

Tritium from Nuclear Wastewater

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Why in News?

Recently, a new study published a breakthrough method to filter tritium from nuclear wastewater, using a metal-organic framework (MOF).

- **Tritium** - Radioactive isotope of hydrogen; forms ***tritiated water (HTO)*** when bonded with oxygen.
- **Problem** - Chemically identical to normal water, making separation extremely difficult.

Conventional Approach

- Materials inside the tower that provide surfaces where steam and liquid can interact.
- These packings just sit there; steam and liquid interact only because of gravity.

New Method - Metal-Organic Framework (MOF)

- Stainless-steel mesh coated with a metal-organic framework called *NH₂-MIL-101(Cr)*.
- MOF acts like a *microscopic sponge*, increasing surface area 32-fold; more surface area means better contact between steam and liquid.
- The chromium-oxygen clusters inside the MOF *grab tritium atoms*.
- They *swap tritium with normal hydrogen atoms*.
- Nitrogen and hydrogen groups in the MOF help this swapping process.
- **Efficiency** - Achieved 42.5 theoretical plates per metre separation efficiency, a record-setting figure in the world of chemical engineering.

This innovation helps tackle the problem of Japan releasing treated wastewater from the Fukushima nuclear plant into the Pacific Ocean

Significance

- **Environmental Protection** - Reduces tritium release into oceans, mitigating ecological risks.
- **Public Health** - Tritium is easily absorbed by living organisms and rapidly distributed via blood.
- **Nuclear Safety** - Offers a practical alternative to dilution, addressing global concerns over Fukushima wastewater.
- **Scientific Breakthrough** - Nobel Prize-winning work was awarded to Susumu Kitagawa, Richard Robson, and Omar M. Yaghi for the development of MOFs.

Reference

[The Hindu | MOF](#)

