Development of Biomass-Derived Activated Carbon for Adsorption Dehumidification

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論 文 名　　：Development of Biomass-Derived Activated Carbon for Adsorption Dehumidification（吸着除湿のためのバイオマス由来活性炭の開発）
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論 文 内 容 の 要 旨
Thesis Summary

Desiccant dehumidification systems can be utilized for decoupling moisture removal duty from conventional mechanical vapor compression systems. Dehumidification using desiccant dehumidifiers is expected to exhibit a better energy efficiency. However, the high energy needed in the regeneration process limits its applicability. To realize the full potential of this technology, it is necessary to develop materials that can be regenerated using low grade heat source such as waste heat and solar heat.

In this study, activated carbons (ACs) derived from waste biomass were developed as desiccant materials. The ability of activated carbon (AC) to remove the moisture was controlled by carefully preparing the material to achieve the right operation window for optimum moisture sorption processes. Different types of biomass waste were utilized, such as fallen leaves and nutshells. Camphor leaves were chosen to represent fallen leaves, while acorn nutshells and walnut shells were chosen for nuts-based biomass. Indeed, different biomass and various preparation conditions obtained ACs with different properties. Among those three biomass, acorn nutshells and walnut shells showed promising results in terms of surface properties and water adsorption uptake. According to the results, physical activation by steam and CO_2 followed with air oxidation could produce ACs with high surface area and pore volume, which consequently enhancing the water adsorption properties of that material.

The efficacy of the ACs for dehumidification applications was assessed using the weather data

from several regions of Indonesia, from North Sumatera to Papua. The results revealed that under the studied conditions, the new desiccant material showed a better dehumidification capacity than silica gel. Moreover, the reported AC can be regenerated using temperatures as low as 40ºC, which is readily available from waste heat, including the heat rejection from the condenser of an air-conditioning unit.