



Development and Application of MOFs as Stationary Phases in Chromatographic and Analysis



University of Tokyo spinout, founded Oct. 2025

Founders and Leadership Team

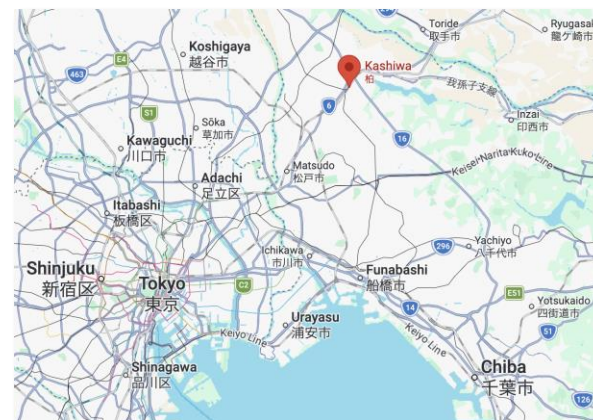


Kenji Sumida, Ph.D. MBA
Chief Executive Officer



Nobuhiko Hosono, Ph.D.
Chief Science Officer

Based in Kashiwa, Chiba



Our Focus

Advancing liquid-phase molecular separations through the development of MOF-based stationary phases and adsorbents



High cost

Costly infrastructure and high running costs



Long lead times

Inefficient, multi-step processes lead to significant delays and wait times



Environmental Impact

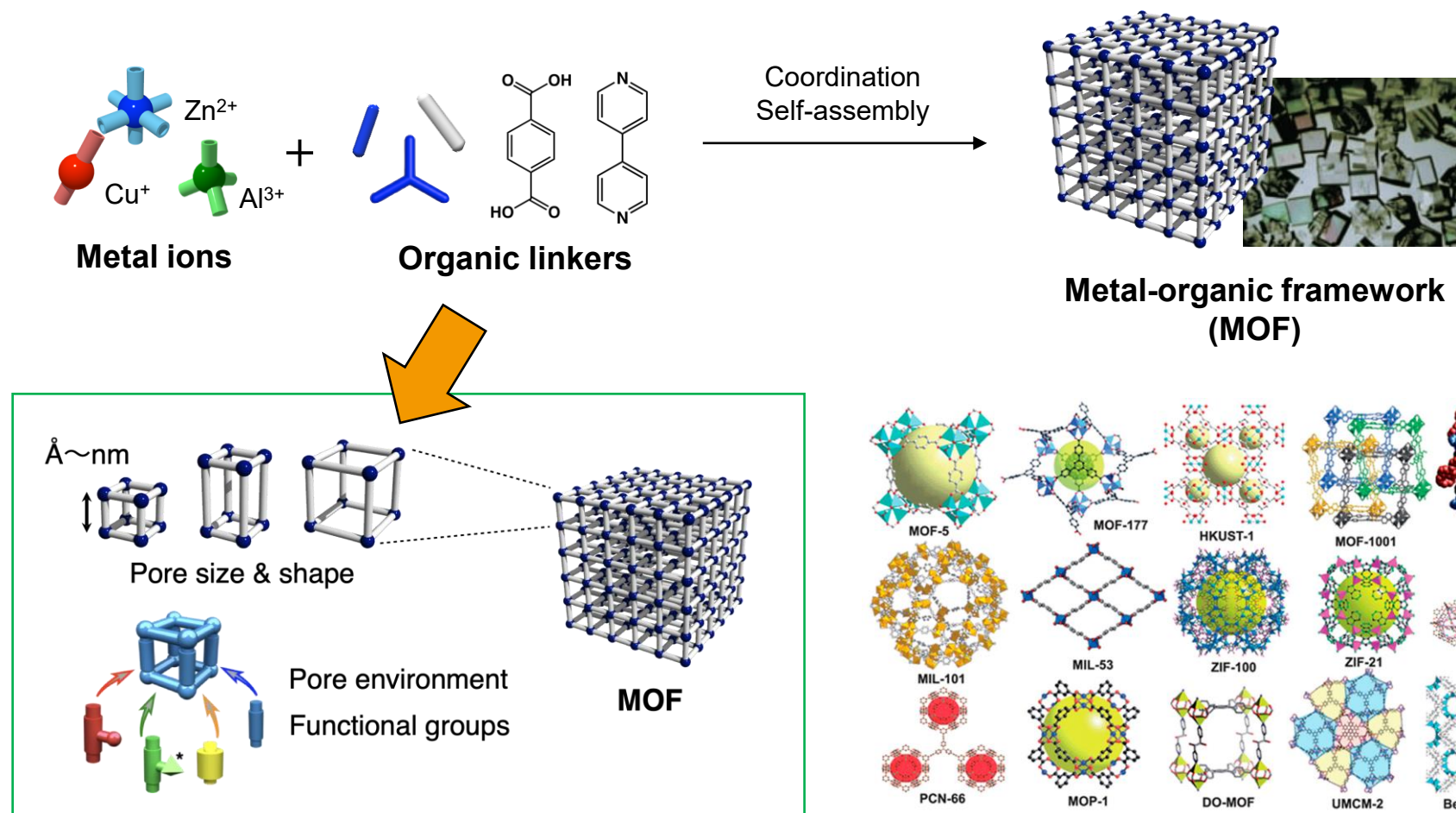
Significant energy consumption and waste products (organic solvents)



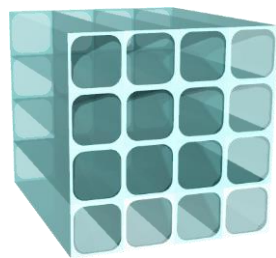
Limited molecular recognition

Mid-sized molecules and polymers are frequently difficult to separate

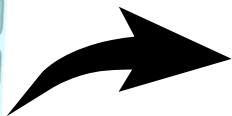
There are significant opportunities to improve existing separation processes using new technologies



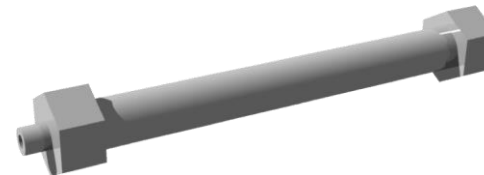
MOFs provide tunable nanospaces ideal for developing customized separation adsorbents



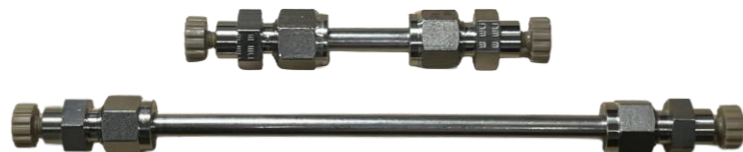
MOF



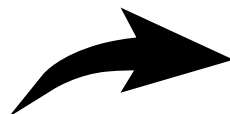
MOF powder
(10 μm crystals)



Packing inside column

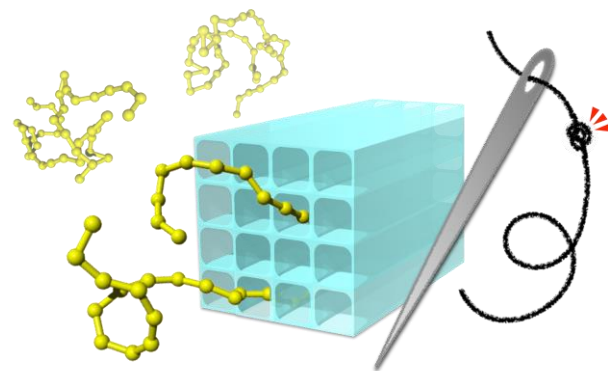


5 or 15 cm analytical columns



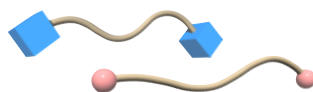
Conventional HPLC

**MOF columns can be rapidly tested in client test environments
using conventional analytical equipment**

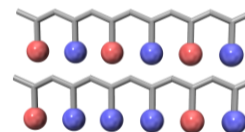


Controlled interaction of molecules with MOF pores

Terminal groups



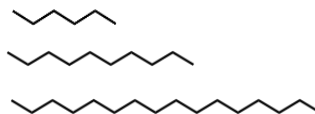
Monomer sequence



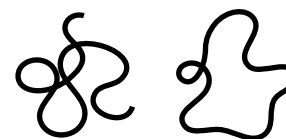
Structural defects



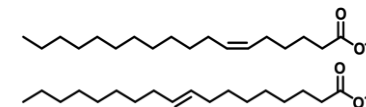
Molecular weight



Molecular topology



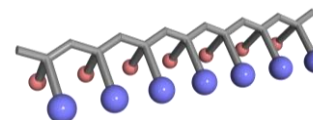
cis-/trans-isomers



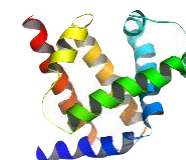
Molecular branching



Spatial configuration



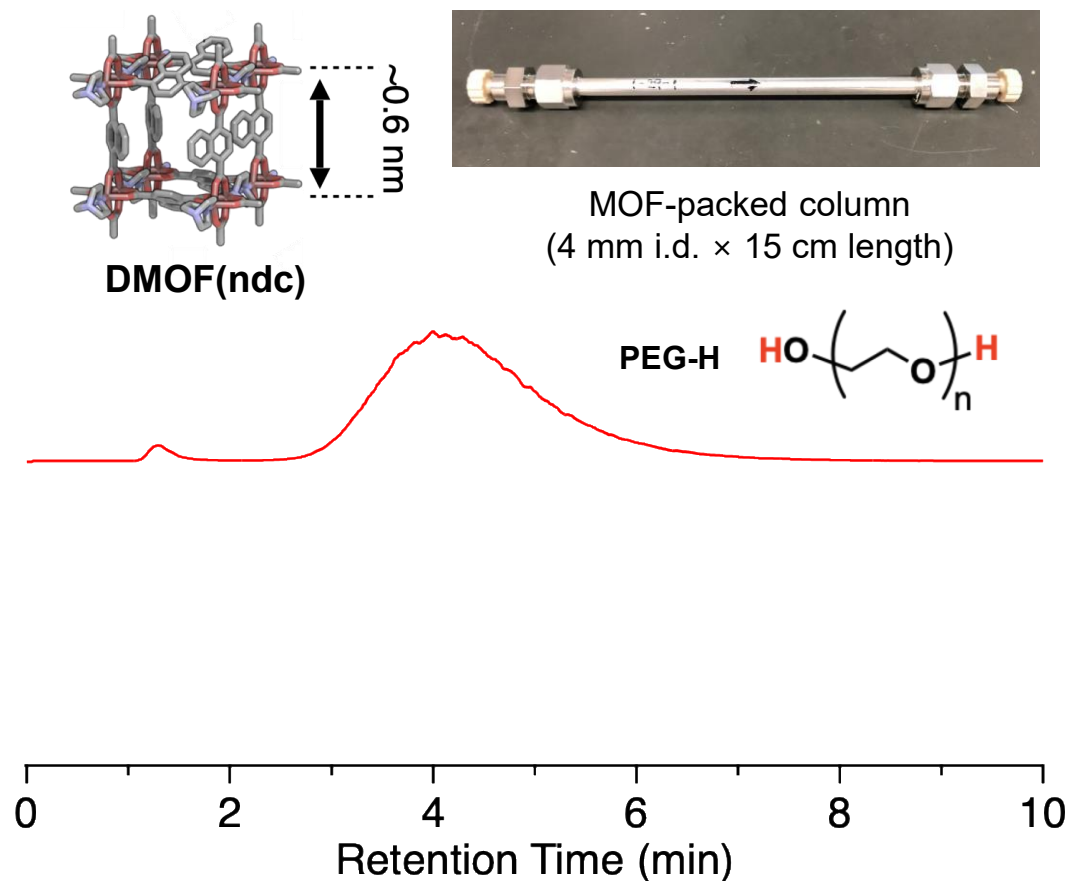
Higher-order structure



The precise control over molecular interactions with MOF pores facilitates new types of molecular recognition modes

(1) Discrimination of Terminal Groups

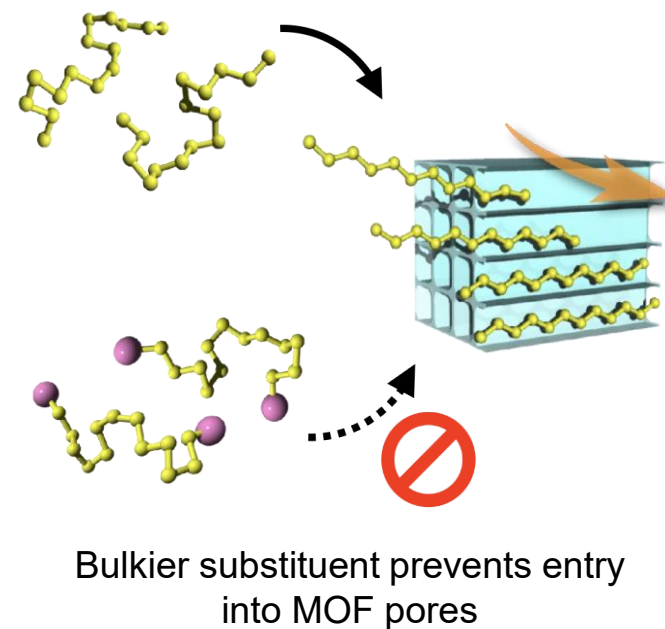
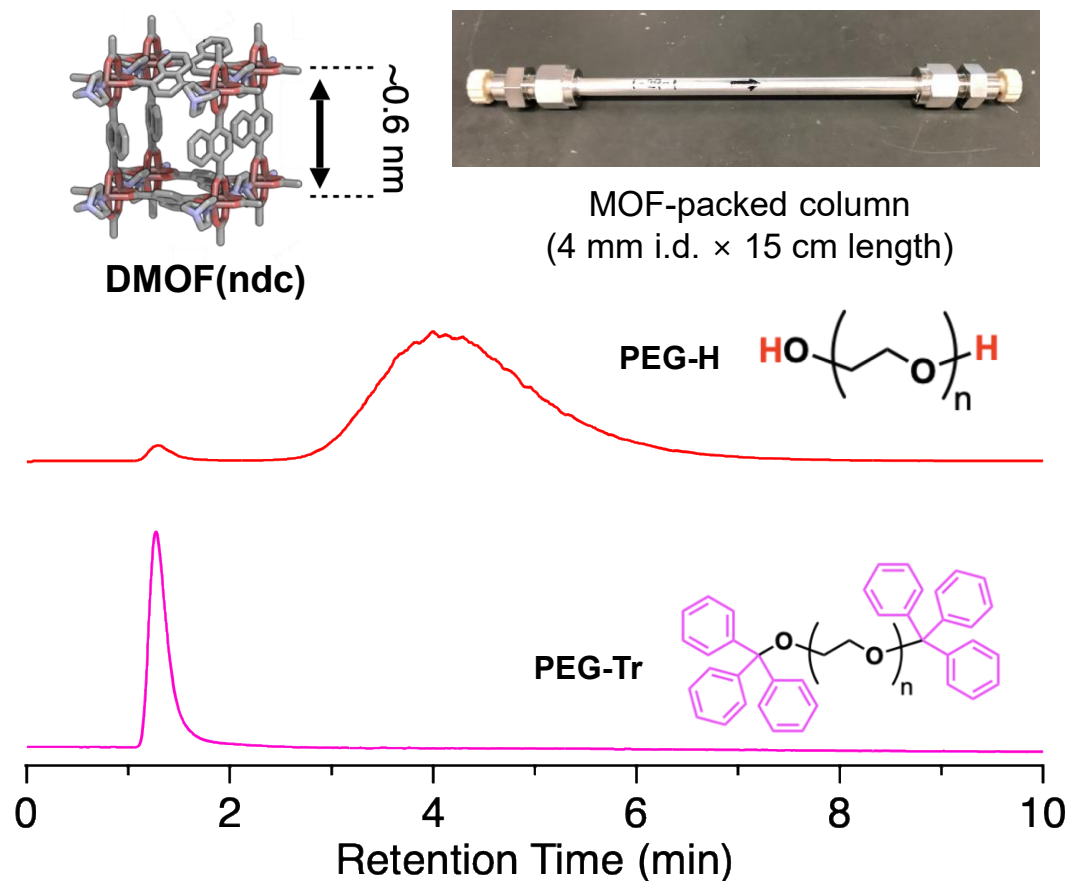
Confidential



Mizutani et al. *J. Am. Chem. Soc.* **2020**, *142*, 3701.

(1) Discrimination of Terminal Groups

Confidential



Terminal groups successfully discriminated by the MOF column

Mizutani et al. *J. Am. Chem. Soc.* **2020**, 142, 3701.

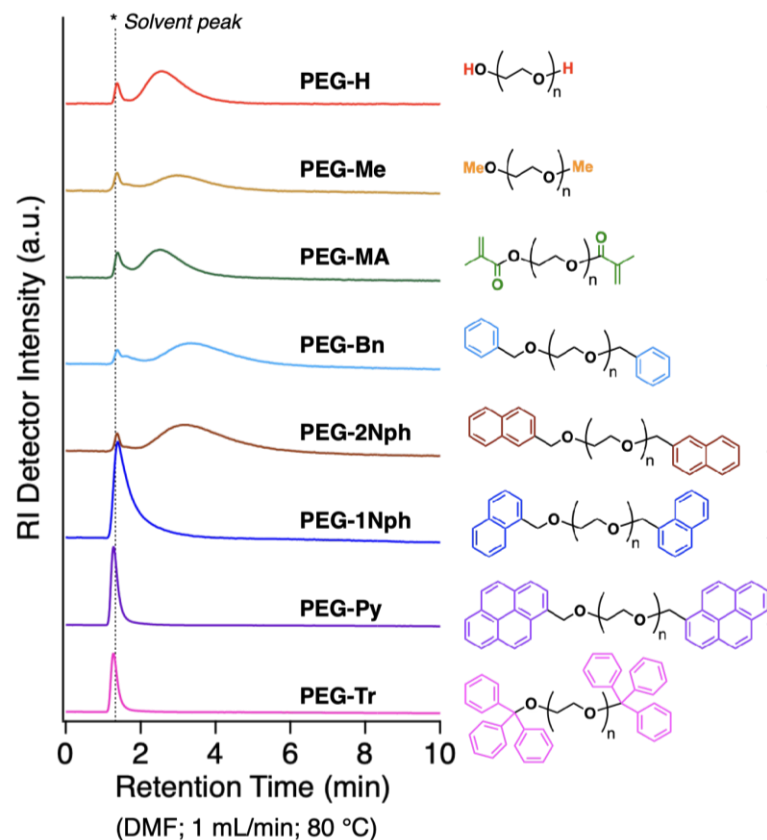
 **NAGASE** | Delivering next.

 **MOFgraphy**

(1) Discrimination of Terminal Groups

Confidential

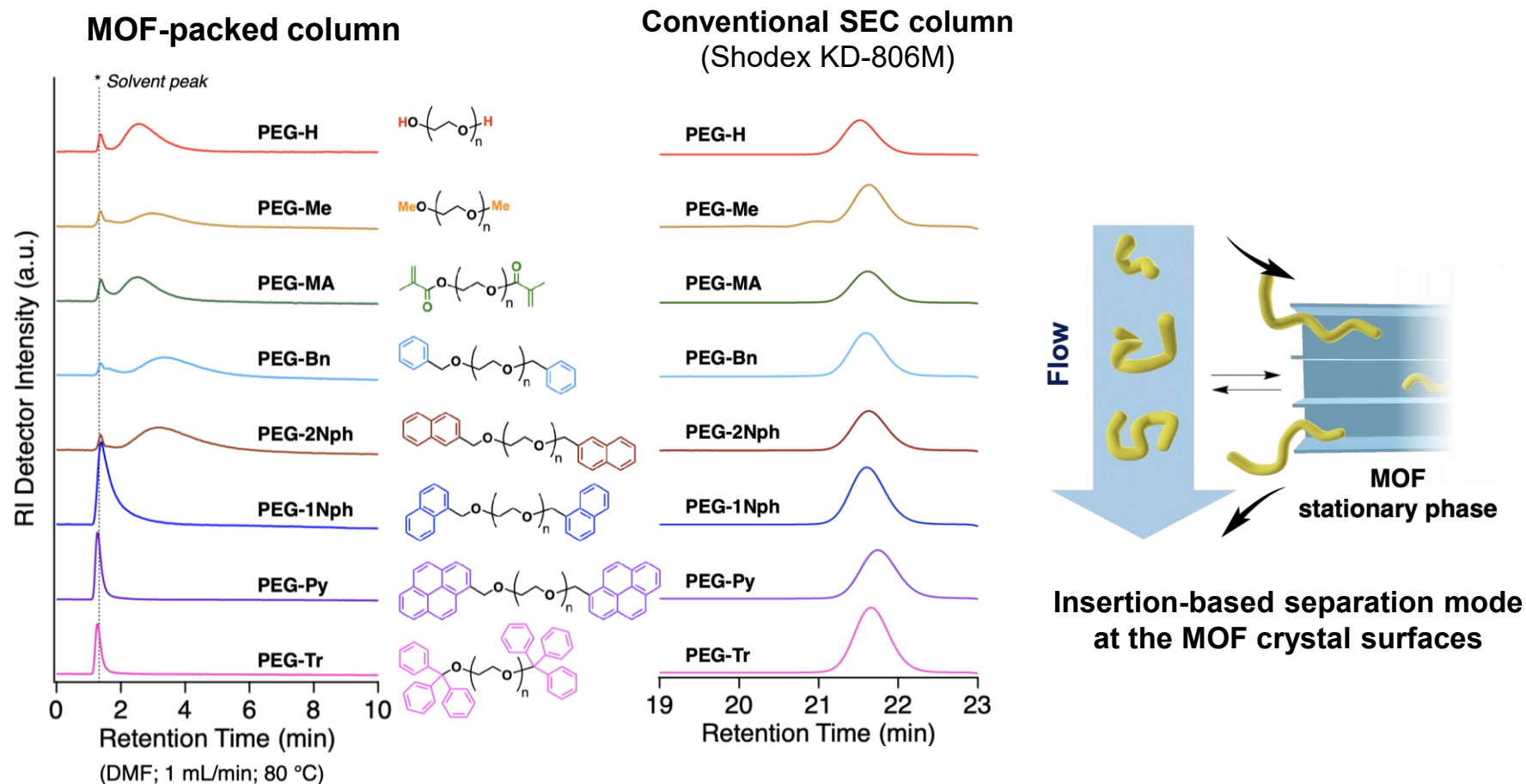
MOF-packed column



Mizutani et al. *J. Am. Chem. Soc.* **2020**, 142, 3701.

(1) Discrimination of Terminal Groups

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MOF column provides selectivity between bulky/non-bulky groups

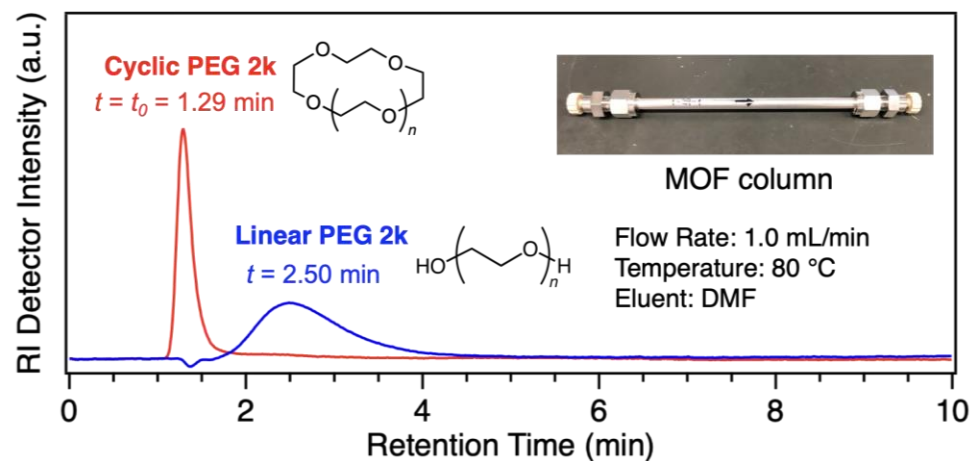
Mizutani et al. *J. Am. Chem. Soc.* **2020**, 142, 3701.

NAGASE | Delivering next.

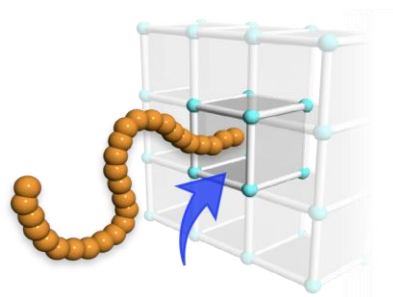
MOFgraphy

(2) Separation of Linear and Cyclic Polymers

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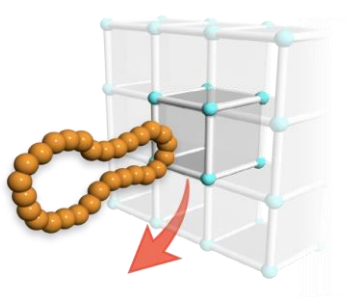


Linear polymer



Inserted

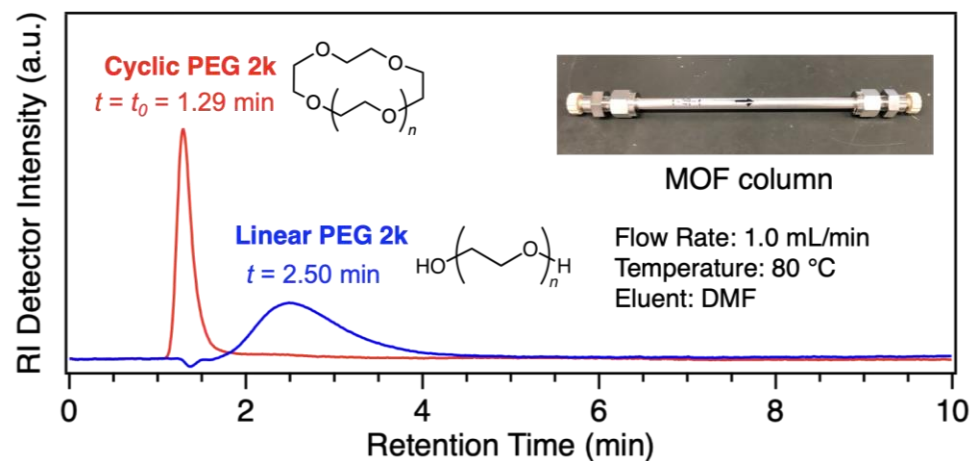
Cyclic polymer



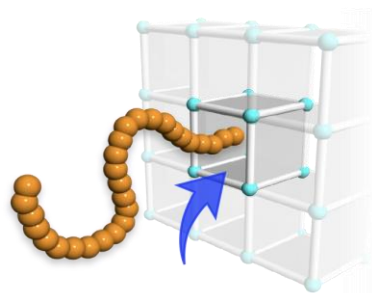
Rejected

(2) Separation of Linear and Cyclic Polymers

Confidential

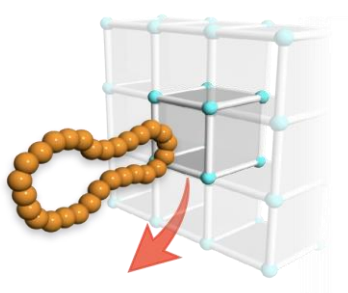


Linear polymer



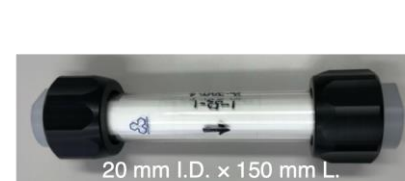
Inserted

Cyclic polymer

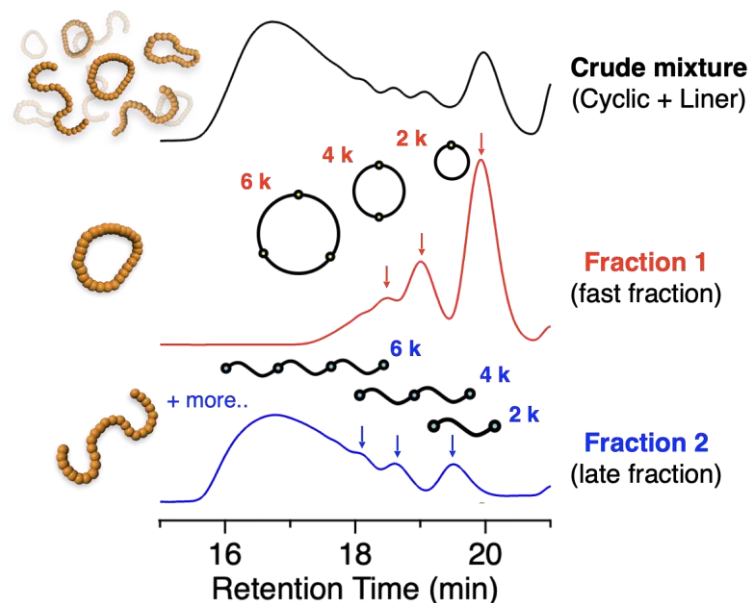


Rejected

Preparative scale separation (gram-scale)



MOF preparative column (~20 g)



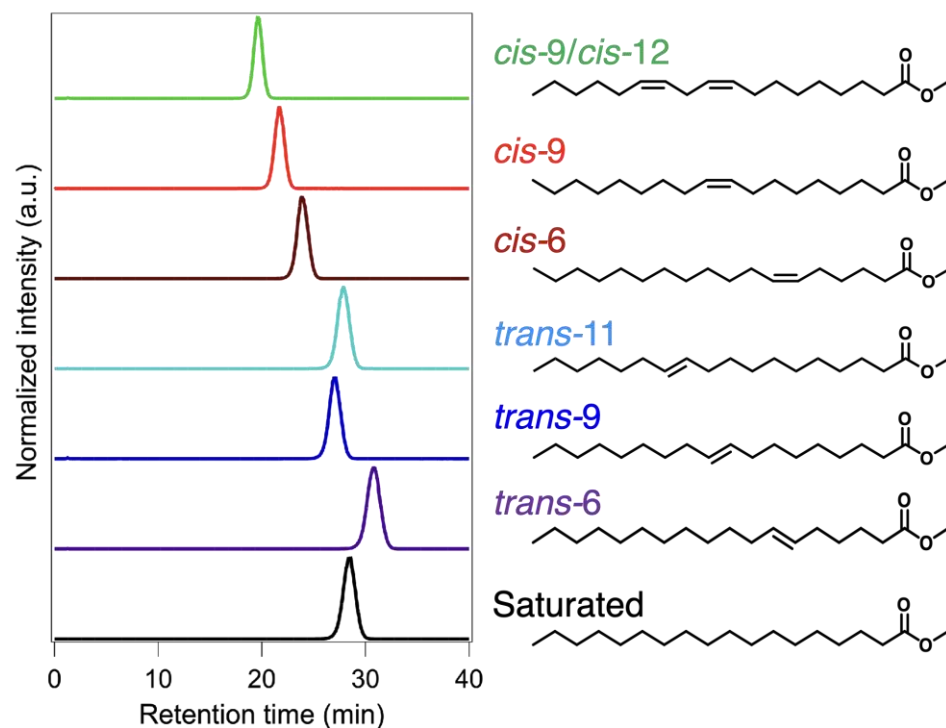
MOF column provides strong selectivity based on topology

Sawayama et al. *Angew. Chem., Int. Ed.* **2021**, 60, 11830.

(3) Separation of C18 Fatty Acid Methyl Esters (FAMES)

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Separation of FAMES by MOF column

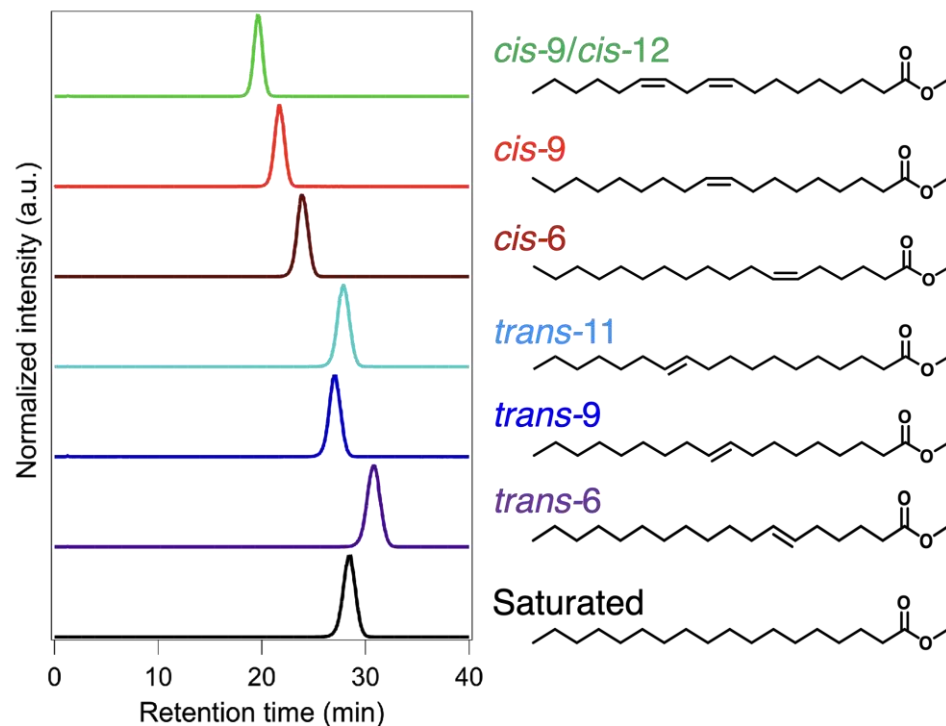


Torimoto et al. *J. Am. Chem. Soc.* **2025**, 147, 17228.

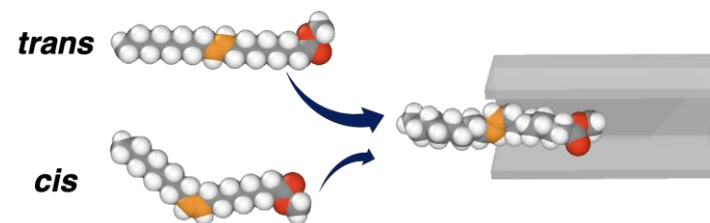
(3) Separation of C18 Fatty Acid Methyl Esters (FAMES)

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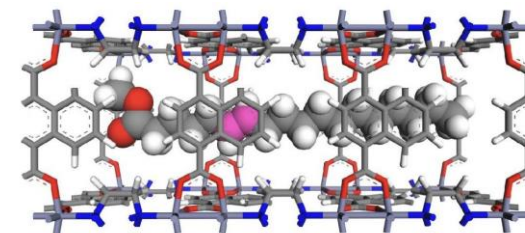
Separation of FAMES by MOF column



E/Z recognition by MOF pores



Multi-site interactions provide selectivity



Minor differences in both position and configuration of unsaturated bonds recognized by MOF column

Torimoto et al. *J. Am. Chem. Soc.* **2025**, 147, 17228.

General Project Workflow



Technical Evaluation

- Understand separation problem, justify use of MOF column
- Perform initial PoC, Go/No-Go decision

Joint R&D

- Select existing or develop new MOF for specific application
- Optimize process and establish solution at laboratory scale

Implementation

- Perform technology transfer (licensing) or joint plant process
- Establish supply chains, continue to improve process performance

We are currently searching for new opportunities to test our lineup of MOF columns

Tell us about your separation and purification challenges.

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