NITROUS OXIDE

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SYNONYMS Dinitrogen oxide; Dinitrogen monoxide; INS No. 942

DEFINITION Nitrous oxide, a colourless and non-flammable gas, commonly known as laughing gas, is manufactured by the controlled heating of ammonium nitrate, at temperatures 170-240°, either using superheated steam or other thermal decomposition processes. The hot, corrosive mixture of gases are cooled to condense the steam and filtered to remove higher oxides of nitrogen. The gas is further purified in a train of three gas washes with base, acid and base again. Nitric oxide impurity, if present, is chelated out with ferrous sulfate, or reduced with iron metal, or oxidised and absorbed in a base as a higher oxide.

Chemical names	Nitrous oxide
C.A.S. number	10024-97-2
Chemical formula	N_2O
Formula weight	44.01
Assay	Not less than 99 % (v/v)

DESCRIPTION Colourless, odourless gas

FUNCTIONAL USES Propellant, antioxidant, packaging gas, foaming agent

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4)	1 volume dissolves in 1.4 volumes of water (20° 760 mm Hg). Freely soluble in alcohol; soluble in ether and in oils.
Infrared absorption	The infrared absorption band of the sample corresponds with the typical infrared absorption band of nitrous oxide
Carbon dioxide test	Passes test See description under TESTS

PURITY

Carbon monoxide	Not more than 10 µl/l See description under TESTS

Nitric oxide	Not more than 1 µl/l See description under TESTS
Nitrogen dioxide	Not more than 1 µl/l See description under TESTS
Halogens (as Cl)	Not more than 5 µl/l See description under TESTS
Ammonia	Not more than 25 µl/l See description under TESTS

TESTS

NOTE 1: The carbon dioxide identification test and all of the purity tests are referenced from the Food Chemicals Codex, 7th Edition, 2011, p. 719-720.
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NOTE 2: The identification and purity tests given below are designed to reflect the quality of nitrous oxide in both its vapour and its liquid phases, which are present in previously unopened cylinders. Reduce the sample cylinder pressure with a regulator. Withdraw the samples for the tests with the least possible release of sample gas consistent with proper purging of the sample apparatus. Measure the gases with a gas volume meter downstream from the detector tubes to minimize contamination of or change to the samples. Perform the tests in the sequence in which they are listed below.

NOTE 3: Detector tubes referenced under identification and purity tests are available from National Draeger Inc., P.O. Box 120, Pittsburgh, PA 15205-0120, USA.

IDENTIFICATION TESTS

Carbon dioxide test	Pass 100 ml of sample gas released from the vapour phase of the contents of the sample gas cylinder through a carbon dioxide detector tube (Draeger CH 30801 or equivalent) at the rate specified for the tube. No colour change occurs.

PURITY TESTS

Carbon monoxide	Pass 1000 ml of sample gas released from the vapour pressure of the contents of the sample gas cylinder, through a carbon monoxide detector tube (Draeger CH 25601 or equivalent) at the rate specified for the tube. The indicator change corresponds to not more than 10 µl of carbon monoxide.
Nitric oxide	Pass 500 ml of sample gas, released from the vapour phase of the contents of the sample gas cylinder, through a nitric oxide-nitrogen dioxide detector tube (Draeger CH 29401 or equivalent) at the rate specified for the tube. The indicator change corresponds to not more than 0.5 µl of nitrogen monoxide.
Nitrogen dioxide	Arrange a sample gas cylinder so that when its valve is opened, a

portion of the liquid phase of the contents is released through a piece of tubing of sufficient length to allow all of the liquid to vaporize during passage through it and to prevent frost from reaching the inlet of the detector tube. Release a flow of liquid into the tubing sufficient provide 500 ml of the vaporized sample plus any excess necessary to ensure adequate flushing of air from the system.

Pass 500 ml of sample gas, released from the vapour phase of the contents of the sample gas cylinder, through a nitric oxide-nitrogen dioxide detector tube (Draeger CH 29401 or equivalent) at the rate specified for the tube. The indicator change corresponds to not more than 0.5 µl of nitrogen dioxide.

Halogens (as Cl)

Pass 1000 ml of sample gas, released from the vapour phase of the contents of the sample gas cylinder, through a chlorine detector tube (Draeger CH 24301 or equivalent) at the rate specified for the tube. The indicator change corresponds to not more than 5 µl.

Ammonia

Pass 1000 ml of sample gas, released from the vapour phase of the contents of the sample gas cylinder, through an ammonia detector tube (Draeger CH 20501 or equivalent) at the rate specified for the tube. The indicator change corresponds to not more than 25 µl.

METHOD OF ASSAY

Determine using an Infrared gas analyzer or conventional IR/FTIR fitted with a suitable gas cell to analyze nitrous oxide in the range of 85% to 100% v/v.

Reference gas standards: (a) nitrous oxide standard (99.9%) and (b) a mixture containing 5%v/v nitrogen and 95%v/v nitrous oxide.

Method using Infrared gas analyzer:
Infrared gas analyzers consist of a light source emitting broad band radiation, an optical device, a gas sample cell and a detector. Set up the instrument and select the filter for nitrous oxide. Calibrate the instrument using reference gas standards (a) and (b). Flush the sample cell using the gas to be examined and read the nitrous oxide concentration from the analyzer.

Method using conventional IR/FTIR:
Set up the instrument, following manufacturer's instructions, and set the wave number at the highest absorption band (2218 cm^{-1}). Construct standard curve, using a set of standard gases containing 5% v/v of nitrogen in 95% nitrous oxide to pure nitrous oxide (>99.9% nitrous oxide). Flush the sample cell using the gas to be examined and read the nitrous oxide concentration from the standard curve.