

Helium : Emerging Crisis for India

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Helium is not just for balloons but it is the key ingredient for India's high technology and the most sophisticated medical diagnosis. However, India imports helium for its needs. USA is the leading exporter of Helium and it is planning to switch off export of helium from 2021. The Indian industry stands to lose out heavily.

In news: The emerging crisis of obtaining helium in India

Placing it in syllabus: Science & Technology

Dimensions

- Helium : Characteristics of the element
- Its uses
- Prevalence on Earth
- Distribution in India
- Importance for India
- Projects in India to produce Helium and Reasons for Failure
- What can India do ?

Content:

Helium : Characteristics of the element:

- Helium is a chemical element with the symbol He and atomic number 2.
- It is a colourless, odourless, tasteless, non-toxic, inert, monatomic gas.
- It is the first in the noble gas group in the periodic table.
- Its boiling point is the lowest among all the elements.
- Helium is the Universe's second most common element

(after hydrogen), accounting for around 24 per cent of its weight.

Its uses

- The largest use (about 32% of the total) is in cryogenic applications, most of which involves cooling the superconducting magnets in medical MRI scanners and NMR spectrometers
- It is the only cooler capable of declining temperature lower than 15K (-434°F).
- Owing to its low melting point, liquid helium has numerous applications in cryogenics, magnetic resonance imaging (MRI), and superconducting magnets.
- It is used in MRI scanners and NMR spectrometers as a cooling medium for magnets and process use.
- Helium is also used in altitudes research and meteorological balloons.
- Helium is used as a protective gas in growing silicon and germanium crystals, in titanium and zirconium production, and in gas chromatography, because it is inert.
- Helium is used as a shielding gas in arc welding processes on materials such as Gas Tungsten Arc Welding (aka tungsten inert gas (TIG) welding)
- Since it has the ability to diffuse through solids much faster than air, helium is used industrially for pipeline leak detection.
- This element is also used in gas chromatography as a carrier gas.

Prevalence on Earth:

- Helium is rare on Earth. In the Earth's atmosphere, the concentration of helium by volume is only 5.2 parts per million.
- The concentration is low and fairly constant despite the continuous production of new helium because most helium

in the Earth's atmosphere escapes into space by several processes.

- In the Earth's heterosphere, a part of the upper atmosphere, helium and other lighter gases are the most abundant elements.
- Most helium on Earth is a result of radioactive decay.
- Helium is found in large amounts in minerals of uranium and thorium, including uraninite and its varieties including monazite
- In this way an estimated 3000 metric tons of helium are generated per year throughout the lithosphere.
- There are also small amounts in mineral springs, volcanic gas, and meteoric iron.
- Because helium is trapped in the subsurface under conditions that also trap natural gas, the greatest natural concentrations of helium on the planet are found in natural gas.
- Most commercial helium is extracted from Natural Gas.
- The concentration varies in a broad range from a few ppm to more than 7% in a small gas field in San Juan County, New Mexico.
- As of 2011 the world's helium reserves were estimated at 40 billion cubic meters, with a quarter of that being in the South Pars / North Dome Gas-Condensate field owned jointly by Qatar and Iran.
- In 2015 and 2016 additional probable reserves were announced to be under the Rocky Mountains in North America and in the East African Rift.

The U.S. became the most important exporter of helium across the world. It was soon realised that the U.S. was also the biggest store house of helium. The U.S., now, is planning to switch off export of helium from 2021.

Distribution in India:

- India's Rajmahal volcanic basin is the storehouse of helium trapped for billions of years, since the very

birth of our Earth from the Sun.

- At present, researchers are mapping the Rajmahal basin extensively for future exploration and harnessing of helium.
- Monazite sand abundantly available in Kerala beaches is also a potential source of Helium.

Importance for India:

- India consumes about 70 million cubic metres per year.
- But, India imports helium for its needs, and with the U.S. appearing set to cut off exports of helium since 2021, Indian industry stands to lose out heavily.
- Every year, India imports helium worth Rs 55,000 crores from the U.S. to meet its needs.
- Helium is used in medicine, scientific research, for blimp inflation, party balloons as well as having welding applications.
- It finds many applications, mainly in magnetic resonance imaging (MRI) scans, in rockets and in nuclear reactors.

Projects in India to produce Helium and Reasons for Failure

- In 1906 a young Englishman by the name of Moris Travers arrived in Bangalore, to take up the position of the Director of Indian Institute of Science.
- Travers extracted helium in small quantities by heating up monazite sand abundantly available in Kerala beach, in a pioneering effort.
- However, Extracting helium on a large scale did not seem to be of great importance to Indian scientific fraternity.
- Variable Energy Cyclotron Centre (VECC) project of Kolkata and Bhabha Atomic Research Centre under the leadership of R. K. Garg, head of the Chemical and Engineering Division, in the 1970s made an effort to extract helium from monazite sand just as Travers did

some years ago. Unfortunately, this project was doomed, and BARC did not push it any further.

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What can India do ?

- India's reserves of helium by far exceed its needs.
- India should aim for production of helium on a commercial scale. So, this effort although somewhat late is not too late yet!
- India should also explore avenues to secure supply of Helium in the international market.
- Qatar is a possible exporter but acute political and diplomatic wrangles have made Qatar unreliable.

Mould your thought: Explore the importance of Helium. Evaluate the need for India to secure its supply of Helium.

Approach to the answer:

- Introduction
- Discuss about the properties and uses of Helium
- Discuss the importance of helium for India
- Discuss the US decision to stop exports of Helium and its effect on India
- Write about India's options
- Conclusion