Application Note B-TA1027

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TA1027 - Water absorption behavior of materials for biomedical application by HUM-TG

Introduction

Organic compound such as α-cyclodextrin and phyllosilicate clay minerals such as smectite and halloysite have been utilized as DDS (drug delivery system) and other biomedical applications with their structures shown below. Here, the STA8122 attached with a humidity generator HUM-1 was used to compare the water absorption and dehydration behavior of materials for biomedical application.

Measurement and results

A 10 mg amount from each sample was weighed in an Al pan. α-Cyclodextrin was heated up to 150℃ while the clay minerals were heated up to 300℃ to dehydrate the sample prior to measurement. During measurement, while holding the temperature at 25℃, a dry condition of 0%RH was kept constant for 30 minutes. Then, a water vapor atmosphere of 80%RH (2534.4Pa) was introduced into the furnace for 3 hours. After which, the atmosphere was changed to a dry condition of 0%RH and was held for 2 hours.

Results are shown in Figure 1. All samples revealed a mass increase due to water absorption. α-Cyclodextrin revealed the highest amount of water absorbed (10.45%), followed by smectite (6.43%) and halloysite (1.91%). In the dry condition (0%RH), almost all of the absorbed water were dehydrated in clay minerals. While more than 2% water is retained α-cyclodextrin even at dry condition which could be identified as strongly adsorbed water molecules. Smectites are known as expanding type of clay mineral with high cation exchange capacity and ability to absorb large amount of water while halloysites are non-expanding type. On the other hand, the inner cavity of the α-cyclodextrin is hydrophobic while its surface is hydrophilic. All these characteristics lead to their difference in water absorption and dehydration results.

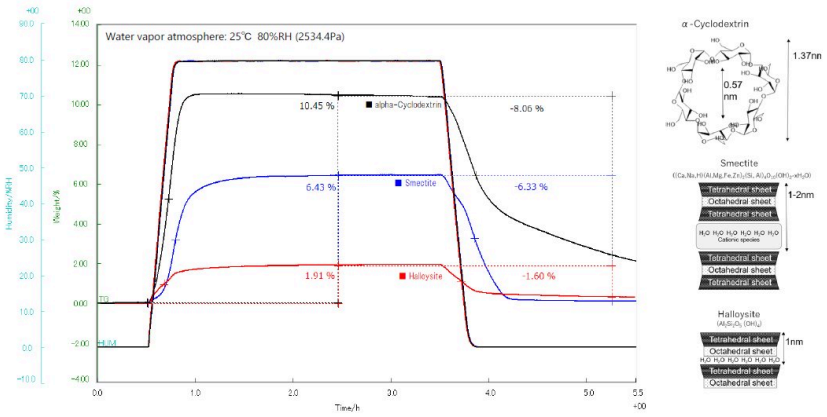

Figure 1: Water absorption behavior of different materials used for drug delivery and their structure.

(The clay mineral samples were kindly provided by Prof. Masanori Okazaki, Tokyo University of Agriculture and Technology)

Reference

(1): M. Ghadiri, W. Chrzanowski and R. Rohanizadeh. *RSC Adv.* **5** (2015) 29467-29481
(2): A. Haimhoffer, et. al., *Scientia Pharmaceutica.* **87** (2019) 2-21

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The compact humidity generator is connected to the STA (T G-DSC) for measurements under constant relative humidity water vapor atmosphere