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IIT Madras Team Produces Gas Hydrates

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A team of Indian researchers at Indian Institute of Technology, Madras has synthesized in a lab tiny water cages containing trace amounts of methane and carbon dioxide at extremely low temperatures and pressure to simulate the conditions of deep space.

- These tiny cages are known as Clathrate Hydrates or Gas Hydrates.
- Normally, the formation of clathrate hydrates requires high pressures and moderate temperature.
- This discovery of hydrates is unexpected at extremely low pressures and ultracold temperatures as cages of water are not expected to form under such conditions.
- At low temperature, both ice and methane are in a frozen state, prolonging the experiment at a very low temperature enhanced the mobility of methane molecules and led to their insertion into the cage of water molecules to form methane hydrate.

Clathrate Hydrates

- Clathrate hydrates are solid cages of water containing small non-polar molecules like carbon dioxide and methane.
- Clathrate hydrates are formed when a gas such as methane gets trapped in well-defined cages of water molecules forming crystalline solids. In terrestrial conditions, gas hydrates are formed naturally under the seabed and glaciers under high pressure, low-temperature conditions.
- On earth, they are found on the ocean floor or the permafrost region of the earth.

Uses of Clathrate Hydrates

- Hydrates are considered as the future sources of fuel. Many countries, including India, have started projects to explore hydrates present on the ocean bed.
- They could be a potentially safe, efficient method for storing and **transporting gases**.

Significance

- Carbon Sequestration
 - Trapping carbon dioxide in hydrates can be a way to reduce to global warming in future. As one can sequester carbon dioxide gas as solid hydrates under the seabed.
 - Sustainable Energy source
- Development of technology to harvest Gas Hydrates can ensure energy security of the nation.

Gas hydrate exploration in India

- Under the aegis of the **Ministry of Earth Sciences**, Government of India, a **comprehensive research-oriented gas hydrates program was launched during the 11th plan (2007-12)** period emphasizing scientific and technology development with following major objectives:
 - Understanding the nature of distribution of gas hydrates in marine sediments
 - Developing techniques for detection and quantification of gas hydrates
 - Identifying promising sites on the regional scale and estimating the resource potential
 - Recommending suitable sites for drilling and ground truth validation
 - Demonstrating occurrences of gas hydrates
 - Understanding the mechanism for the formation and accumulation of gas hydrates
 - Studying the impact of hydrate dissociation on climate and geological environment
 - Developing environment-safe technology for commercial production on a pilot scale
 - Developing hazardless and cost-effective transportation of gas from gas hydrates and
 - Monitoring environmental perturbation during harvesting of gas hydrates
- National Centre For Polar And Ocean Research (NCAOR), Ministry of Earth Sciences has been identified as the nodal agency responsible for implementation of the scientific aspects of the study.
- **National Gas Hydrate Programmes (NGHP)**
 - The programme was initiated in **1997** with a Steering Committee and a Technical Committee.
 - National Gas Hydrate Programme (NGHP) is steered by the **Ministry of Petroleum and Natural Gas** and technically coordinated by Directorate General of Hydrocarbons (DGH).