Engineered Material for Removal of Ammonia from Water

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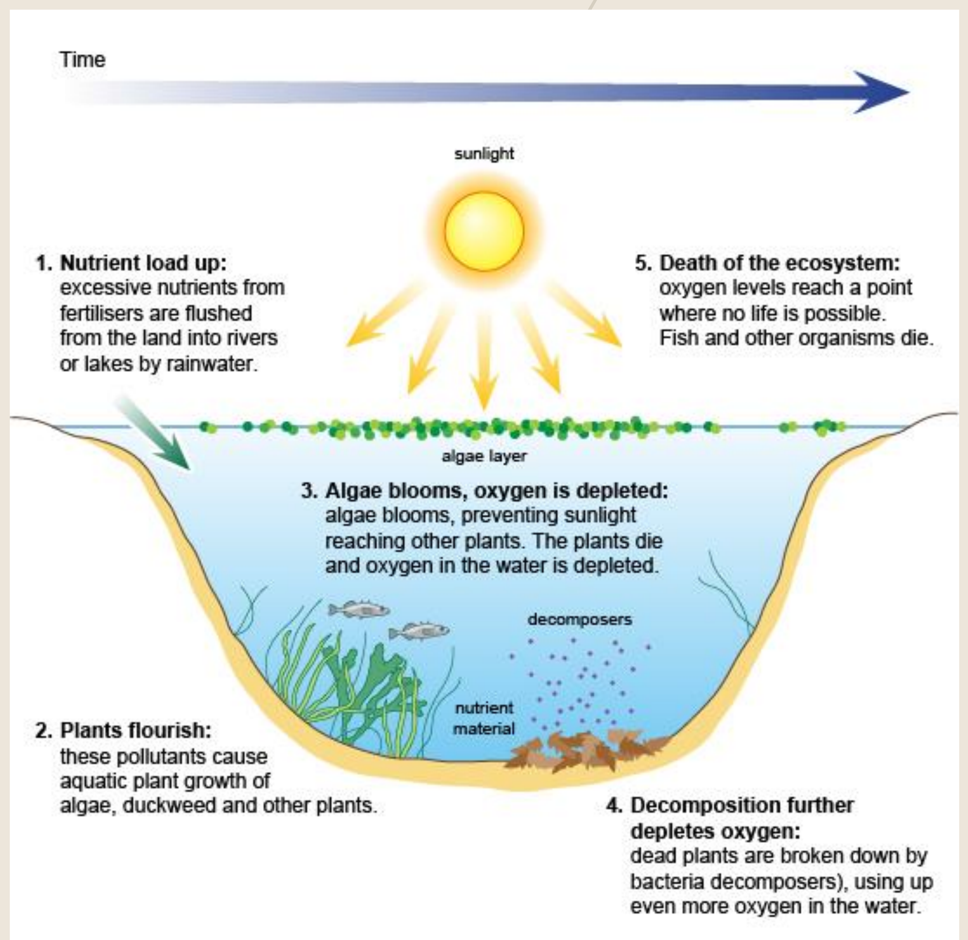
Introduction:

Ammonia: (NH_4^+) A source of nitrogen overload in rivers and lakes.

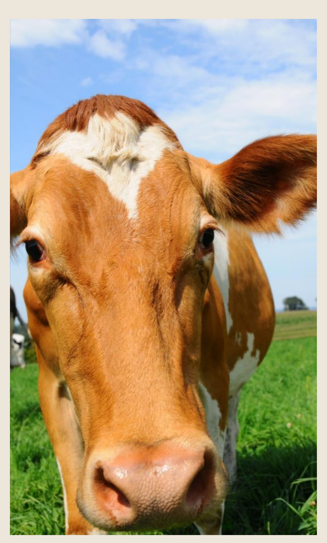
Eutrophication: The proliferation of algae due to nutrient overload (phosphorus, nitrogen). Algal blooms consume too much oxygen and can be the cause of damage to the health of these ecosystems.



Point source: An area with high amounts of nutrient discharge.

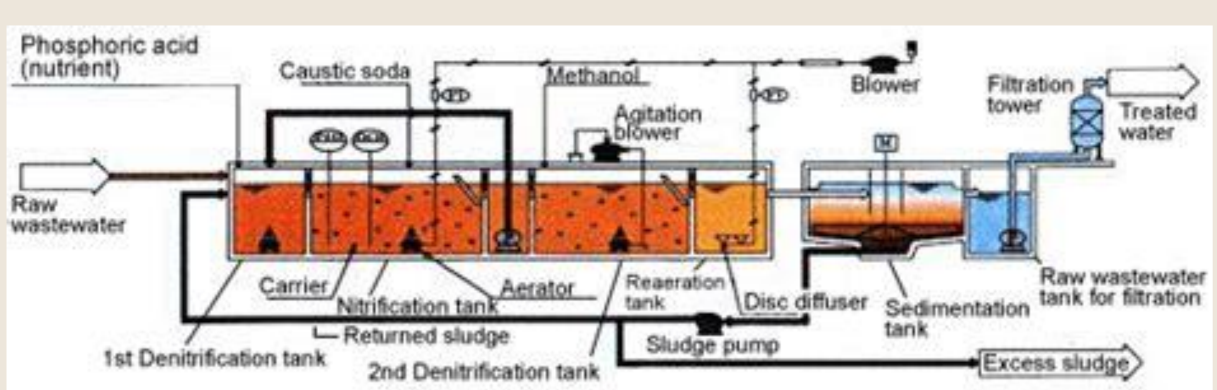
Examples:

- Agriculture
- Industry
- Wastewater Treatment



What can we do?

Nitrification: A process for removing nitrogen at point sources. Will not operate in colder climates.



Abstract:

This project intends to develop a material for removal of ammonia at point sources. It can be engineered to accept ammonia over other pollutants, which makes it a good choice for use in waters with multiple contaminants. Unlike nitrification this method may be implemented in cooler climates. This study involves optimizing adsorption kinetics and ensuring suitability for environmental applications.

Methods:

Ion-exchange: The method by which this study targets ammonia for removal from water.

Cation: Molecules like ammonia which hold a positive net charge.

Anion: Molecules holding a net negative charge.

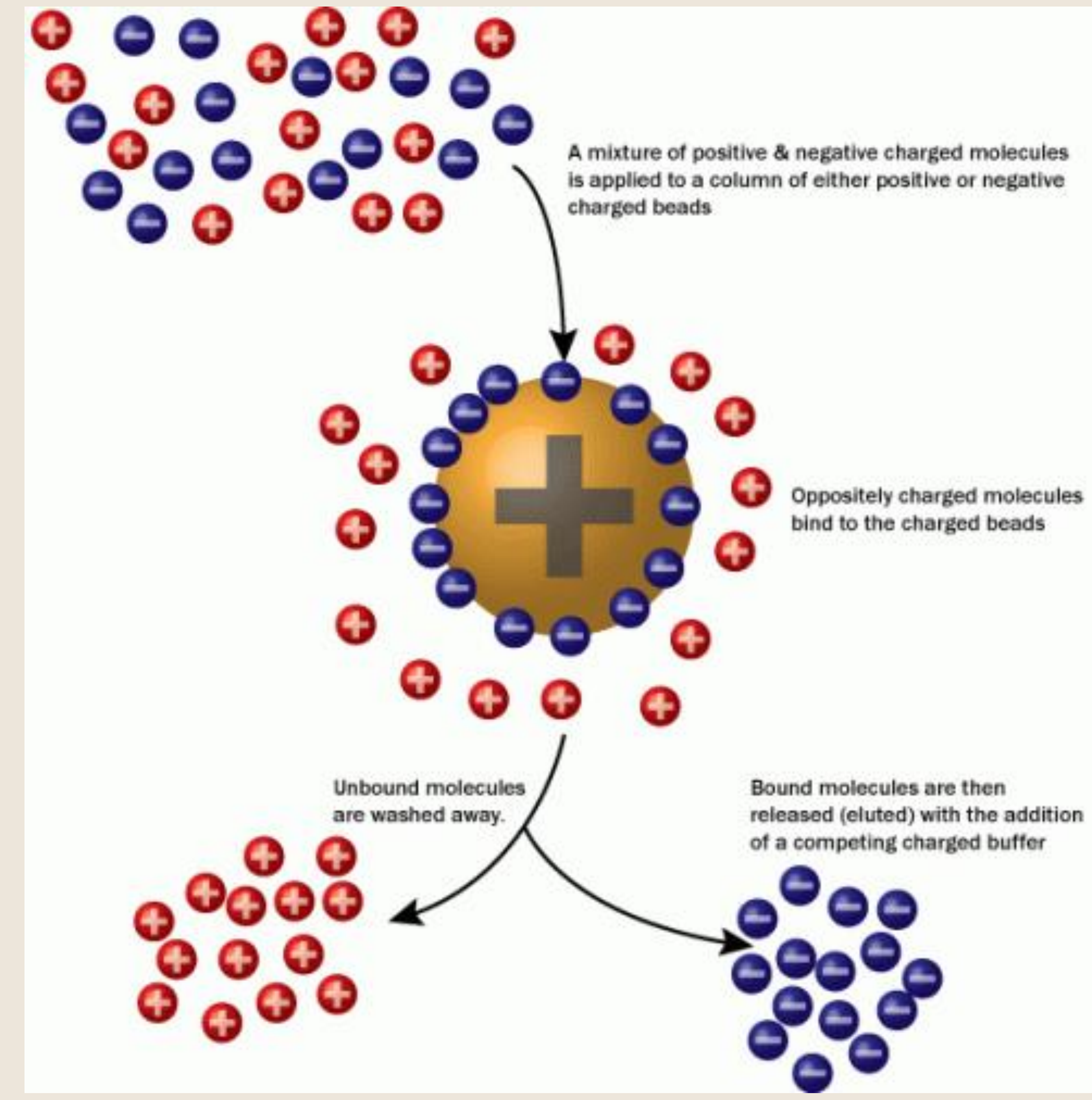
Reversibility: Exhausted exchange material may be restored to its original state and used again.

The chosen cation acceptor…

- Occurs naturally and is cheap to procure.
- Can be modified to improve performance.

The modification…

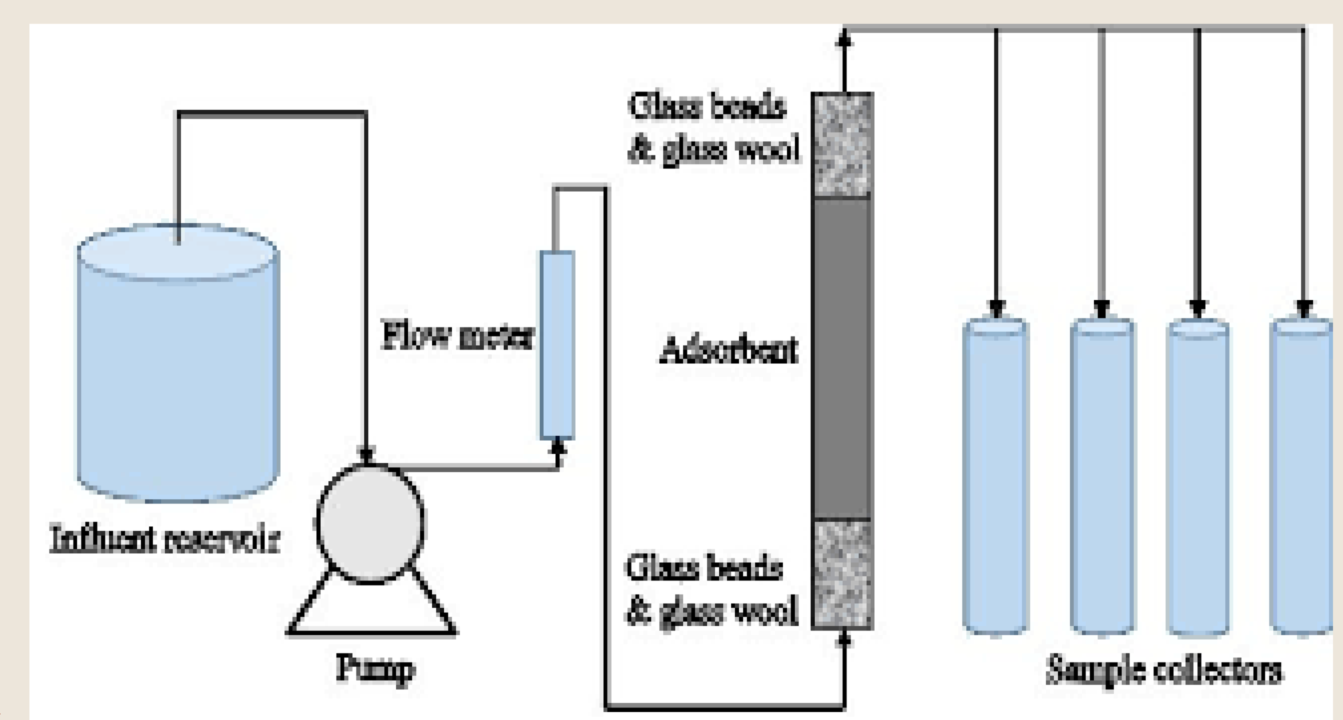
- Does not incur prohibitive cost.
- Involves two steps.
- 1.) Cleaning the particle
- 2.) Impregnating with a metal precursor at high temperatures



After regeneration, the filter is once again challenged with ammonia solution to ensure the material does not see a decrease in performance. Finally, we deploy the filter at a point source and record ammonia levels both upstream and downstream of the filter to ensure the material performs as well in the field as it did in the lab.

Experimental Design:

We challenge the modified filter with ammonia solutions of known concentration and compare it to the performance of the unmodified materials. This involves finding the amounts of ammonia adsorbed in both static and dynamic conditions.



Conclusions:

This material acts as an alternative to nitrification in cooler climates. Costs at installation and throughout the products life are low in comparison to other methods. The material's ability to be cheaply restored make it a viable alternative to nitrification in all climates.

This study is part of an initiative to alleviate issues seen in streams with high nutrient concentrations.

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