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論 文 要 旨

THESIS SUMMARY

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工　科
博士　（　　）
Doctor of

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

FA utilization is strongly requested according to its huge amounts of generation every year in worldwide. Global FA generation is estimated to be 800 million Mg/yr in worldwide and desertification all over the world has becoming more and more serious and threating agricultural productions nowadays in arid and semi-arid area. This research is focused on recycling and reusing FA as eco-friendly products and engineering composites. In addition, functional polymers are promising candidates in fabrication of FA based composites because of their high chemical stability, good compressive strength, and high durability. If FA can be recycled as water retention and absorbent materials, it would not only solve FA management problem and desertification problem at the same time, but also provide potential applications of FA in agriculture and industry field. In this research, evaporation mitigation (EMC) was identified to specify water evaporation resistance ability. Drying experiment was conducted to measure EMC of soil/sand and FA mixed samples. EMC of tested soil/sand clearly showed sieving size dependency regardless of FA mixing ratio. The effects of raw-FA amendment on EMC are also much smaller than the sieving size effect. This study found that the sieving size dependency of EMC could be explained partially by organic matter content in each soil/sand sieving size fraction. Correlations between organic matter contents and EMC also have temperature dependency, which could be explained by the impacts of the temperature on the hydrophilic/hydrophobic properties of the organic matters. According to the results, it is concluded that organic matters play a dominant part on EMC. If FA is used in the arid/semi-arid areas to increase EMC of the sandy soil, proper chemical modification of FA will be necessary to suppress water

evaporation in soil system. Effects of polymer-FA amendment on EMC of the soil/sand were also tested, and results showed polymer treated FA amendment can increase EMC of soil/sand positively. Further study showed that showed that the hydrophilic groups such as –OH and –COO- of the polymer-modified FA had significant effects on the EMCs of soil/sand. Therefore, sufficient surface modification with hydrophilic groups could greatly increase the water retention ability of the FA particles. On the other hand, if fly ash particle can be made into composites, multiple modifications could be conducted for increasing the EMC and others properties of the FA composites. Biodegradable polymer polyvinyl alcohol (PVA) was used as matrix; cellulose was used as the crosslinking holder to form supporting structures of the FA based porous composites. The results showed that PVA modification can increase the mechanical strength of the PVA-FA composites. PVA-FA composites modified with cellulose showed good porosity compared to those without cellulose modification. The proper modification of PVA and cellulose can improve the hydrophilicity and the porosity of the FA-composites. The results of the drying experiment on the FA composites showed that the improvement of the hydrophilic groups is applicable to increase the water retention ability of the material, although the porous structure at a suitable capillary pore size range didn't make significant difference on the EMC values. It suggested that pore size range smaller 1μm, or larger than 10μm might have a non-negligible impact on the EMC. In addition, to improve the polymer-FA composites as the adsorbent material, further chemical activation such as the addition of the C=O functional groups can be useful to increase the adsorption ability.