

# NitriFire™ Nitrifying Bacteria

## Ignite nitrification in your WWTS



### Product Description

**NitriFire** is a blend of *Nitrosomonas* and *Nitrobacter spp.* bacteria designed to supplement nitrification in municipal and industrial wastewater treatment systems. It can be applied to activated sludge systems, aerated lagoons, fixed film bioreactors, and sequencing batch reactors. **NitriFire** can supplement nitrifying systems not meeting their desired level of nitrification, to establish nitrification during system startups, or re-establish nitrification following system upsets or shutdowns.

Many commercial nitrifier formulations only contain *Nitrosomonas* strains and only impact the first step (ammonia oxidation) of the process. By including *Nitrobacter*, **NitriFire** addresses elevated nitrite (aka nitrite lock) and facilitates completing the reaction to nitrate.

Nitrifiers are slow growing organisms and cannot be stabilized in spores or a dry form. EBS ships product on icepacks via overnight courier to ensure prompt delivery of the highest quality product. The shelf life for **NitriFire** is three months when refrigerated, even if the container has been opened and partially used. Product has >50% activity for up to six months. Stability testing shows that the EBS **NitriFire** formulation will continue to meet specification if accidentally left unrefrigerated for up to 48 hours.

### Key Product Features

- Balanced ratio of Ammonia Oxidizing Bacteria (AOBs) and Nitrite Oxidizing Bacteria (NOBs).
- 1.25-gallon jugs available for cost effective application in systems of all sizes.
- State-of-the-art QA/QC using the dual techniques of both respirometric ammonia and nitrite oxidation measurement as well as chemical conversion measurement.
- Regular DNA sequencing to ensure the presence of desired microorganisms and identification of any undesirable ones.
- High purity products with less heterotrophic contamination to improve stability and shelf life even once the package is opened.

### Application Rate and Feeding

The **NitriFire** application rate is directly based on the amount of nitrification improvement needed in pounds per day nitrogen (ammonia + nitrite). The unique balance of AOBs and NOBs in **NitriFire** allows you to address limitations in both ammonia oxidation and nitrite

oxidation with a single product. The recommended application rate is one pound of product per 5-10 pounds of desired improvement in nitrogen conversion. Typically, EBS recommends a three-day application based on the initial amount of ammonia and/or nitrite needing to be converted.

To determine the required amount to order and apply, follow these steps:

1. Determine the pounds of ammonia/nitrite to be treated:  
 $(\text{Effluent Flow in MGD}) \times (\text{mg/L NH}_3\text{-N} + \text{NO}_2\text{-N in effluent}) \times 8.34 = \text{lbs./day of untreated ammonia and nitrite to be removed.}$
2. Divide the number of pounds of untreated nitrogen by 5 to determine the daily application rate.
3. Multiply the daily application rate by 3 to determine the three-day requirement.

### Example Calculation

Effluent Flow = 1.5 MGD

Effluent Ammonia = 15 mg/L

Effluent Nitrite = 6 mg/L

Target effluent ammonia + nitrite = 1 mg/L

Total nitrogen to be removed =  $15 + 6 - 1 = 20 \text{ mg/L}$

a.  $(1.5 \text{ MGD}) \times (20 \text{ mg/L}) \times 8.34 = 250 \text{ lbs./day N}$

b.  $(250 \text{ lbs./day N}) \div (5 \text{ lbs. N per lb. product}) = 50 \text{ lbs./day product addition}$

c.  $(50 \text{ lbs./day}) \times 3 \text{ days} = 150 \text{ lbs. needed for application}$



## Product Specifications

**Ammonia Conversion Rate:**  $\geq 500$  mg/L  $\text{NH}_3 - \text{N}$  per hour per kg of product.

**Nitrite Conversion Rate:**  $\geq 100$  mg/L  $\text{NO}_2 - \text{N}$  per hour per kg of product.

**Genus/Species:** *Nitrosomonas/Nitrobacter spp.* – Class One Organisms.

**Product Form:** Liquid Slurry

**Appearance:** Rose to Brownish Red in color.

**Odor:** Musty

**Product Density:** 8.41 lbs./gallon

**pH:** 6.7 – 7.4

**Boiling Point:** 212°F (100°C)

**Freezing Point:** 32°F (0°C) - Do not allow product to freeze.

**Shelf Life:** Three months when refrigerated at 34-38°F (1.1-3.3°C), and maintains >50% activity for up to 6 months. Do not freeze.

**Packaging Specifications:** Standard packaging for NitriFire products is 1.25-gallon jugs containing 10 pounds of product.

of the rate at 86°F (30°C). Temperatures above 113°F (45°C) will significantly inhibit nitrification. Below 50°F (10°C), nitrification often ceases but will recover when the temperature increases.

- **Alkalinity and pH:** The optimal pH range for nitrification is 7.2-8.0 with values above 8 more desirable than values below 7.2. Alkalinity is consumed at a rate of 7.14 mg of alkalinity as  $\text{CaCO}_3$  for every mg of ammonium ion oxidized. It is important to maintain adequate alkalinity in the aeration tank to provide pH stability and inorganic carbon for the nitrifying bacteria. A good target is to maintain a minimum residual alkalinity of 50 mg/L in the aeration tank after complete nitrification.
- **Mean Cell Residence Time (MCRT or Sludge Age):** Due to their slower growth rate, nitrification generally requires longer Mean Cell Residence Time (MCRT), which is the average number of days that microorganisms are kept in the activated sludge process. This is exacerbated by cold temperatures, so in winter months, an increase in MCRT by reducing the wasting (WAS) rate and/or adding supplemental nitrifiers is often required to maintain effective nitrification.
- **Inhibition/Toxicity:** Both *Nitrosomonas* and *Nitrobacteria* are more susceptible to inhibition and toxicity than heterotrophs. Many heavy metals (Cu, Cr, Ni, and Zn), quaternary amines, and phenolic compounds can be inhibitory at amounts sometimes lower than 0.25 mg/L. Some soluble forms of biodegradable compounds can inhibit the activity of nitrifying bacteria at concentrations well below the inhibitory threshold of heterotrophs.

## Necessary Environmental Conditions

A healthy and stable population of nitrifiers (*Nitrosomonas* and *Nitrobacter*) requires meeting the following conditions:

- **Influent BOD:N Ratio:** Carbonaceous BOD conversion and biomass formation (sludge yield) requires approximately 5 pounds of  $\text{NH}_3\text{-N}$  per 100 pounds of BOD converted. Systems operating under ammonia deficient conditions, (i.e. BOD:N  $\ll$  100:5) will not support nitrification.
- **BOD Loading (F:M Ratio):** Nitrifiers depend on heterotrophs to reduce cBOD to relatively low concentrations (<40-50 mg/L). Excess BOD (high F:M ratio) can create high carbonaceous oxygen demand, which may cause a drop in DO that adversely affects nitrifying bacteria. Fluctuations in BOD loading may lead to intermittent nitrification.
- **Oxygen:** The minimum acceptable level of dissolved oxygen (DO) to support nitrification is approximately 1.0 mg/L with >2.0 mg/L DO considered optimum. These levels are dependent on the F:M ratio, as higher heterotrophic activity generates more competition for available oxygen. Nitrification generally halts at <0.5 mg/L DO with anaerobic conditions inhibiting nitrification.
- **Temperature:** Nitrification is temperature sensitive. The optimum temperature for nitrification is often reported as 82 – 96°F (28 – 36°C). At 60°F (15°C), the nitrification rate is approximately 50%

## Additional Technical Support

We are recognized as experts in identifying and troubleshooting nitrification problems in activated sludge systems, particularly in petrochemical plants, oil refineries, and meat/poultry processing facilities. EBS capabilities include data review and on-site troubleshooting to provide a comprehensive approach to wastewater treatment optimization.

The EBS Microbiology lab can monitor the biological health of your system over time via microscopic exams and flow cytometry to assess total and live bacterial cell counts. The EBS Advanced Analytical Lab employs state-of-the-art instrumental techniques to analyze for over 100 organic and inorganic compounds known or suspected of being toxic or inhibitory to nitrification. These value-added services, in conjunction with our product offerings, create a unique value proposition for clients while ensuring that product application provide maximum impact and cost effectiveness.

**To determine if NitriFire is right for your application, please contact EBS at (985) 674-0660 or at [info@ebsbiowizard.com](mailto:info@ebsbiowizard.com).**

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