

# THE RHEOLOGICAL PROPERTIES FROM ORGANIC WASTE IN DEVELOPING COUNTRIES

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## The problem of mechanical separation from organic waste in Asian countries

Feed

Separated Particles

Particles that were too large

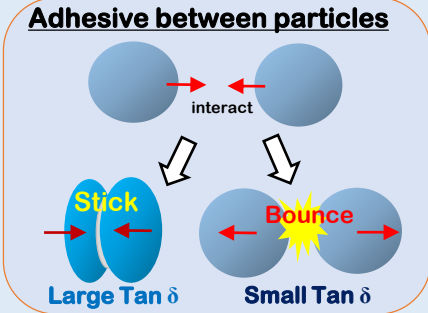
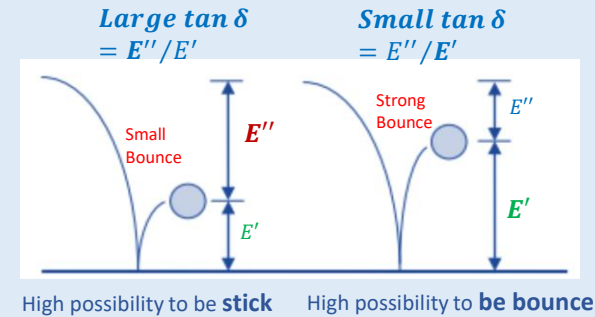
waste sticks on the machine

waste makes larger by sticking each other then clogging

Q1: What kind of adhesive force can let waste sticking on to the trommel, and How?  
 Q2: How the moisture influences on the adhesiveness?  
 Q3: How can we measure the adhesiveness?

## How the Rheological Properties contribute to adhesive interaction?

- **Storage Modulus ( $E'$ )** and **Shear Modulus ( $G'$ )** → Explain ability of energy storage (**Hardness**)
- **Loss Modulus ( $E''$  or  $G''$ )** → Explain ability of energy dissipation (**Softness**)
- **Tan  $\delta$**  (The loss Factor) ( $E''/E'$  or  $G''/G'$ ) → **Softness/hardness** (indicator for elastic or viscous)



## Sample Preparation and Measurement

**Solid liked Material;**  
MC reduction  $\approx$  70-80% from the initial.



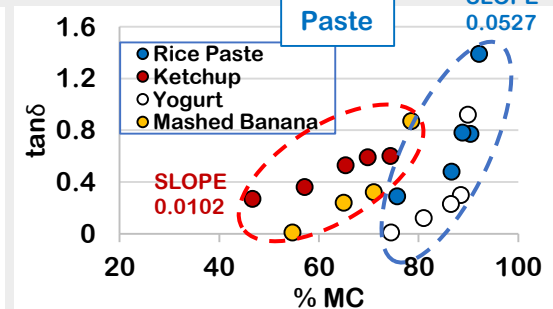
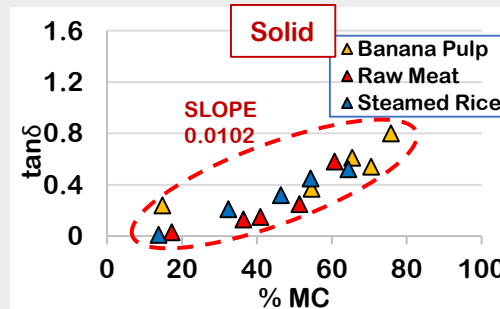
Samples in difference drying condition  
[Left: High MC >>> Right: Low MC]

**Paste liked Material;**  
MC reduction  $\approx$  17-40% from the initial.



## Result of Tan $\delta$

\* Tan  $\delta = 0 \gg$  Elastic, Tan  $\delta = 1 \gg$  Viscous

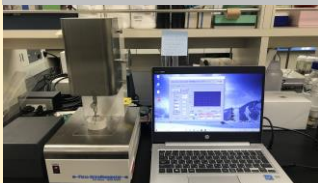


## Interesting Point

- **Rheological properties** (especially tan  $\delta$ ) has a possibility to clarify the adhesive behavior from organic waste.
- “Tan  $\delta$ ” are depending on the **moisture content**. It confirms the effect of MC on the appearance of the adhesiveness on the organic waste.
- For **all solid liked materials**, the slope between “tan  $\delta$ ” and “MC” has the same trend (0.0102). For paste liked material, “Yogurt/Rice paste (high MC) (0.0527)” show higher slope compared to “Ketchup/Mashed Banana (Low MC)” (0.0102).
- The result suggests **strong MC dependency** of the organic waste. That refers to the deformation from softness to hardness by the moisture reduction.

**Further**, this study is the initial stage to investigate the rheological properties by the individual material. Therefore, the investigation of the mixed organic waste as in the real situation is necessary.

## RHEOMETER



Measurement condition of Rheometer:

- Amplitude 1-600  $\mu$ m,
- Frequency 1.5-6 Hz

carried out without destroying the sample's structure + within the range of previous reported