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Groundwater Treatment: Iron and Manganese Removal by Biological Filtration

NAE Grand Challenges

- Access to clean and safe water is one of the most serious challenges for today's world.



Objective

PROVIDE ACCESS TO CLEAN WATER



- The aim of this work is to present the Biological Filtration Treatment-
- It is an ecologic and accessible purification treatment to remove Fe and Mn from groundwater

Map of the presentation

IRON AND MANGANESE IN GROUNDWATER

- Groundwater Characteristics
- Effects of High Concentrations of Iron and Manganese in Human Health

BIOLOGICAL FILTRATION

- Characteristics of the Method
- Advantages
- Disadvantages

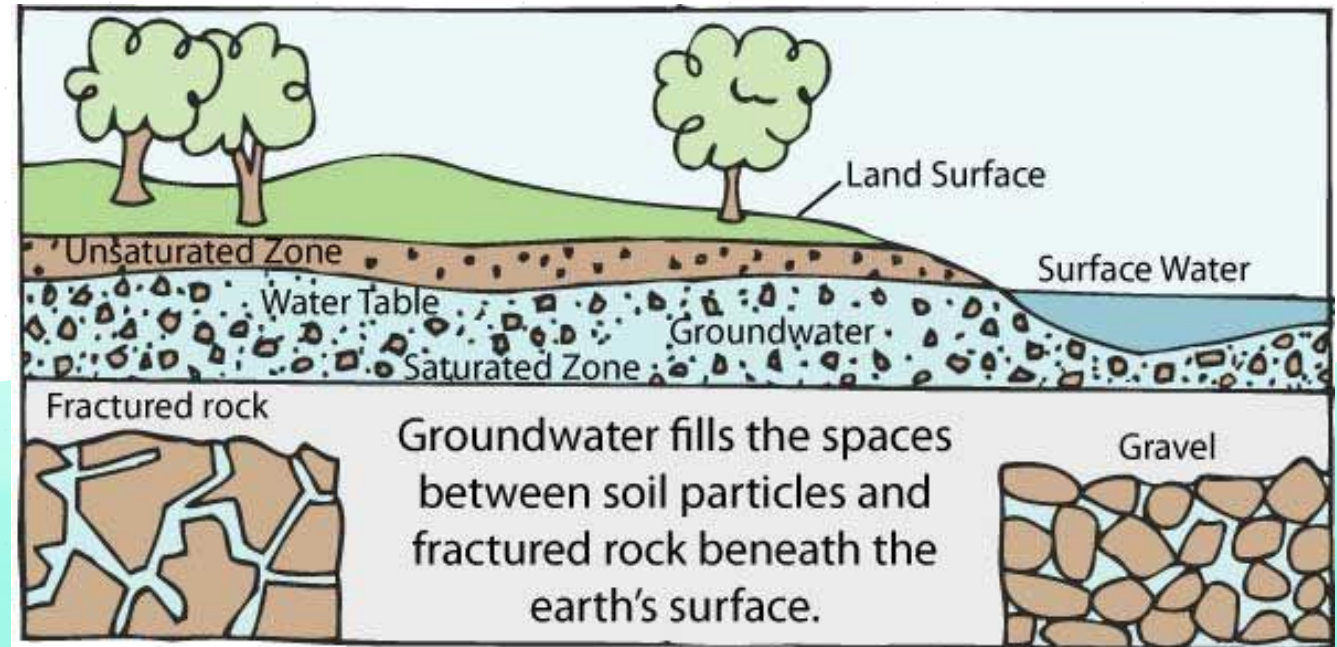
Groundwater

It is water found underground

It is stored in aquifers

It can be extracted by pumps in wells drilled to the aquifer.

It is usually contaminated by poisonous pollutants of natural origin and by human-caused contamination



Iron and Manganese in groundwater

- Fe and Mn are two of the most common contaminants found in groundwater
- They can come from various natural and anthropogenic sources.



NATURAL
DISSOLUTION OF
SUBSTANCES



INDUSTRIAL
WASTEWATER



MINING



PESTICIDES



DOMESTIC
SEWAGE



WASTE FROM
LIVESTOCK AND
FARMS

Iron and Manganese in groundwater



- Iron and Manganese in groundwater are found dissolved in the form of divalent ions.
- Water contaminated with Fe and Mn contains dark precipitates. It is a dull reddish-brown color.

Effects of High Concentrations of Fe and Mn in Human Health

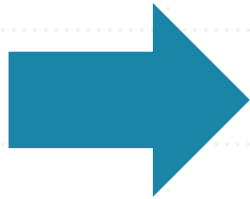
In Argentina, the recommended limits of Fe and Mn in water are 0.10mg/l for Fe and 0.05 mg/l for Mn.

Exceeding those limits can cause several health problems

- Anorexia
- Metabolic acidosis
- Vascular congestion of the gastrointestinal tract, brain, spleen and thymus
- Lung, liver, and vascular disturbances
- Decrease in blood pressure
- Brain damage
- Death

Traditional Methods To Remove Fe and Mn

- Ultrafiltration
- Coagulation
- Flocculation
- Activated carbon



- Add other chemical compounds to water

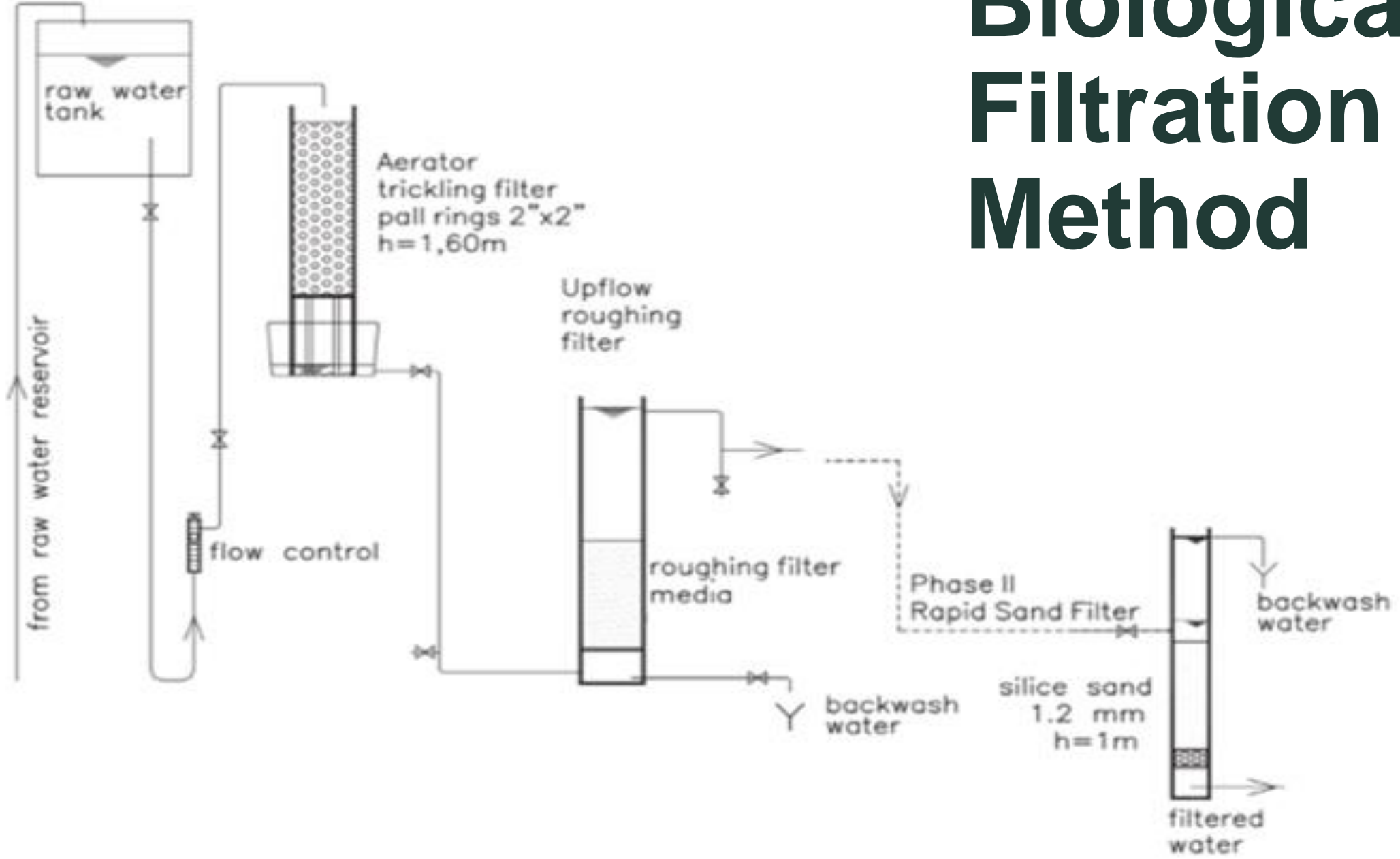


- Add operating costs
- Generate polluting sludge
chemical

Biological Filtration Method

- It is based on contact oxidation of iron and manganese oxidizing bacteria
- It uses bacteria to remove Fe and Mn from groundwater
- The bacteria can oxidize both Fe and Mn.
- Some of them are *Leptothrix*, *Crenothrix*, *Hyphomicrobium*, *Siderocapsa*, *Siderocystis*, and *Metallogenium*

Biological Filtration Method



Advantages

It functions under natural conditions

It does not use chemical agents

It does not generate contaminating chemical sludge

Removal efficiencies are between 85% and 95%

It is a viable and economical alternative

Disadvantages

It is suitable for small waterworks

It demands large quantities of filter media

It demands longer time to purify water

It demands manual labor for cleaning process

Conclusion

- Fe and Mn are two common pollutants in groundwater that have a negative impact on the human health
- The biological filtration is an alternative method that is effective and environmentally friendly
- It is a simple process that functions without the addition of chemicals
- The biofiltration is the best option for the purification of groundwater in rural areas.

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