

Technical Bulletin

Fluoride Removal By INDION RS-F (Resin Selective For Fluoride)



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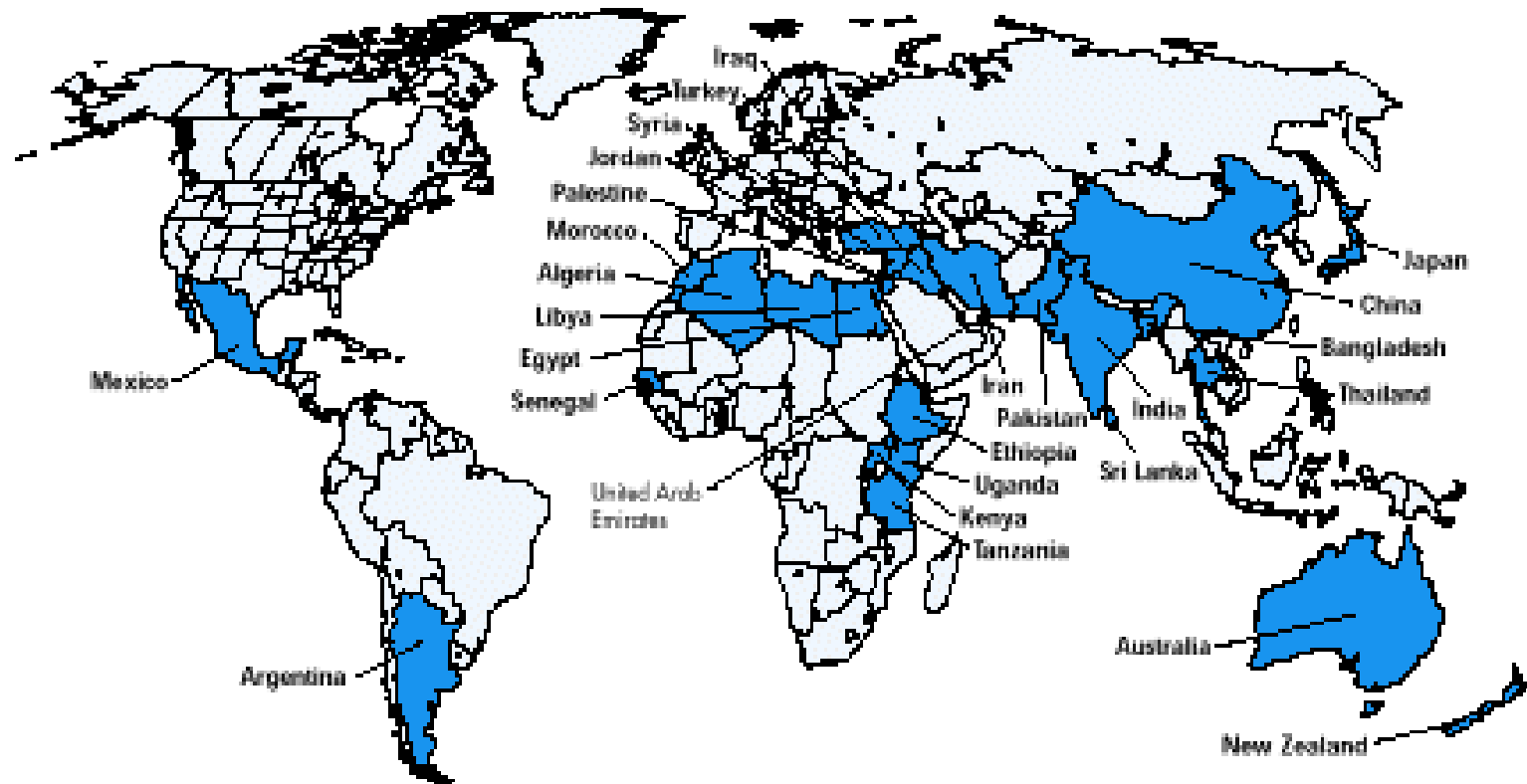


Introduction

- Fluoride related health hazards are a major environmental problem in many regions of the world.
- Literature review reveals that, India is among the 25 nations around the globe, where health problem occurs due to the consumption of fluoride- contaminated water.
- In India, 17 states have epidemic for fluorosis. More than 60% of our fluoride demand is fulfilled by the consumption of drinking water.
- Excess of fluoride (>1.5 mg/L) in drinking water is harmful to the human health



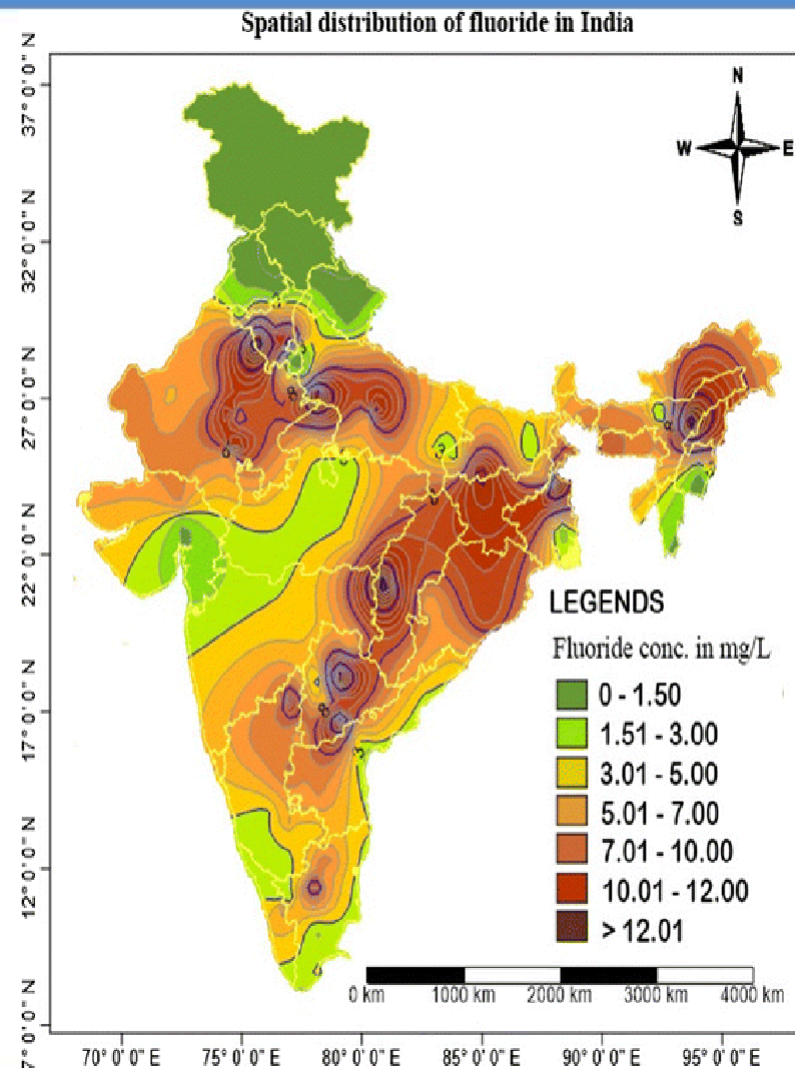
Fluoride Affected Area – World Scenario



Countries with endemic fluorosis due to excess fluoride in drinking water

Fluoride Affected Area

- Fluoride has a significant mitigating effect against dental caries if the concentration is approximately 1 mg/l.
- However, continuing consumption of higher concentrations can cause dental fluorosis and in extreme cases even skeletal fluorosis.
- As per WHO & BIS, Desirable limit for fluoride in drinking water is 1.0 mg/l & the permissible limit is 1.5mg/l.
- The fluoride affected states are: Chhattisgarh, Andhra Pradesh, Jammu & Kashmir, Karnataka, Haryana, Punjab, Madhya Pradesh, Bihar, Uttar Pradesh, Maharashtra, Tamil Nadu, Orissa, Rajasthan.



Health Effects



NORMAL



MILD



MODERATE



SEVERE

Dental Fluorosis



Skeletal Fluorosis

Concentration of fluoride in water	Diseases
<0.5 mg / lit.	Dental caries
0.5 to 1.5 mg/lit.	Promotes dental health
1.5 – 4 mg / lit.	Dental fluorosis
> 4 mg / lit.	Dental, skeletal fluorosis
>10 mg / lit.	Crippling fluorosis.

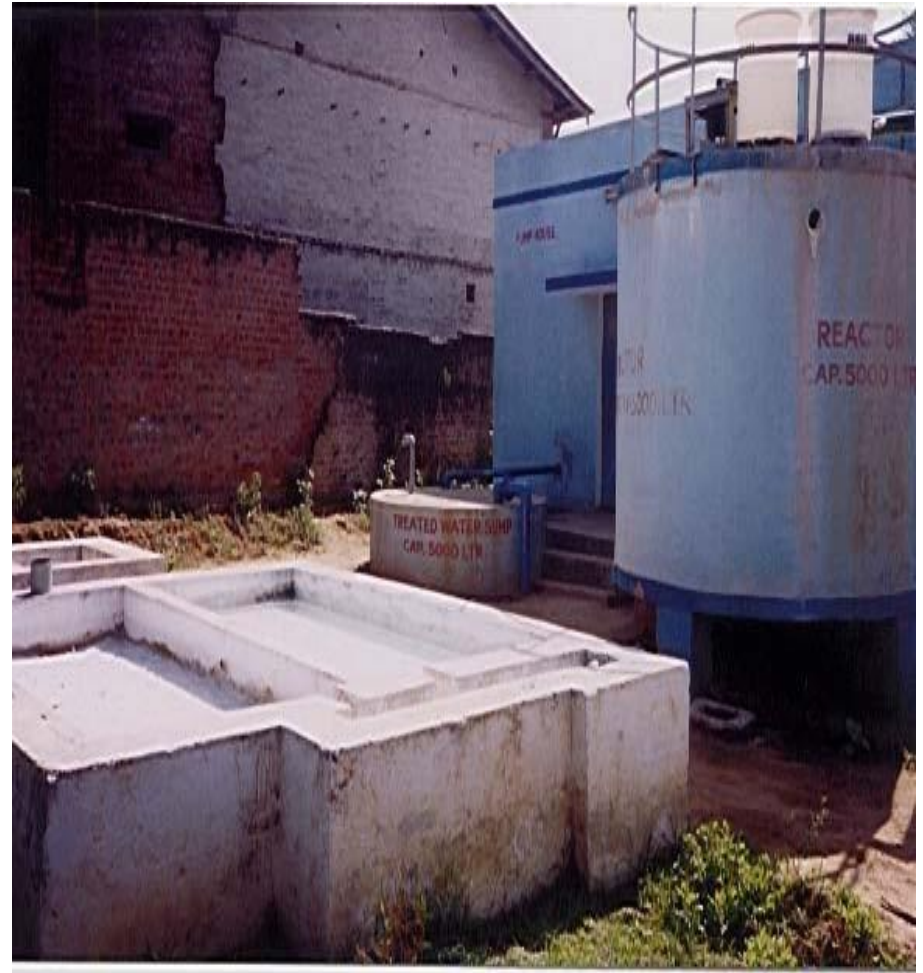
Drinking Water Standard

Organisation	Desirable limit (mg/L)
Bureau of Indian standards (BIS)	1.0
Indian council of medical research (ICMR)	1.0
The committee on public health engineering manual & code of practice, government of India	1.0
World health organization (International standards for drinking water)	1.0

Conventional Fluoride Removal Methods

Precipitation and filtration (Nalgonda technique)

- Complex process
- Useful for community based plant
- Non continuous supply of water
- Needs skilled manpower
- Requires storage and handling of various chemicals



Conventional Fluoride Removal Methods

- **Others:**

Reverse osmosis and electro dialysis are two membrane processes which can be used for removal of fluoride.

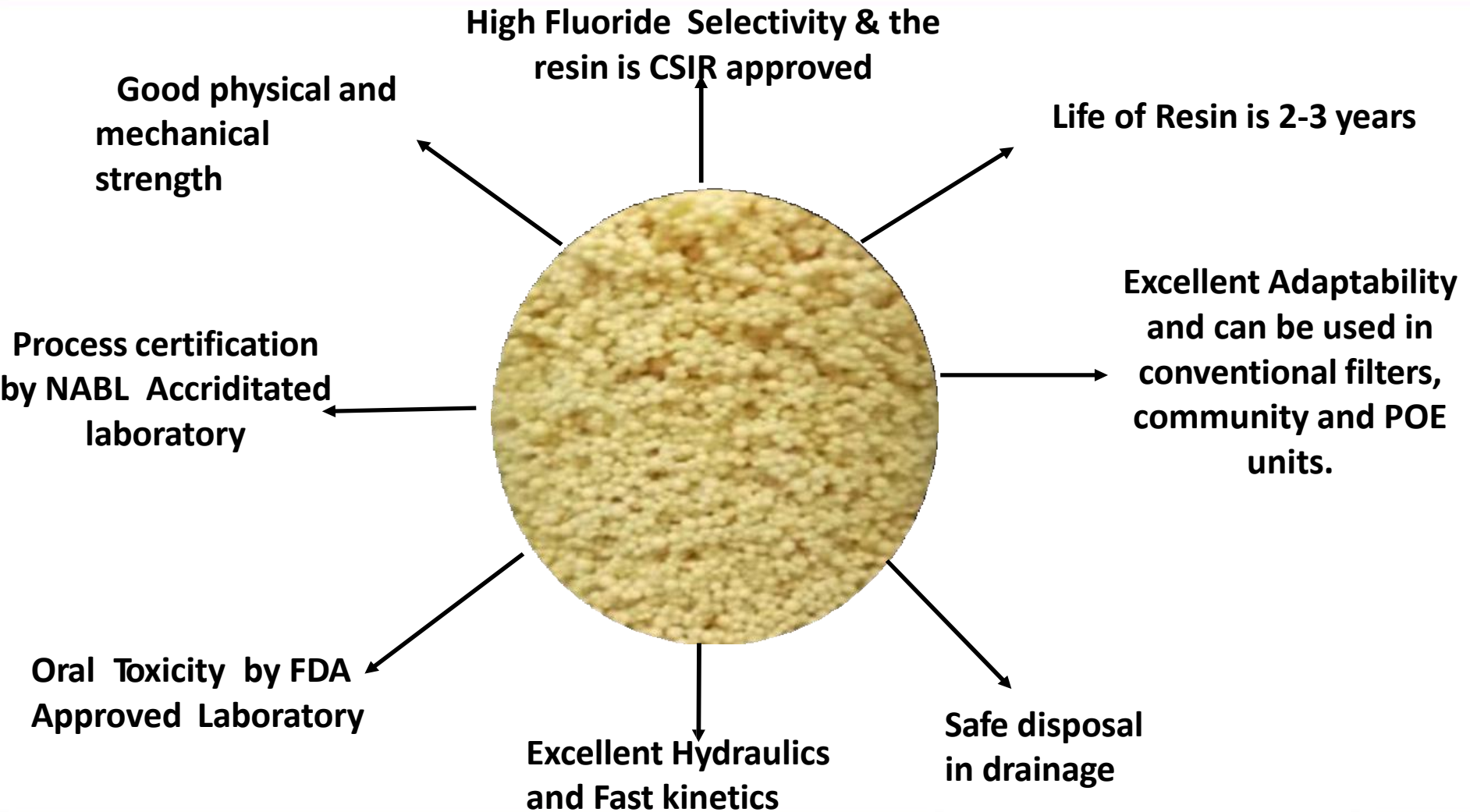
- **Adsorption and Ion-exchange:**

Adsorption processes involve the passage of water through a contact bed where fluoride is removed by ion exchange or surface chemical reaction with the solid bed matrix. After a period of operation, a saturated column must be refilled or regenerated. Regenerations waste of media can be treated with lime. The different adsorbents used for fluoride removal include activated alumina, carbon, bone charcoal and synthetic ion exchange resins. These media can be useful for HPA (hand pump attachment) ,TWA (tube well attachment) and POU (point of use) and POE (point of entry) units .

Basics of INDION RS-F

- INDION RS-F is an ion exchange resin designed to selectively remove fluoride from potable water as well as for waste water treatment
- INDION RS-F performs well, even in the presence of common anions such as chlorides, sulphates.
- INDION RS-F can treat potable water having fluorides up to 10 ppm maximum.
- For optimum performance the influent water should have turbidity 1-2 NTU, organics - nil, TDS <1200 ppm, total alkalinity < 350 ppm as CaCO_3 , sulphate <500 ppm, heavy metals < 0.5 ppm.
- Regeneration waste of the resin can be treated by lime and iron salt for safe disposal.

INDION RS-F – Unique Features



Design Guidelines

Characteristics

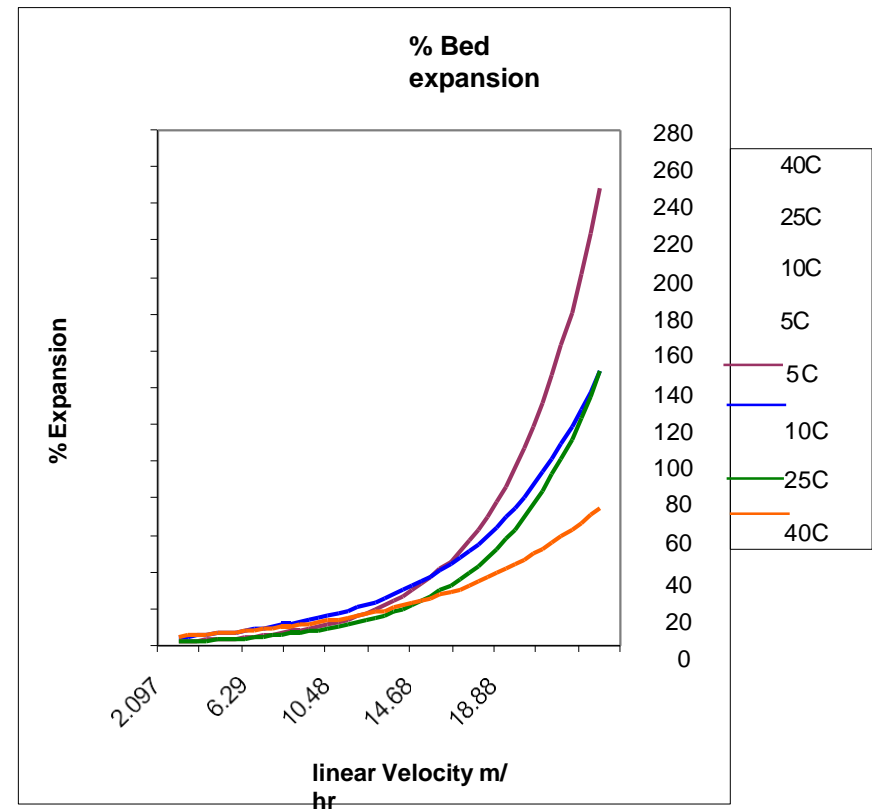
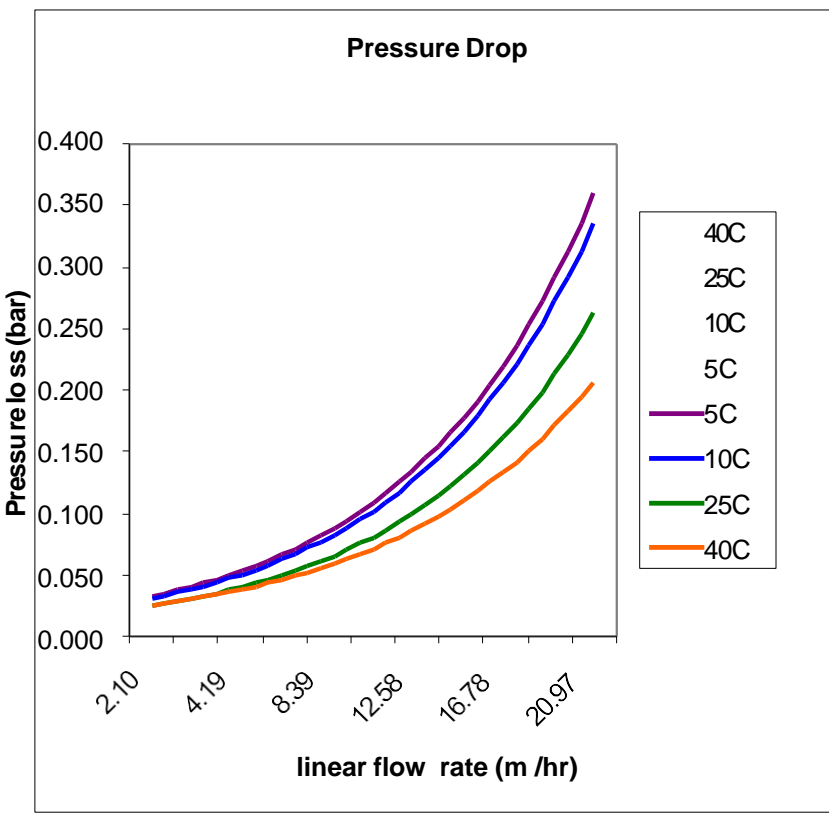
Appearance	Opaque off white beads
Matrix	Macroporous
Moisture holding capacity	50 - 60 %
Shipping weight *	800 kg/m , approximately
Particle size range	0.3 to 1.2 mm
> 1.2 mm	5.0%, maximum
< 0.3 mm	1.0%, maximum
Uniformity coefficient	1.7, maximum
Effective size	0.4 to 0.5 mm

Operating parameters

Maximum operating temperature	45°C
Operating pH range	6.5 to 8.0
Fluoride adsorption capacity	0.8 -1 g/l
Recommended contact time	4.5-5 minutes
Specific service flow rate	10 -13 BV/h
Minimum bed depth	0.7-1 m

System Hydraulics Pressure Loss & Bed Expansions

- Pressure loss across the bed for different velocities and temperatures.
- % Bed expansion at different flow rates and temperatures.



Commercial Success: Hand Pump Attachment Unit

Advantages:

- Sturdy
- Economical
- Does not require electricity
- Easy to operate
- Poly aluminium chloride required for recharge
- Ideal for rural applications
- Long life
- Flow of unit is 8-10 lpm
- Directly attached to hand pump
- **150-200 PE/ Day are accessible to pure drinking water**



More than 2500 units sold across various states of India

Community Based Plants Working On Gravity/Solar Power

Advantages:

- Sturdy
- Economical
- Does not require electricity
- Easy to operate
- Ideal for rural applications
- long life of media (2-3years)
- Flow of unit is 8-10 lpm
- Unit can be regenerated with Poly Aluminum Chloride
- Regeneration frequency once in a week for 3-5ppm inlet Fluoride
- Unit can be operated by solar power or gravity
- Easy and Safe disposal of regeneration waste.

More than 400units sold across various states of India



Community Based Plants Working On Solar/Electricity

Fluoride reduced to <1.0 ppm WHO/BIS standards with 10 ppm max fluoride level

Advantages:

- Sturdy
- Easy to operate
- System can be designed on grid or Off grid
- Poly aluminium chloride required for recharge
- Ideal for rural applications
- Long life of the resin
- Flow rate: 1 m³/ h.
- Directly attached to the tube well



Community Based De-fluoridation Unit- 2m³/hr

- 2m³ / hr plant Installed at Yamatwal , Maharashtra State
- Solar operated Plant
- Fluoride Removal along with Disinfection System
- Inbuilt water vending Machine for water distribution.
- 1500-2000 Persons/Day are accessible to Pure drinking water.



Standard Systems For Fluoride Removal (1 to 10 m³/ Hr)

Model	Max Flow m ³ /hr	Specifications
NGFR 10	1	<ul style="list-style-type: none"> Unit consist of multi grade filter(NGMF) , followed by fluoride removal(NGFR) , last is polishing filter(NGPF) . One set of frontal pipe work and valves for each vessels Two pressure gauges to monitor head loss across the each vessel RS-F Maximum operating pressure will be 3.5 kg/cm²
NGFR 20	2	
NGFR 60	3	
NGFR 85	4	
NGFR 85	5	
NGFR 50	7	
NGFR 75	10	

Pre-Treatment Requirements

INDION RS-F is a robust resin 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 resin, resulting in the reduction in capacity and life time. Pretreatments are required for removal of organics , suspended solids etc .

INDION RS-F Pretreatment:

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

Packaging, Storage And Safety

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 demineralized water and keep it in completely moist condition. Always keep the resin drum in the shade. Recommended temperature is between 20°C and 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.

Thank You
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