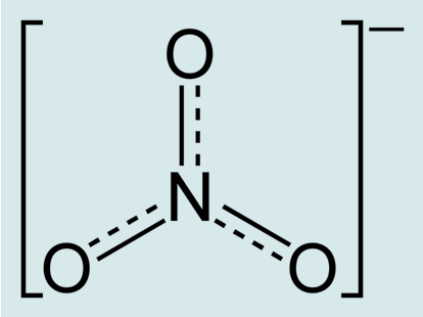
Technical Bulletin

Nitrate Removal by

INDION® NSSR

(Nitrate Selective Resin)



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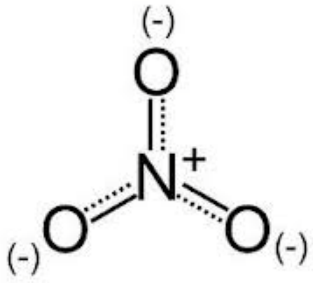
INTRODUCTION

- Nitrate is a wide-spread ground and surface water contaminant worldwide.
- The higher concentration of nitrate may be due to excessive use of fertilizers, pesticides and insecticides leaching from animal waste and nitrogen fertilizers.
- Urea is common type of fertilizer used in agriculture due to its higher N content, high solubility .
- The nitrate poses some unique problems to ground water because it moves quickly through the soils with percolating water and it often indicates potential biological contamination.



NITRATE AFFECT AREA

Nitrate Contamination: Excess Nitrate causes blue baby syndrome in infants *(Methaemoglobinemia)* Which causes high infant mortality in rural India.

WHO / BIS limit - 45 ppm as Nitrate
- 10 ppm as Nitrogen

Excess Nitrate has affected people in over 11 states like Punjab Haryana, Karnataka, Uttar Pradesh etc. in India. Which is caused by indiscriminate use of a nitrogenous fertilizers and Improper disposal of sewage and industrial effluents.

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EFFECT ON HEALTH…

Nitrate Contamination…

High nitrate level in drinking water leads to infant methaemoglobinaemia (blue-baby syndrome), gastric cancer goiter, metabolic disorder, birth malformations, hypertension and livestock poisoning.

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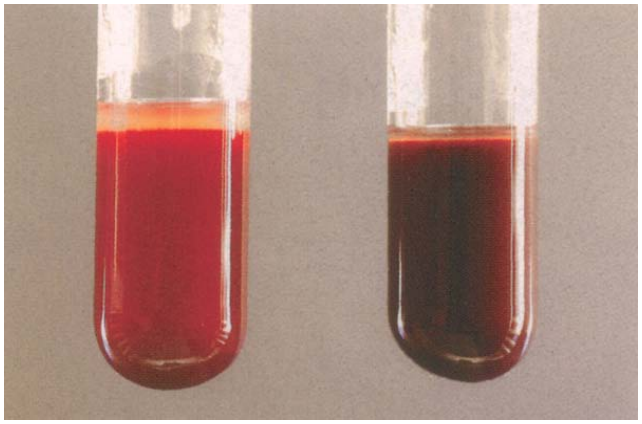
…EFFECT ON HEALTH

Elevated levels of methemoglobin in the blood is caused when the mechanisms that defend against oxidative stress within the red blood cell are overwhelmed and the oxygen carrying ferrous ion (Fe2+) of the heme group of the hemoglobin molecule is oxidized to the ferric state (Fe3+). This converts hemoglobin to methemoglobin, resulting in reduced ability to release oxygen to tissues and thereby hypoxia. This can make the blood a bluish or chocolate-brown colour.



CONVENTIONAL NITRATE REMOVAL METHODS

- **Biological denitrification,**

  Nitrate is readily removed from water by denitrification, a bacterial respiration process which converts nitrate to harmless dinitrogen gas. Denitrification is carried out by numerous bacterial species found in soil and aquatic environment.

- **Reverse osmosis (RO)**

  RO system uses non-selective membrane to remove almost all dissolved contaminants from the water. RO is used to remove dangerous contaminant like nitrate also.

CONVENTIONAL NITRATE REMOVAL METHODS

- **Electrodialysis**

  Electrically driven process that uses a voltage potential to drive charged ions through a semi-permeable membrane, reducing the TDS in the source water. The process uses alternating, semi-permeable cation (positively charged ion) and anion (negatively charged ion) transfer membranes in a direct-current (DC) voltage potential field. The source water flows between the cation and anion membranes via flow spacers that are placed between the membranes.

- **Nitrate selective - ion exchange process**

  In the ion exchange process nitrate ions are exchanged by chloride. When all chloride ions are exchanged with nitrate ions the resin is exhausted. Resin is regenerated with sodium chloride solution. The regeneration waste is to be disposed in drainage/sewage.

BASICS OF INDION NSSR

- INDION NSSR is a macroporous strong basic anion resin which is tailor-made to suit removal of nitrate ions from water for potable use.
- The proper mix of physico - chemical properties gives ideal nitrate exchange kinetics to this resin making it suitable for nitrate removal in the presence of sulphate ions.

High concentration of nitrate in water is a potential hazard for two reasons.

- The nitrate ions form complexes with the blood and in the long run cause oxygen depletion affecting human life.
- The flow of nitrate bearing water through iron pipes can cause depletion of oxygen leading to corrosion.

In view of these difficulties use of an Ion Exchange resin is the preferred process for nitrate removal.

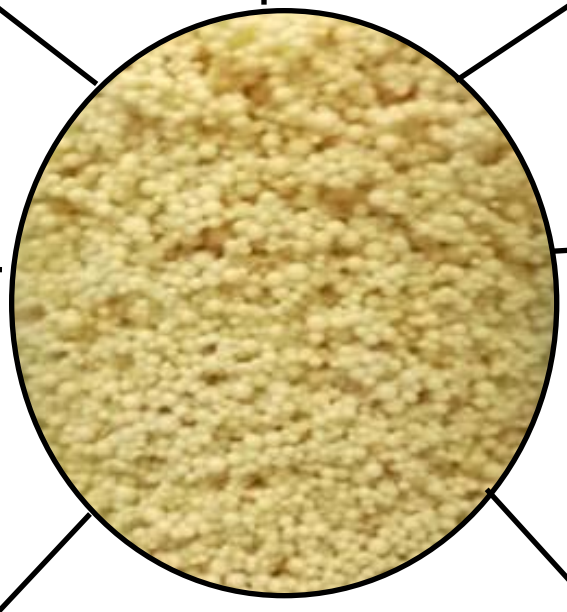
INDION NSSR – Unique Features

High nitrate selectivity

Good physical and mechanical strength

Resin life 2-3 years

Gold Seal /NSF- 61 Certification



Excellent adaptability and can be used in conventional filters, community and POE units.

Excellent hydraulics and fast kinetics

Easy disposal in drainage

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DESIGN GUIDELINES

Characteristics

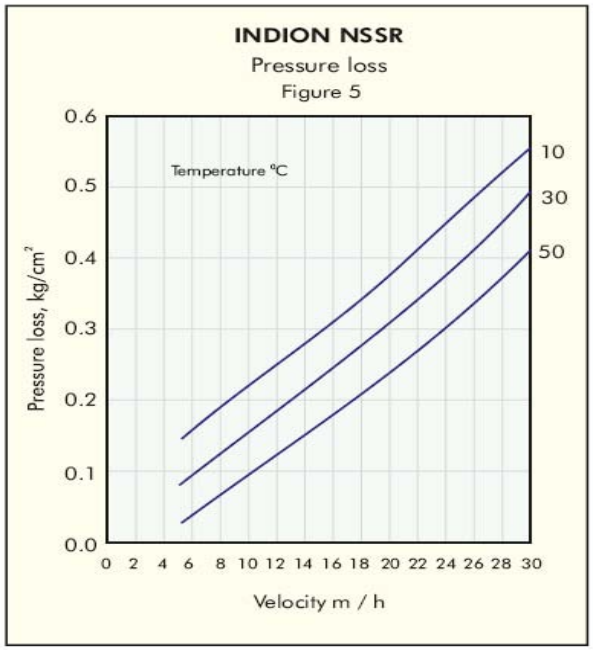
Appearance	Opaque off white to brown beads
Ionic form as supplied	Chloride
Moisture holding capacity	45 - 55 %
Particle size range >1.2 mm < 0.3 mm:	0.3 to 1.2 mm 5.0%, maximum 1.0%, maximum
Maximum operating temperature	100 ^{0} C in Cl form
Reducing and oxidizing agent	should be absent

Operating Conditions

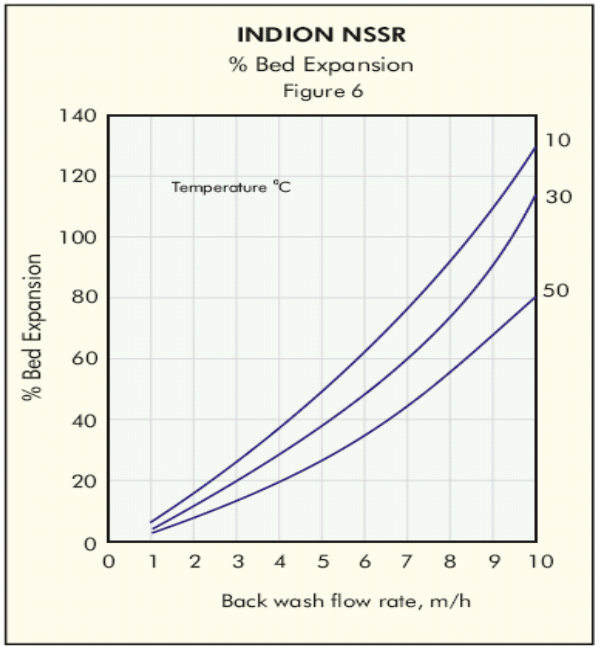
Bed Depth	1.0 m
Nitrate Level	200 ppm max
TDS Level	1200 ppm max
Operating pH range	6 - 8.5
Regenerant	NaCl
Regeneration level	125g/l of resin

SYSTEM HYDRAULICS PRESSURE LOSS

Pressure loss across the bed for different velocities and temperatures.



% Bed expansion at different flow rates and temperatures.



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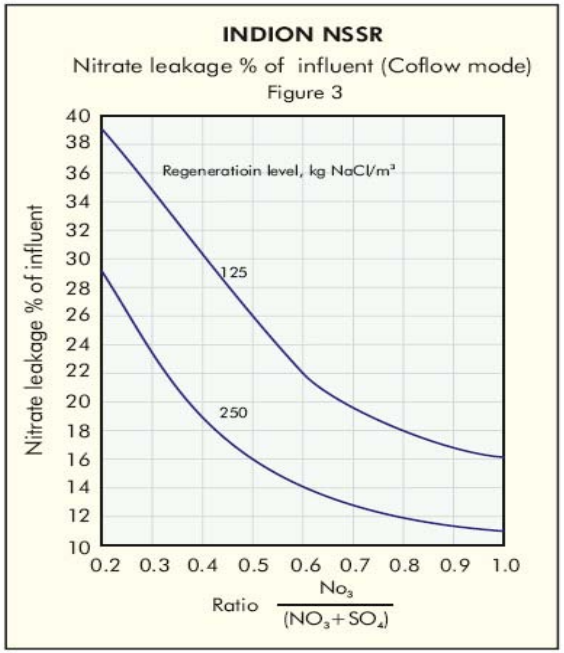
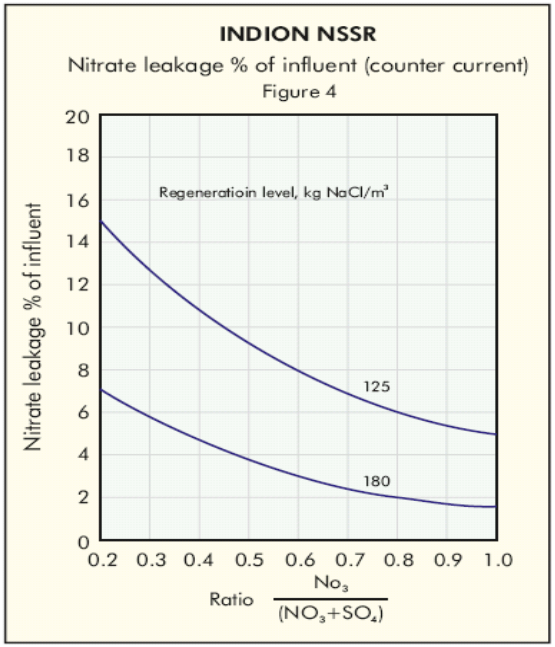
SYSTEM HYDRAULICS

Leakage : The leakage of Nitrate (CCR) at the outlet of NSSR





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HAND PUMP ATTACHMENT UNIT

Advantages

- Sturdy
- Economical
- Does not require electricity
- Easy to operate
- Common salt (NaCl) required for recharge
- Ideal for rural applications
- Long life
- Flow of unit is 8-10 lpm
- Directly attached to hand pump

HAND PUMP ATTACHMENT UNIT

STANDARD SYSTEMS
FOR DOMESTIC /COMMUNITY BASED UNIT

Model	Max Flow m^3/h	Specifications
NGNRF 1	1	• One vertical cylindrical FRP pressure vessel • One set of frontal pipe work and valves • Two pressure gauges to monitor head loss across the NSSR system • Maximum / minimum operating pressure will be 3.5 kg/cm^2 and 2.0 kg/cm^2 respectively
NGNRF 2	2	
NGNRF 3	3	
NGNRF 4	4	
NGNRF 5	5	
NGNRF 7	7	
NGNRF 10	10	

PRE-TREATMENT REQUIREMENTS

INDION NSSR is a robust media with good mechanical strength and generally requires minimal pretreatment . However, the presence of high levels of suspended solids and biological organic matter may foul the media, resulting in the reduction in capacity and life span of the media. Hence, we recommend pretreatment with INDION NSSR for removal of suspended particles and other organic matter.

INDION NSSR Pretreatment

- Removal of organics
- Monitoring pH and removal of suspended solids
- Removal of scale forming compounds

PACKAGING, STORAGE AND SAFTEY

Packing

HDPE lined bags	25/50 lts
Super sack	1000 lts
With liner bags	180 lts
MS drums	

LDPE bags	1 cft/25 lts
Super sack	35 cft
with liner bags	7 cft
Fiber drums	

Storage

Ion exchange resins require proper care at all times. The resin must never be allowed to become dry. Regularly open the plastic bags and check the condition of the resin when in storage. If not moist, add enough clean demineralised water and keep it in completely moist condition. Always keep the resin drum in the shade. Recommended storage temperature is between 20°C - 40°C.

Safety

Acid and alkali solutions are corrosive and should be handled in a manner that will prevent eye and skin contact. If any oxidizing agents are used, necessary safety precautions should be observed to avoid accidents and damage to the resin.