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Background / Aim

Background :

Soil organic matter (SOM) has a major impact on the physicochemical properties of soils



Evaluations of amounts and state are very important.



Walkley-Black method, CHNS/thermogravimetric/spectrometric analyses, loss on ignition (LOI), etc.



the most economical and accessible method for developing countries.



Hibino et al., 2014; Touch et al., 2015; Touch et al., 2017

➤ LOI_{300}/LOI_{600}

➤ $(LOI_{300}-LOI_{200})/LOI_{600}$

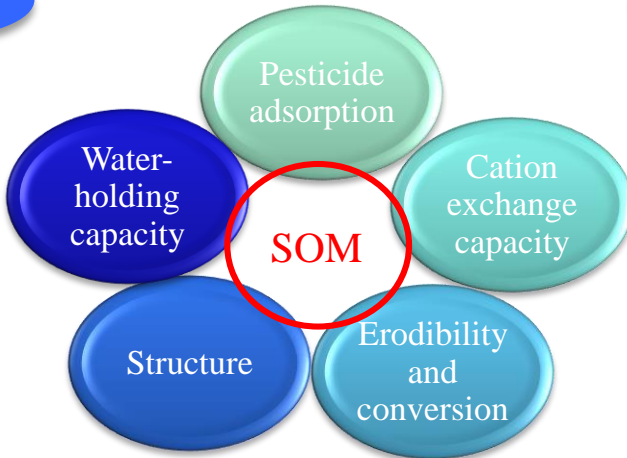
For representing not only the amount, but also the state of organic matter

However, in the case of littoral sediments

※ LOI_{300} : weight losses on ignition at 300 °C

Aim of this study :

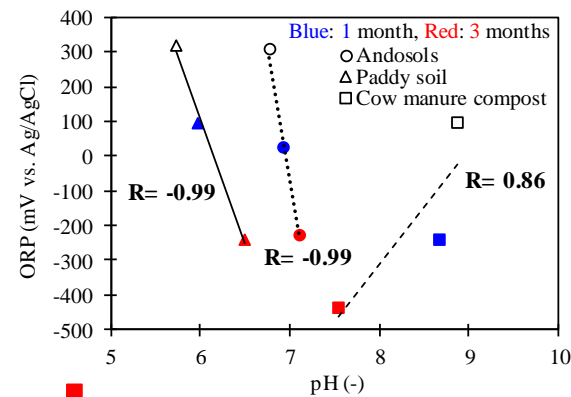
Examine the validities of LOI_{300}/LOI_{600} and $(LOI_{300}-LOI_{200})/LOI_{600}$ metrics in evaluating changes in the state of organic matter present in paddy soil, andosol, and cow manure compost.



(Schulate, 1995; Ding et al., 2002)

Results / Discussion

Temporal Decomposition of Organic Matter

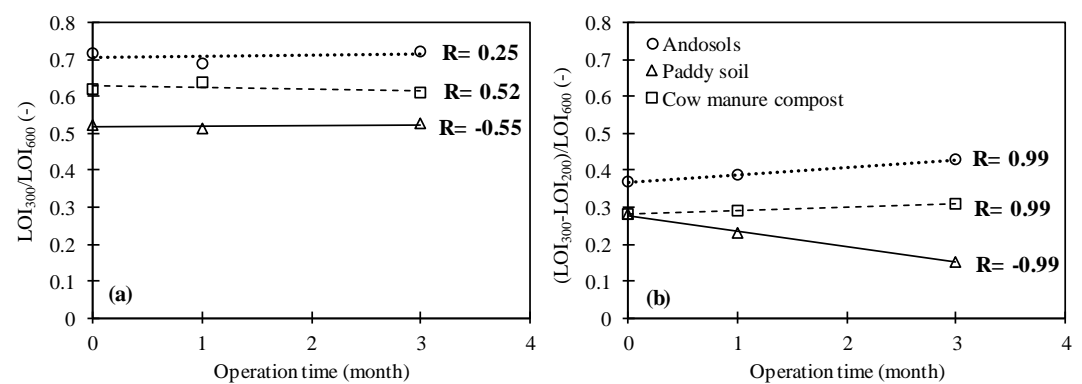


➤ Temporal decreases of redox potential (ORP) were found for all materials

➤ ORP decrease indicates the decomposition of organic matter. (Touch et al. 2015)

Clear signs of decomposition of organic matter over time

Validities of LOI_{300}/LOI_{600} and $(LOI_{300}-LOI_{200})/LOI_{600}$

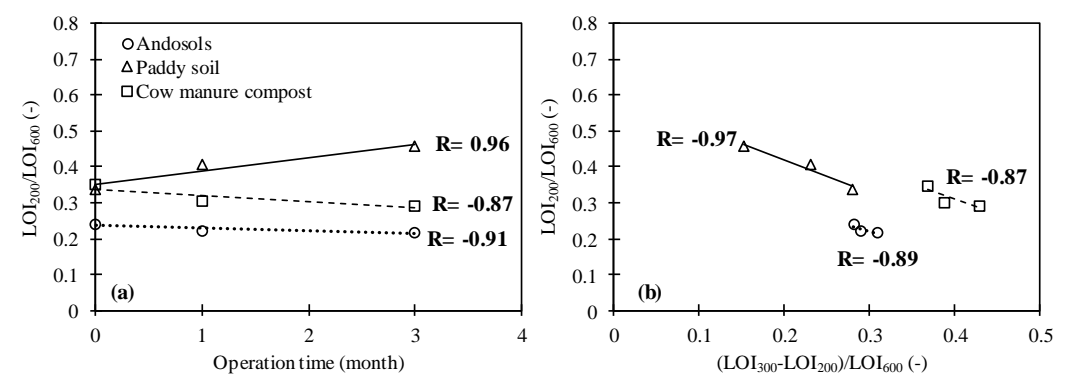


◆ LOI_{300}/LOI_{600} remaining nearly constant over the span of experiment
➔ Unable to reflect the decomposition of organic matter

◆ $(LOI_{300}-LOI_{200})/LOI_{600}$ had a strong correlation with operation time
➔ Can represent the decomposition of organic matter

$(LOI_{300}-LOI_{200})/LOI_{600}$ can represent the decomposition of organic matter either in littoral sediments or in agricultural soils, including compost materials.

New index for evaluating the decomposition of organic matter



◆ LOI_{200}/LOI_{600} had a strong correlation with operation time
◆ LOI_{200}/LOI_{600} had a strong correlation with $(LOI_{300}-LOI_{200})/LOI_{600}$

➔ LOI_{200}/LOI_{600} can be used instead of $(LOI_{300}-LOI_{200})/LOI_{600}$

A new index for evaluating the decomposition of organic matter

Summary

Temporal changes in LOI_{300}/LOI_{600} were not observed, while $(LOI_{300}-LOI_{200})/LOI_{600}$ had a strong correlation with operation time. This reinforced the idea that $(LOI_{300}-LOI_{200})/LOI_{600}$ can represent the decomposition of organic matter, either in littoral sediments or agricultural soils, including compost materials. Furthermore, we found out that LOI_{200}/LOI_{600} had a strong correlation with $(LOI_{300}-LOI_{200})/LOI_{600}$, suggesting that it can be used as a simpler proxy for $(LOI_{300}-LOI_{200})/LOI_{600}$. Finally, the proposed indices, i.e., $(LOI_{300}-LOI_{200})/LOI_{600}$ and LOI_{200}/LOI_{600} , were used to identify the decomposition and humification of organic matter. For example, the humification of organic matter caused a decrease in LOI_{200}/LOI_{600} and an increase in $(LOI_{300}-LOI_{200})/LOI_{600}$.

Materials / Methods

Materials:

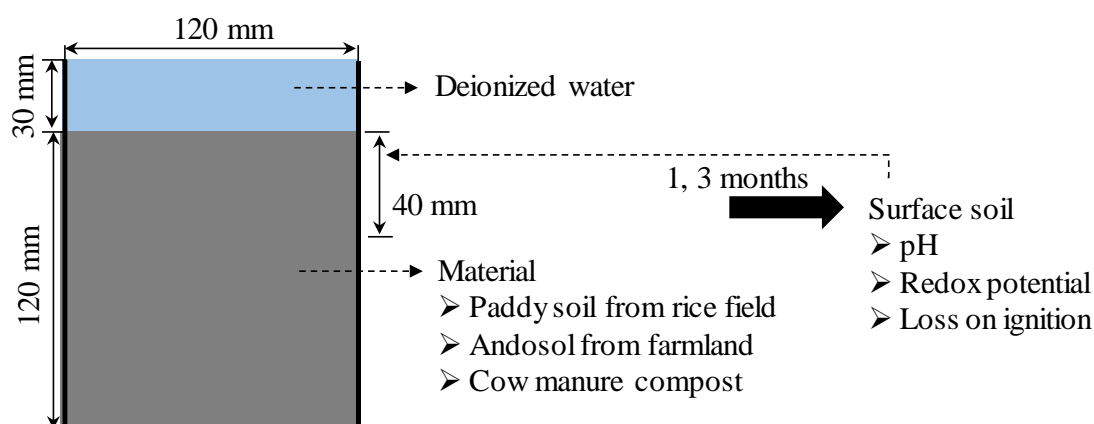
Paddy soil: Approximately 150 mm of the surface soil collected from a rice field (Ebina, Kanagawa, Japan).

Andosol: Approximately 200 mm of the surface soil collected from a farmland (Nakai, Kanagawa, Japan)

Cow manure compost: commercial product

Procedures:

The bottle (diameter: 120 mm, height: 150 mm) was filled with each material to a depth of 120 mm. The bottle was then filled the rest of the way with deionized water, and placed under ambient conditions for 3 months. After one and three months, the top 40 mm of the surface soil was collected from the bottle for measurements of pH, redox potential (ORP), and weight LOI.



Measurements:

◆ pH and Redox potential (ORP): A D-50 pH/ORP meter (Horiba, Japan) was inserted directly into the sample.

◆ LOI test: After oven-drying sample at $50 \pm 5^\circ\text{C}$ for more than three days, the dried sample was burned for 4 h at each of three temperatures: 200, 300, and 600°C using an electronic muffle furnace. LOI for each stage was determined by comparing these values with the 50 °C oven-dried weight.

References

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 Hibino, T., Tachiuchi, K., et al. 2014. J. Jpn. Soc. Civ. Eng. Ser. B2 (Coast. Eng.), 70(2), 1101-1105. in Japanese
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