Technical Bulletin

INDION® ISR

(IRON SPECIFIC RESIN)

ION EXCHANGE
Refreshing the Planet

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INTRODUCTION

Iron is a common metallic element found in nature. Water percolating through soil and rocks dissolves iron present in it, which subsequently enters into ground water bodies. In deep wells and springs, where both oxygen and pH content tend to be low, water containing dissolved iron appears colourless. When the same water is exposed to air, the dissolved iron reacts with atmospheric oxygen and converts to yellow coloured suspended particles which finally forms a reddish brown residue. High concentration of iron cause reddish brown stains on laundry and household fixtures, sometimes clogs water distribution pipes and imparts a bittersweet or metallic taste to drinking water.

The following types of iron can be found in potable water supplies:

- Sequestering Iron
- Organic Iron - “Heme Iron”
- Iron Bacteria
- Ferric Hydroxide or Red Water Iron
- Ferrous Bicarbonate or Clear Water Iron

We see that iron is found in many different forms. It is a challenge to remove iron from water as the treatment method differs for each type for iron. In India there is an acute problem of iron in water. The concentration of iron ranges from 1 – 20 ppm in areas such as West Bengal, Assam, Tripura, Chhattisgarh and in the east coast (Chennai and surrounding areas). This problem is faced in countries like Bangladesh, Malaysia and Kenya as well as in some part of the United States.

CONVENTIONAL IRON REMOVAL METHODS

Oxidation & Chemical Precipitation Methods:

Aeration, chlorine and ozone are generally used to precipitate iron in a retention tank. Supernatant water is then passed through sand filter to get iron free water.

Demerits:

This requires large space and continuous monitoring. Precipitated iron may cause clogging and rusting of pipes which affects the treatment cost.

Use of Green Sand

Naturally occurring green sand coated with manganese results in purple-black media and acts as catalyst to precipitate iron and manganese.

Demerits:

As density of media is > 1.5, the required backwash pressure and flow is high. Continuous regeneration increases the chemical and operating cost of the unit.

Ion Exchange Water Softener

Can treat low level iron concentration (< 1 – 5 ppm).

Demerits:

Cleaning of resin is difficult. Oxidised iron may reduce the operating capacity of softener resin.

INDION® ISR

INDION® ISR*(Iron Specific Resin) is based on ion exchange resin technology and has manganese dioxide as a catalytic moiety. It works as a catalyst to promote iron oxidation. Basically, iron and oxygen are attracted to manganese dioxide, which enhances the oxidation of dissolved iron and converts the soluble iron (Fe^{++}) into insoluble ferric (Fe^{+++}), which can be filtered through the media that acts as catalyst in this process and does not get consumed. In this reaction, manganese dioxide is reduced to manganese oxide and ferric hydroxide is precipitated. During backwash, the surface of this material is scoured, converting it to MnO_2, which is further used to oxidise the iron. Simple backwash regenerates manganese dioxide. No chemicals are required to regenerate the resin.

UNIQUE FEATURES :

- **The media size ranges from 0.3 to 1.2 mm therefore it also acts as filter media, apart from iron precipitation.**
- **The media doesn't get consumed in the process of iron removal; as a result media has longer life.**
- **The media can be easily backwashed for removal of filtered iron from the bed, and does not require regeneration.**
- **The catalytic oxidation by the media requires less contact time and hence, less bed depth.**
- **Negligible labour and operational cost.**
- **Due to spherical beads, media undergoes less compaction.**
- **Increased service velocity at lower feed iron content, resulting in cost reduction**
- **Operable in a wide range of temperature (20-45° C)**
- **Operates with high TDS (up to 2500 ppm) and lower alkalinity level**
- **Easily adaptable**

*** INDION® ISR is a product of Ion Exchange and has been patented**

DESIGN GUIDELINES…

Characteristics

Colour	Black
Physical Form	Beads
Wet Screen Grading	0.3-1.2 mm
Osmotic Strength	Good
Moisture Content	46-52%
Mechanical strength	Good
Voids	40% approximately
Bulk Density	0.8 kg/l
Particle Density (Wetted in water)	1.23 kg/l
Uniform Coefficient	1.7 max
Effective Size	0.45- 0.5mm
Approximate Shipping Weight	760 kg/m^3

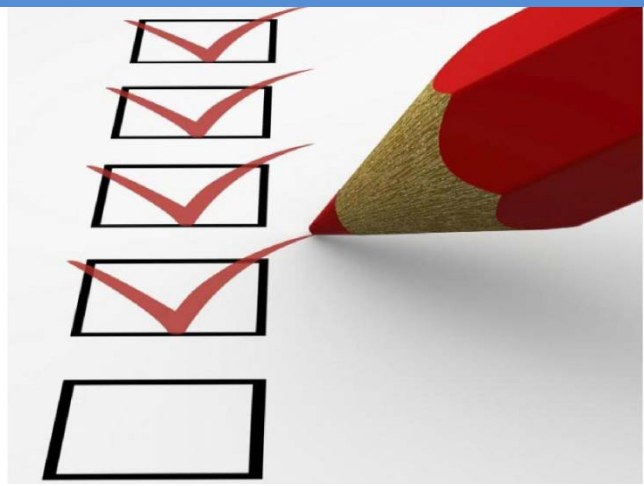
Recommended Influent Limitations

U.S. Environmental Protection Agency (USEPA) have listed iron and manganese in secondary drinking water standards, applicable to drinking water contaminants that cause offensive taste, odour, colour, corrosion, foaming or staining problems. Secondary drinking water contaminants do not pose risks to humans at the levels usually found in natural water.

As per USEPA (June 2003) and WHO Guideline 2006, drinking water standard for iron is 0.3 ppm.

…DESIGN GUIDELINES

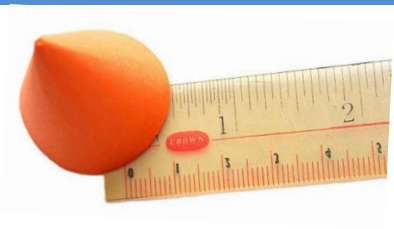
pH	>6.5
Dissolved Oxygen	Greater than 15% of Iron Content
Alkalinity	100 ppm minimum
Hydrogen Sulfide	Nil
Oil	Nil
Free Chlorine	Nil
Organic Matter	<1.0ppm
Total Dissolved Solids	2500ppm max.
Total suspended Solids	10 ppm max
Temperature Range	15-45° C (59-113 F)



SUGGESTED OPERATING CONDITIONS

	Up to 10.0 ppm feed iron	Up to 5.0 ppm feed iron
Bed Depth	0.7 – 1.5 m minimum	0.5 – 1.5 m minimum
Service Velocity	15 m/h	15-20 m/h
Backwash Velocity	26-30 m/h	26-30 m/h
Backwash Bed Expansion	40-50%	40-50
Backwash Time	15-20 mins	15-20 mins
Backwash Frequency	8-10 hrs or ΔP of 1.0kg/cm^2 whichever is earlier	once in 10- 12 hrs or ΔP of 1.0kg/cm^2 whichever is earlier

…DESIGN GUIDELINES



SIZING OF DE-FERROUS UNIT

Check the raw water analysis thoroughly, so that it meets all limiting conditions.
Provide necessary pretreatment to condition the water to meet feed water limiting conditions.

Note the iron content in feed water and select appropriate service velocity from the suggested operating conditions.

Calculate the diameter required for the selected velocity. If the standard FRP vessel is used, select nearest higher diameter and ensure sufficient height for required bed depth and expansion.

Select required bed depth based on iron content in feed water. Calculate quantity of media required.

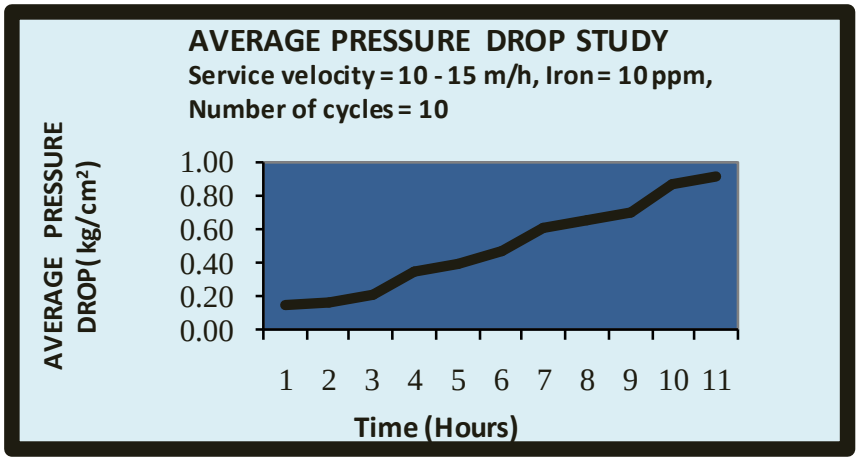
Calculate HOS (height on straight) of the vessel considering 50-60% bed expansion. The media can be directly supported on strainer on plate system. Add 0.4 m in HOS, if underbed system is used for media support.

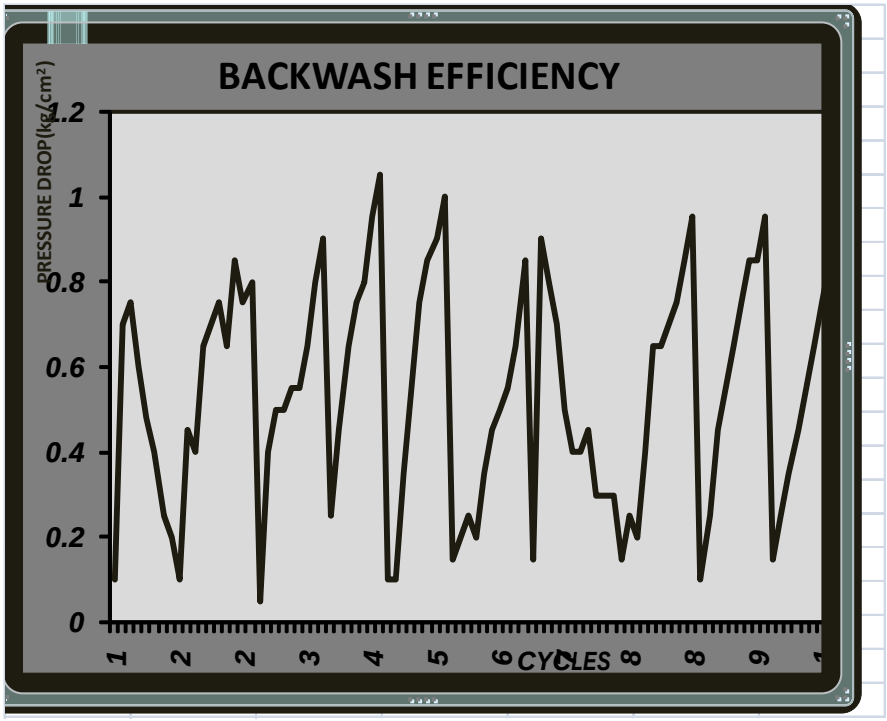
Calculate backwash flow rate at 24-30 m/h velocity. Provide adequate pump to cater backwash flow requirement. Provide a separate backwash water tank and pump for iron content of 8 ppm and above so as to carry out backwash with iron free water.

TECHNICAL SUPERIORITY OF *INDION® ISR*

Characteristics	INDION® ISR	Catalytic 1	Catalytic 2
Physical			
Colour	Black	Black	Blackish grey
Shape	Beads	Granules/Pellets	Granules/Pellets
Size	0.3 to 1.2 mm	0.1 to 0.25 mm	0.5 to 1.5 mm
Effective size	0.5 to 0.6 mm	0.6 - 0.66 mm	0.61 mm
True density - g/cc	1.2	Not stated	1.5
Bulk density - g/cc	0.8	1.5	0.750
Uniform coefficient	1.5 to 1.7	1.4 to 1.7	1.7
Attrition loss per annum %(depend on water condition and pressure)	1 to 2	1 to 5	Not stated
Operating Conditions			
Water pH range Feed alkalinity, minimum	6.5 to 8.5 100 ppm	5.8 to 8.6 ------	7.0 to 7.5 >2 times EMA
Bed depth minimum	500 mm	600 mm	700 mm
Free board	40% of bed depth min.	40% of bed depth min.	40% of bed depth min.
Service	Downward	Continuous chlorination is required to remove iron	Downward
Regeneration	Not required	Not required	Not required
Activation of media	Only backwash	Sodium hypochlorite for iron and sodium hydroxide for manganese	Only backwash
Service flow rate	10 to 25 m/h	1 to 30 m/h	10 to 15 m/h
Backwash flow rate	24 to 30 m/h max.	Between 25 to 80 m/h	25 m/h
Pretreatment of water	None	Yes	None
Operating chemical cost	None	Yes (media activation)	None

SYSTEM HYDRAULICS





APPLICATIONS OF *INDION® ISR*

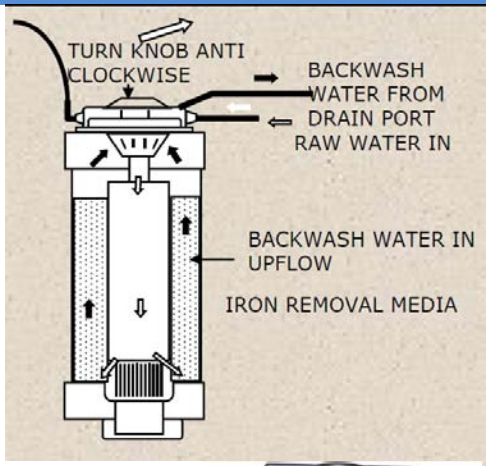
Point-of-use (POU)
- Pre treatment to drinking water systems
- Household applications like pretreatment to washing machines, bathroom showers
- Other domestic applications

HPA Unit
- Directly attach to Hand pump, ideal for rural communities. Sturdy, economical, no chemicals and electricity required. Hence, applicable in remote areas

Community Base Units
- Drinking water for residential colonies and commercial complexes
- Suitable for hospitals, hotels, schools, colleges, corporate offices and other institutions

Industrial Plants
- Pre treatment for Industrial water treatment plants
- Beverage, food processing and mineral water
- Pre treatment to cooling towers

POINT OF USE (POU) UNIT



- POU device is an online iron removal gravity filter that handles 90 litres per hour. In this mode, the knob should be in straight position.
- The raw water enters the inlet port, passes downward through the resin bed which facilitates the conversion of dissolved iron to insoluble iron.
- This precipitated iron settles down on the resin bed and water free of iron is then pushed through the bottom distributor through the riser pipe to the outlet port.
- The product water is delivered through outlet port. In this mode drain port inactive. In this way the unit delivers iron free water.
- In backwash mode, the knob should be turned anticlockwise. During backwash mode the flow of water is reversed.
- The incoming water passes through the riser pipe and flows upwards through the resin media. During this reverse flow, the resin bed and trapped dirt is loosened, precipitated iron is flushed through the drain port. There will be no water at the outlet port.

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HAND PUMP ATTACHMENT (HPA) UNIT

UNIQUE FEATURES

— Sturdy

— Economical

— Does not require electricity

— Easy to operate

— No chemicals required

— Ideal for rural applications

— Long life

— Flow of unit is 8-10 lpm

POINT OF ENTRY (POE) DEVICE

- **De-Ferrous POE** is a complete house water conditioning plant, which will be primarily connected to direct source of ground water.
- **De-Ferrous 500** has FRP vessel which contains filter media. The performance of the unit is controlled by semi automatic valve, which is mounted on the tank.
- The iron contaminated water enters through the inlet of the valve and passes through the filter media where dissolved ferrous iron is converted to ferric iron which is insoluble in water and gets trapped in the iron removal media.
- The treated water which comes out of the outlet, is devoid of excessive iron. After consistent use, the filter media gets clogged with the iron precipitate and the unit needs to be backwashed. In order to do this, the same inlet water is injected into the vessel under high pressure for 15 - 20 minutes.
- The filter media gets rubbed against each other thereby releasing the trapped iron precipitate which is washed out through the drain. Performance of De-ferrous depends entirely on the backwash. It is mandatory to do backwash regularly to ensure that you get iron free water at all times.

UNIQUE FEATURES

- Economical
- Sturdy
- Easy to operate
- Maintenance free
- Produces consistent quantity & quality of treated water.
- No Chemicals required for regeneration. Backwash is sufficient
- Ideal for rural, domestic, commercial & industrial applications

STANDARD SYSTEMS FOR DOMESTIC & INDUSTRIAL DESIGN

Model	Flow Rate (m^3/h)	Specifications
NGIF* 1	1.0	— One vertical cylindrical FRP pressure vessel. — One initial charge of under bed material and ISR resin. — One set of frontal pipe work and valves — Two pressure gauges to monitor headloss across the IRF system. — Maximum / minimum operating pressure will be 3.5 kg/cm^2 and 2.0 kg / cm^2 gm respectively. — INDION IRF systems are extended range up to 3000 mm diameters.
NGIF 2	2.0	
NGIF 5	5.0	
NGIF 7	7.5	
NGIF 10	10.0	
NGIF 12	12.0	
NGIF 15	15.0	
NGIF 17	18.0	
NGIF 20	20.0	

Note: Industrial systems available as per design specifications in mild steel pressure vessel

PACKAGING, STORAGE AND SAFETY

Packing Specifications

The resin is supplied in 180 liters of mild steel with plastic liner or in plastic drum. It can also supplied in 50 liters bags.

Storage

INDION® ISR requires proper care at all times. The media should not be stored in a dry condition. Always keep the resin drum in shade. Recommended temperature is between 20^{o} to 40^{o} C

Thank You

www.ionresins.com