendment on WRC of soils and sands.

WRC was measured at room temperature and 40 °C. WRC is defined as integrated area below water retention curve as a function of drying time. WRC measurements were repeated more than 3 times and experimental errors were always assessed by statistical test. Tested soil and sand samples were degraded granite soil (DGS), akatama soil (AS), silica sand (SS) and river sand (RS).

When raw FA was amended, it significantly decreased WRC of soils and SS at 40 °C although its amendment has been usually reported as effective on increase of WHC. At room temperature, FA amendment gave no impact on WRC. When FA was treated by apatite synthesis, treated FA amendment increased WRC of soils and SS at 40 °C. P/Ca ratio of apatite synthesis treatment gave large impacts on FA amendment effect on WRC. When P/Ca ratio was 11.7, WRC of FA-amended soils increased and was almost equal to that at room temperature. Owing to single correlation analysis, this study found that WRC was not controlled by FA surface morphology, particle size distribution of FA, specific surface area, water repellency, capillary water content, nor pF. Because WRC might be controlled by some of these factors together and/or interactively, variations of WRC and these factors after FA amendment were used to make variables unitless and multi-regression analysis was conducted including an unknown factor. WRC variation could be explained by specific surface area, water repellency and an unknown factor. On the other hand, capillary water content had a limited impact. Because organic matters of soils are known important for WHC, some organic treatments of FA were tested. Organic-treated FA amendment had complicated effects on WRC of soils and sands. Although simple organic-treated FA decreased WRC of sands at 40 °C, organic-apatite treated FA increased WRC. Owing to the results of organic-added thermal treatment, “mm size” macro-pores in FA aggregates had no contribution to WRC. This study suggested interactions of hydrophilic/hydrophobic organic matters in soils/sands and FA might explain complicated effects of FA amendment on WRC.

This study is summarized as follows. A new indicator, WRC, was suggested to evaluate water evaporation resistivity of soil system. Although raw FA amendment has been usually reported effective on increase of WHC, it gave no effect on WRC at room temperature and decreased it at 40 °C. When FA was modified by organic and inorganic treatments, FA amendment effects on WRC were very complicated. This study found that WRC variation could be predicted by specific surface area, water repellency, and an unknown factor. The unknown factor might be interactions of organic matters in soil/sand and FA. This study found that WRC were controlled by complicated mechanisms.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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