



sucrosolutions™
FOR WATER

**Guide for Storage and Handling of
D.Nitro™ and D. Nitro UV™**
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A business unit of



Introduction

This document provides information about bulk handling and storage of D.Nitro™ and D.Nitro UV™ (D.Nitro™).

The D.Nitro™ solution is used as a carbon supplement in wastewater treatment processes where additional carbon is required to aid in the removal of nitrogen, minimising effluent discharge TN content.

This document discusses the requirements of the plant and equipment for the receipt and storage of D.Nitro™ solutions and some aspects of the operation of a D.Nitro™ solution system. If a customer is contemplating the installation and use of a D.Nitro™ solution system, we suggest that they contact the Sucrosolutions™ team to discuss the most suitable grade, availability, usage, delivery and other relevant information. It is advisable to complete such discussions before proceeding with planning or expenditure on the process.

D.Nitro™ (D.Nitro™ solution) is supplied as a water solution at approximately 67% solids on a mass to mass basis (67° Brix). This concentration has been chosen to minimise the transport of water while not risking crystallisation of the solution at room temperatures. D.Nitro™ solutions are supplied at a pH close to neutral.

The high concentration of sucrose contributes to the storage qualities of these products, however it should be understood that D.Nitro™ solutions are susceptible to microbiological degradation, especially if diluted. In order to minimise the risk of microbial attack, it is important that good plant hygiene procedures are followed. The storage tanks and associated pipework should be constructed properly; they should be inspected regularly and cleaned as required. The length of safe storage depends on the type of D.Nitro™ solution, the particular storage conditions, and plant maintenance. It is advisable to minimise storage time, however it is possible to satisfactorily store some D.Nitro™ solutions for over one month.

Design of a D.Nitro™ Solution Installation

The long-term successful operation of a D.Nitro™ installation is strongly influenced by the initial design and construction. It is important that the appropriate size and number of tanks are selected and that they are fitted with the appropriate services to ensure ease of operation. This section discusses the design considerations of a D.Nitro™ installation.

The basic requirements are that:

1. the installation provides for simple operation in the receipt, storage and use of the D.Nitro™ solution.
2. the installation allows for cleaning of the system to remove any residue of sucrose, while enabling continuing dosing regime to occur.

Capacity of Storage Tanks

The total D.Nitro solution storage capacity which should be installed and the number and size of tanks, depends on:

1. the rate of usage
2. the extra capacity required to allow for delivery scheduling and any downtime for cleaning/maintenance.
3. the volume of each delivery.

Sufficient total storage capacity should be installed so that the customer's production does not depend on a critically-timed delivery.

The minimum bulk liquid tanker delivery is about 12 wet tonnes (9,000 litres, 8 tonnes sugar solids) while the maximum size road tanker is a B-double of about 28 wet tonnes (21,000 litres, 19 tonnes sugar solids).

Other smaller delivery options come as 1.3 wet tonnes (1,000 litres, 0.9 tonnes sugar solids) palletcons which can be of the leased or disposable type.



The Sucrosolutions™ team should be contacted for actual minimum and maximum load sizes. It is recommended that the sucrose tank should have sufficient capacity to accept one or more of the delivery options specified. Tank sizes in multiples of 1, 12 or 28 wet tonnes (working volume) are thus appropriate.

Tank Construction

Tanks for the D.Nitro™ solution should be fully enclosed so that microbial contamination from the air can be minimised and the product is sheltered from rain. A fully-enclosed vertical cylindrical tank is the preferred form for D.Nitro™ solution storage. The height-to-diameter ratio of each tank should be kept high, consistent with availability of space, in order to minimise the exposed surface area of the liquid. Vertical rather than horizontal tanks are preferred for this reason. Access should be provided into the tank for ease of maintenance cleaning.

If selecting tanks of stainless steel, the tanks should be of welded construction, with the welds being ground to ensure a high quality internal finish free of any cracks and crevices which may lead to stagnant pockets of liquor.

Depending on the site, purpose, and climatic conditions there are a number of options for the materials used in tank construction. These range from polyethylene, fibre reinforced plastic, stainless steel 316 and stainless steel 304. It is highly recommended that the technical data sheet outlining the properties of sucrose and the site specifics are used to select the appropriate vessel for the application.

Tank Fittings

A number of fittings can be included on the tanks, and should be considered by the design engineers. These fittings include a tank level indication system and nozzle connections for filling, emptying and cleaning the tanks, as well as a vent or overflow. Vermin mesh may also be required on any vents or overflows if wasps are a concern.

Tank Insulation

The D.Nitro™ solutions can be delivered at temperatures ranging from 25-70°C. 67 Brix sugar solutions are saturated at 20°C, so there is a potential risk that at temperatures lower than this crystallisation might occur. In fact, significant supersaturation is usually required before crystallisation occurs and this means that in practice, pipelines can be subjected to atmospheric temperatures of about 0°C overnight without problems.

It should be noted that the viscosity of D.Nitro™ solutions vary significantly with temperature. For example, for a 67 Brix sugar solution, at 20°C the viscosity is 229 cP (0.23 Pa s) while at 0°C and 60°C it is 1355cp and 24 cP (1.355Pa s and 0.024 Pa s) respectively. It is necessary that pumps can handle the viscosity range encountered. Heating may be necessary at times to achieve satisfactory operation.

Insulation may be desirable for tanks located external to buildings in very cold environments where the high viscosity could make pumping difficult. In these circumstances trace heating can be used (if the appropriate tank is selected) particularly if crystallisation in pipelines and storage tanks is a problem or if the D.Nitro™ solution remains stagnant for long periods (e.g. more than one month) and is subject to very low temperatures.

It is a recommendation by the Sucrosolutions™ team that a hot water flushing system is designed for the D.Nitro™ solution facility to clean the pipelines and pump of residual sucrose. Ensure that flushing water is of potable quality. It is not advisable to use recycled water from the treatment plant if it is less than Class A standard.

Tank Location

The tanks may be located either inside a building or in the open, depending on the availability of space and the cost of the installation of pipework from the tanks to the process. General supervision of the tankage and delivery should be considered when selecting a site.

It is recommended that tanks are bunded, so that any spillage incident does not result in high levels of COD leaking into stormwater or nearby rivers, lakes etc.



Note that an externally mounted tank needs to be anchored securely to prevent the danger of the tank being blown around in high winds.

Delivery and Tanker Unloading Facilities

In designing a D.Nitro™ solution system, consideration should be given to the tanker unloading requirements. The Sucrosolutions™ team can provide details about the tanker requirements in your area.

There should be sufficient space available at the loading bay for tanker access and manoeuvring. A source of hot and cold water, with hoses, should be available near the unloading bay for cleaning purposes.

The tanker bay should be bunded to prevent spillages on delivery reaching the storm water system. Some spillage of the D.Nitro™ solution is possible during the decanting process. In some States, self-sealing couplings (dry brake) are used and these minimise spillage. A protective cap should be fitted to the coupling when not in use.

Supply pipes should be sized on the basis of a flow rate up to 40m³ per hour and this usually requires a 100mm diameter supply pipe. The piping should be able to cater for some thermal expansion. The supply pipework should enter the tank at the top so that the D.Nitro™ solution is disturbed, thereby mixing in any dilute surface layers.

Unloading pumps are generally required, otherwise a 3-phase power outlet is required to operate the on-board tanker pumps (please note that not all liquid tankers hold these pumps). A 3" male Camlock fitting is also required for the hose connection. The Sucrosolutions™ team will work with you to ensure unloading facilities meet tanker requirements.



Delivery System to Process

The discharge pipe from the storage tank to the pumping system should be located in or near to the bottom of the dished or sloping base to allow complete drainage of the D.Nitro™ solution. The pipe should be sized consistent with the plant's rate of usage.

Positive displacement pumps or sealed centrifugal pumps are suitable. It should be noted that a positive displacement pump requires a pressure relief system. Valves can be ball, gate, butterfly or diaphragm valves. Globe valves are generally not recommended because of poor sealing characteristics. A drain valve should be fitted for cleaning the tank.

Metering of the D.Nitro™ solution into the plant's process can be carried out in a variety of ways. In a batch process, the simplest metering is based on volume and can be achieved by measurement of change in level in the feed tank or the batching tank. Alternatively, some form of integrating flowmeter may be used. Change in mass may be more appropriate in a particular installation but generally the density changes in the D.Nitro™ solution are small and result in negligible errors if the dry weight of sugar is determined from volumetric measurements. Non-invasive flowmeters, such as a magnetic flowmeter or a Coriolis meter, are preferred. The D.Nitro™ solution has high "clarity" and hence ultrasonic or doppler flowmeters are generally not suitable.

Shelf Life

An important factor in the operation of a D.Nitro™ solution system is the need for adequate microbial contamination control (this should be considered if the tank turnover is infrequent and the solution remains stagnant for long periods of time).

When a D.Nitro™ solution at a temperature higher than ambient is stored in a tank, water condenses on the non-wetted surfaces and runs down onto the surface of the D.Nitro™ solution, thereby leading to localised dilution. The diluted surface zone is an area where microbiological growth can occur, with consequential decline in the quality of the D.Nitro™ solution and a decrease in shelf life. Some of the construction requirements mentioned earlier (e.g. smooth welds, proper drainage and cleaning facilities) assist in overall control, however it is the prevention or extra precautions taken to limit the effect of the dilute surface layer which is most important.

Further contamination is minimised by ensuring that the air in contact with the inside tank surfaces and the liquid is not a source of contamination. This is achieved by ensuring the tank is sealed or always subject to a slight positive pressure.

Physical Properties of the D.Nitro™ Solutions

A Technical Data Sheet and MSDS information provide details of the properties of the D.Nitro™ solutions and are available from the Sucrosolutions™ team. Contact our sales office by phone on 1300 134 568 or email water@sugaraustralia.com.au.

IMPORTANT INFORMATION

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The Sucrosolutions™ business has technical personnel with a range of experience in the design and operation of bulk liquid sucrose handling systems. Before proceeding with a new system, or modifying an existing system, we suggest you contact the Sucrosolutions™ technical personnel to refer to their experience in assessing your needs.

All enquiries should be directed to the the Sucrosolutions™ Sales Office on 1300 134 568.

Occupational Health & Safety

Material Safety Data Sheets for D.Nitro™ products are available on the Sucrosolutions™ internet site or upon request - www.sucrosolutions.com.au.

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