

Nitrous Oxide

Known to some as 'Hippy Crack' and to others, more mildly, as laughing gas the compound Nitrogen Oxide - N_2O , also known as Dinitrogen Oxide or Dinitrogen Monoxide is a colourless gas and one of the gas industry's major product lines. Commercially it is used extensively in the food sector as an aerosol propellant and by surgeons and dentists for its analgesic effects. To the man on the street however it is most commonly known as 'Laughing Gas' - due to its ability to produce euphoria to those inhaling it.

Nitrous oxide was first discovered in 1793 by pioneering British scientist and clergyman Joseph Priestley. He is also credited with being the first to isolate other important gases such as oxygen, carbon monoxide, carbon dioxide, ammonia and sulphur dioxide. Priestley was able to make N_2O by heating ammonium nitrate in the presence of iron filings, filtering the gas emitted through water to remove toxic by-products. Initially Priestley was unsure as to how his discovery might be applied to practical use; at first he hoped that it may be a preserving agent. However this was quickly disproved and it was Sir Humphrey Davy of the Pneumatic Institute in Bristol, England who learnt the full extent of N_2O 's physical properties.

Davy learnt of its effects on human respiration when he administered purified N_2O to himself, visitors and friends (including the poets Samuel Taylor Coleridge and Robert Southey). Davy was the first to note its euphoric and anaesthetic properties and coined

the term 'laughing gas'. Ironically it was the inhalation of N₂O as well as other gases that Davy made his name exploring that eventually led to Davy's premature death.

Despite Davy's observations of N₂O's potential medical benefits for the next 40 years its use was largely restricted to recreational purposes. In fact N₂O became the 19th century's drug of choice for social gatherings of the wealthy classes, particularly amongst the dignitaries and elite of Bristol, England. The public were also able to buy a minute's worth of nitrous oxide from travelling medicine shows and carnivals known as 'nitrous oxide capers'. Upon inhaling the gas people would become relaxed, have laughing fits and behave uncontrollably until the drug suddenly wore off, people would then be abruptly left standing around in confusion.

The 19th century philosopher William James and many contemporaries found that inhalation of N₂O resulted in a powerful, spiritual and even mystical experience for users. James even claimed that N₂O led him to experience the fusing of dichotomies into a unity and a revelation of ultimate truth during the inhalation of nitrous oxide. Predictably however memories of these so called 'experiences' faded quickly and any attempt to describe or communicate the 'discoveries' were near to impossible.

Surprisingly it wasn't until 1844 that an American dentist, Dr Wells attempted to explore N₂O's anaesthetic qualities. After witnessing a public demonstration of N₂O Wells administered it to himself and had a fellow dentist remove a tooth. He experienced no significant pain and seized on the gas as a newfound anaesthetic - the dawn of N₂O as a medical anaesthetic had arrived.

Use of N₂O has continued to modern times, despite being illegal in many countries to inhale for the purpose of becoming intoxicated. In fact the drug is still popular for recreational purposes, especially among 'psychedelic' communities as an inhalant. This has led to the newest, somewhat pejorative, slang term for N₂O - 'Hippie Crack'.

However N₂O inhalation is not without its dangers, while the gas itself is pure if it is not inhaled with a sufficient percentage of oxygen death can result. Long-term use in large quantities has been associated with dangerous symptoms similar to vitamin B12 deficiency: anaemia due to reduced hemopoiesis, neuropathy, tinnitus and numbness in extremities. It can be habit-forming, primarily because of its short lived effects (1 to 5 minutes) users are prone to repeated doses.

In modern medicine N₂O is quite a weak general anaesthetic and is generally used in tandem with other more powerful anaesthesia. Pharmacologically it is still useful as it has a very low short-term toxicity; therefore a 50 / 50 mix with oxygen known as Entanox is widely used for dental procedures obstetrics and emergency medicine.

N₂O has been used in food production both as a food additive and as a propellant in aerosol products. N₂O's worth as an inert gas means it is used to displace staleness-inducing oxygen in packages of potato snacks and other similar products. N₂O is uniquely soluble in fatty compounds like whipped cream, dissolved N₂O is mixed into cream contained in a spray can until it leaves, becomes gaseous and creates a foaming effect.

Mechanical engineers have favoured also N₂O's unique properties as a propellant, it is comparably non-toxic and, because of its stability at room temperature, relatively safe to work with at altitude. The German Luftwaffe was among the first to use N₂O to boost the power output of aircraft's engines, by injecting N₂O into the engine they were able to propel aircraft to high altitude operations.

Car racing has been used N₂O extensively to boost performance, NO₂ was subsequently banned from mainstream racing after its use became controversial due to dangerous performance enhancement. Indeed harnessing the raw power of N₂O as a propellant was the main difficulty facing engineers. The stresses that power increases of 100-300% place on engine require extensive re-enforcement necessary to prevent their destruction.

The darker consequences of N₂O production in industrial use and, more significantly, agricultural fertilizers; is only now becoming evident. N₂O emissions attack the ozonosphere, after carbon and methane it is the world's third most significant contributor to greenhouse gases and global warming. N₂O is naturally emitted from soils and oceans but human activity especially in cultivation of soils and the use of Nitrogen fertilizers in agriculture, Nylon production, the burning of fossil fuels and other matter combine to produce dangerously large N₂O emissions. Government are only now taking steps to combat the levels of N₂O in the atmosphere and are helping industry to achieve emission targets.

Philip Urne Manger Helison Marketing Ltd

Q. Gas World: Who are the biggest N2O suppliers?

‘In Europe it would have to be Stromberg in Belgium, they’re situated north of Brussels. Worldwide it would have to be Puritan Bennett, based in California’

Q. Gas World: What types of N2O are commercially produced?

‘There are two grades, for food and medical grade there is 99.7% purity, but also 6.0% for electronic applications in manufacturing in the far east, where N2O is used in fairly large amounts for electronic gas’

Q. Gas World: What new applications are we seeing for N2O?

‘N2O is being used to produce Nitride; we are seeing this in the far east where Nitride is for metal binding in micro chips’

Q. Gas World: Any new products in the N2O market?

‘I don’t see any new applications in the near future no. I think that we are seeing a decline in the use of N2O as an anaesthetic, it is being replaced by injectable drugs that are more expensive but far more convenient for use’

Q. Gas World: Future developments for N2O?

‘There could be in the not to distant future developments in applications N2O in line items refrigeration units requiring –50oC & -60oC cooling temperature’

Jatind Sanghi (Manager Sanghi, India)

Q. Gas World: What role do you have in N2O production?

We only produce N2O for medical use at the moment.

Q. Gas World: New applications for the future of N2O?

Currently we are producing N2O mostly for Medical purposes although we study developments.