

## A REVIEW ON APPLICATIONS OF LIQUID NITROGEN IN MEDICINE

**K. Sravani\*, E. Jajili and Dr. I. Sudheer Babu**

Sir. C. R. Reddy College of Pharmaceutical Sciences, Shanthi Nagar, Eluru, A.P, India.

Article Received on  
10 March 2019,

Revised on 01 April 2019,  
Accepted on 21 April 2019

DOI: 10.20959/wjpr20196-14861

### \*Corresponding Author

**K. Sravani**

Sir. C. R. Reddy College of  
Pharmaceutical Sciences,  
Shanthi Nagar, Eluru, A.P,  
India.

### ABSTRACT

Liquid nitrogen which has a boiling point of  $-196^{\circ}\text{C}$  is used for a variety of things such as coolant for computers, in medicine to remove unwanted skin, warts, pre cancerous cells and in cryogenics. It is inexpensive and is rarely refrigerated, it is stored in insulated containers called Dewars. Liquid nitrogen can be referred as LN2 or LN or LIN. It is a diatomic liquid because the diatomic character of nitrogen retains after liquefaction. In cryo therapy it is used to remove malignant skin lesions, warts, and to store cells for laboratory work. It is also used in the transportation of food products. It is used in the preparation of frozen desserts such as ice creams.

**KEYWORDS:** Cryotherapy, Liquid Nitrogen, Cancer, Cryogenics, Warts.

### INTRODUCTION

Nitrogen is inert until it is heated at higher temperatures, about 75% by weight of nitrogen is present on earth. It is available in the form of oxides & nitrides, in the free form it is found in meteorites, gases of volcanoes, mines etc., when it is combined with hydrogen it will form ammonia. The top five producers of nitrogen are India, Russia, The United States, Trinidad, Tobago & Ukraine. Nitrogen is commonly stored and transported as a liquid.<sup>[1]</sup>

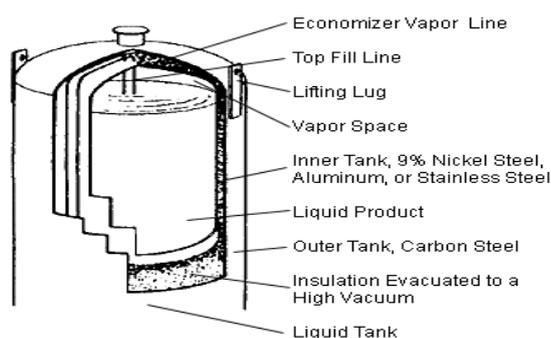
Liquid nitrogen is supercool, colourless, odour less, non corrosive, non flammable and it has a boiling point of  $-320^{\circ}\text{F}(-196^{\circ}\text{C})$ . It can be prepared by fractional distillation of liquefied air, on large scale it can be prepared by burning carbon or hydrocarbons in air by separating the carbon dioxide and water from the residual nitrogen which can be recovered as a cryogenic liquid.<sup>[2]</sup> The temperature of the liquid nitrogen can readily be reduced to its freezing point 63K by placing it in a vacuum chamber pumped by a vacuum pump.<sup>[3]</sup>

**Storage**

The types of container used for storage of liquid nitrogen are dewar, cryogenic liquid cylinder, cryogenic storage tank. The quantity of storage varies from liters to gallons. the storage container should consist of the following components such as cryogenic storage tank, pressure control system, temperature control system, 1 or more vapourizers.

**Dewars**

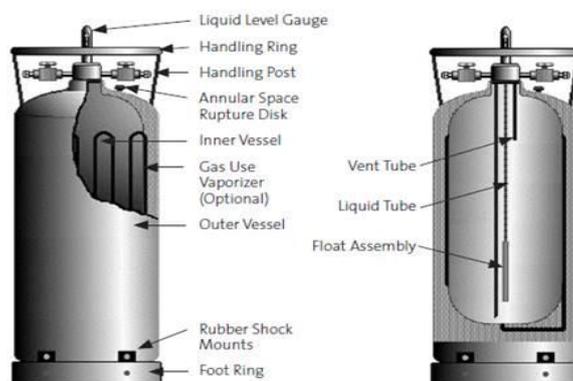
It is a typical vacuum jacketed, non pressurized dewar which are measured in litres. The dust cap over the outlet of the neck tube prevents atmospheric moisture.



**Fig 1: Dewars.**

**Cryogenic liquid cylinders**

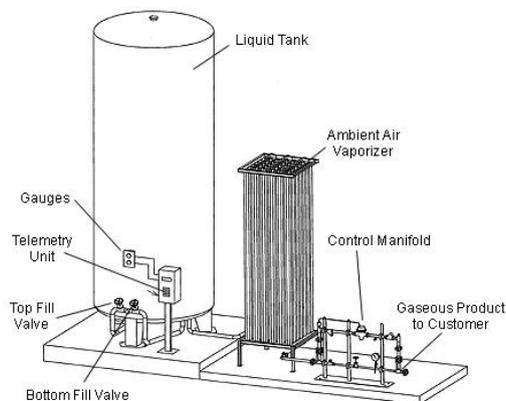
These are insulated vacuum jacketed pressure vessels which are equipped with safety valves and discs to protect the cylinders from pressure buildup. The capacity of the cylinder ranges from 80-450 litres.



**Fig 2: Cryogenic cylinder.**

**Cryogenic storage tank**

The tank which consist of a vapourizer and pressure controller. These tanks are spherical or cylindrical in shape which are vaccum insulated in the annular space. The tank size ranges from 500-420000 gallons which are equipped with circuits to control pressure buildup, pressure relief, product fill, product withdrawal and tank vaccum.



**Fig 3: Cryogenic tank.**

**Physical & Chemical properties of Liquid Nitrogen<sup>[4,5]</sup>**

Chemical formula	N <sub>2</sub>
Molecular weight	28.01
Boiling point @ 1atm	-320°F
Density liquid	808.5kg/m <sup>3</sup>
Freezing Point	-232.5°F

**Safety**

Due to low temperature careless handling of liquid nitrogen leads to cold burns, special gloves should be used to handle. When it gets in contact with skin leads to freezing of the tissues.<sup>[6]</sup>

**Applications**

- Liquid nitrogen will freeze any living tissue it comes into contact with. Now -a-days this liquid nitrogen is used to treat various skin problems. It can be used as
- Cryosurgery: To remove cancer tissue a super chilled scalpel is used. In dermatology it is used to remove benign growths, pre cancers, skin cancers. It can be applied by using a cotton swab or spray.
- Cryopreservation: It is a process where cells, tissues, organs or any other are susceptible to damage by chemical kinetics which are preserved by cooling to low temperatures i.e -196°C.

- Cryotherapy: It is used to treat variety of lesions at low temperatures.
- This liquid nitrogen is effective in the treatment of removal of warts and removal of small skin cancers. The causative organism of warts is Human Papilloma virus (HPV). By keeping small amounts of liquid nitrogen drop by drop directly, the warts become freeze and the cells will die and fall off.
- MRI: The super cold gas is used as a colorant for the magnets used in MRI.
- It can be used as a pressurizing gas which propel the liquid through pipelines.
- It can be used to shield oxygen sensitive materials from the air and to remove volatile organic materials from process streams.
- In Chemical industry liquid nitrogen can be used for inerting, nitrogen stripping and recovery, reactor cooling.
- It is used as purging agent in piping and equipment to prevent contamination.
- It is used for tissue transport and blood preservation.
- It can be used as an assist gas for laser cutting and enhances plasma cutting.
- In the refining industry it can be used for VOC (Volatile Organic Compounds) treatment and recovery.
- It is used to treat verrucas, skin tags, small fleshy growths and small lumps on the skin.
- In the production of sterile pharmaceutical products positive pressure is created with nitrogen to avoid atmospheric contamination.
- It helps in packaging of the medical devices and products which maintains sterility and cleanliness of the product.<sup>[7,8,9,10]</sup>

## CONCLUSION

Liquid nitrogen has various applications in medicine mainly it can be used to treat benign tumors, warts and other skin lesions.

## REFERENCES

1. Database of BOC health care <https://www.bochealthcare.co.uk/en/products-and-services/products-and-services-by-category/medical-gases/liquid-nitrogen/liquid-nitrogen.html>.
2. Database of Liquid nitrogen of air products . <https://www.airproducts.com>.
3. Umrat, W. (1974). "Cooling bath for rapid freezing in electron microscopy". *Journal of Microscopy*, 101: 103–105.

4. Database of Liquid Nitrogen Air Products  
<https://www.airproducts.com/~media/Files/PDF/company/safetygram-7.pdf>.
5. Henshaw, D. G.; Hurst, D. G.; Pope, N. K. (1953). "Structure of Liquid Nitrogen, Oxygen, and Argon by Neutron Diffraction". *Physical Review*, 92: 1229.
6. British Compressed Gases Association (2000) BCGA Code of Practice CP30. The Safe Use of Liquid nitrogen Dewars up to 50 litres. Archived 2007-07-18 at the Way back Machine ISSN 0260-4809.
7. Database from warts <https://warts.org/wart-removal/cryotherapy>.
8. Habif TP. Dermatologic surgical procedures. In: Habif TP, ed. *Clinical Dermatology*. 6th ed. Philadelphia, PA: Elsevier, 2016; chap 27.
9. Data book for cryogenic gases and equipment. [Aspenycap.org](http://Aspenycap.org).
10. <https://www.medicinenet.com/script/main/hp.asp>.