Nalgonda Technique, Process, Benefits, Limitations, Importance

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The Nalgonda Technique is an indigenous and cost-effective method developed by the National Environmental Engineering Research Institute for removing excess fluoride from drinking water

About Nalgonda Technique

- The Nalgonda Technique is an indigenous, low-cost method for defluoridation of drinking water.
- It was developed by the National Environmental Engineering Research Institute (NEERI), Nagpur, after systematic research beginning in the early 1960s.
- It is named after Nalgonda, a district in Telangana, that historically reported high levels of fluoride contamination and widespread fluorosis.

Nalgonda Technique Background

Fluoride contamination of groundwater is a major public health issue in India, particularly in arid and semi-arid regions. While fluoride up to ~1.0 mg/L is beneficial for dental health, concentrations above permissible limits (1.5

mg/L as per BIS) lead to dental and skeletal fluorosis.

India’s dependence on groundwater, combined with geological conditions, has made defluoridation a critical requirement. In this context, the Nalgonda Technique emerged as a community-friendly and economically viable solution, especially for rural areas.

Nalgonda Technique Process

The Nalgonda Technique is based on the principles of coagulation, flocculation, and precipitation. When aluminium salts are added to water, they undergo hydrolysis to form aluminium hydroxide flocs, which possess a high surface area and adsorb fluoride ions. The fluoride is subsequently removed through sedimentation and filtration along with these flocs.

- Initially, calculated doses of aluminium salts (such as alum or aluminium chloride), lime, and bleaching powder are added to the raw water.
- Aluminium salts act as the primary coagulant for fluoride removal, lime aids in floc formation and alkalinity adjustment, and bleaching powder serves as a disinfectant.
- Rapid mixing is then carried out to ensure uniform dispersion of the added chemicals.
- This is followed by flocculation, during which micro-particles aggregate to form larger flocs.
- These flocs adsorb and enmesh fluoride ions present in the water.
- The water is then allowed to remain undisturbed for sedimentation, enabling the flocs to settle at the bottom.
- The supernatant (clear water) is subsequently separated through filtration.
- Finally, the treated water undergoes disinfection to make it suitable for potable use.

Advantages of Nalgonda Technique

The Nalgonda Technique offers several practical advantages, especially in the context of rural water supply and fluoride-affected regions.

- The Nalgonda Technique is low-cost, making it suitable for rural and resource-poor areas.
- It uses chemicals that are easily available and inexpensive.
- The method is simple to operate and does not require advanced technology.
- It can work even without electricity in basic setups.
- It is flexible and can be used at household, community, and large-scale levels.
- Because of its simplicity and affordability, it has been widely used in fluoride-affected regions.

Limitations and Concerns of Nalgonda Technique

Despite its widespread use, the Nalgonda Technique has several limitations and concerns that affect its efficiency and long-term safety.

- The technique requires daily and accurate addition of chemicals, which needs trained handling.
- It produces a large amount of sludge, creating disposal and environmental issues.
- It is less effective in water with high total dissolved solids and high hardness.

- A large part of fluoride forms soluble aluminium complexes instead of being fully removed.
- Only a small portion of fluoride is removed as solid precipitate, reducing efficiency.
- Residual aluminium may remain in treated water, which can be harmful to health.
- Long-term exposure to high aluminium levels may lead to neurological problems.

To address the limitations of the Nalgonda Technique, several improvements and alternatives have been developed. Modified coagulants such as Poly Aluminium Chloride (PAC) and Poly Aluminium Hydroxy Sulphate (PAHS) are being used to enhance the efficiency of fluoride removal. In addition, adsorption-based methods, particularly those using activated alumina, have proven to be more effective in removing fluoride. Researchers are also exploring low-cost materials like brick powder as alternative adsorbents, especially for rural applications. These newer approaches aim to reduce sludge generation, improve safety, and provide more efficient defluoridation solutions, making them suitable for both household and small community-level use.
