

Making of Green Propellant: Indian Space Research Organisation (Download PDF)

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Scientists at Indian Space Research Organisation (ISRO) have reported progress in development of environment-friendly propellant to power satellites & spacecraft. New propellant is blend based on hydroxyl ammonium nitrate (HAN).

A greener alternative
Is hydrazine, the much-used monopropellant, on its way out?

- Hydrazine has one of the highest specific impulses (kilograms of thrust obtained by the consumption of one kilogram of propellant in one second). Thus, despite its hazardous nature, it is preferred as a propellant

Drawbacks of hydrazine:

- Highly corrosive
- Carcinogenic and toxic
- Storage, handling issues

Replacing Hydrazine:

- ISRO is working on a hydroxylammonium nitrate-based monopropellant (HAN) to replace hydrazine

Low toxicity: HAN is less toxic than hydrazine

Performance: HAN has a density of 1.4 to 1.5 g/cm³, much higher than 1.0 g/cm³ of hydrazine propellants

Safety: HAN is known to not be combustible, thus is a safer alternative

Source: ISRO, NASA

Image of A Greener Alternative

New Propellant for ISRO:

- New HAN-based monopropellant is already being tested.
- Monopropellant is chemical propulsion fuel which does not require separate oxidizer.
- It is used extensively in satellite thrusters for orbital correction & orientation control.
- In-house formulation consists of HAN, ammonium nitrate, methanol & water.
- While methanol was added to reduce combustion instability, choice of AN was dictated by its capacity to control burn rate & lower freezing point of propellant.

Need for New Propellant:

- Hydrazine rocket fuel is being used.
- It is highly toxic & carcinogenic chemical.

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- Due to its high performance characteristics, hydrazine has dominated space industry as choice of propellant for over 6 decades, despite its environment & health hazards & challenges faced in its manufacturing, storage, ground handling & transportation.

Hydroxylammonium Nitrate

- HAN is inorganic compound.
- It is salt derived from hydroxylamine and nitric acid.
- In its pure form, it is colourless hygroscopic solid.
- It has potential to be used as rocket propellant either as solution in monopropellants or bipropellants.

Indian Space Research Organisation

- ISRO is space agency of GoI headquartered in Bangalore.
- ISRO was established in 1969.
- Objective of ISRO is to use space technology & its application to various national tasks.

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