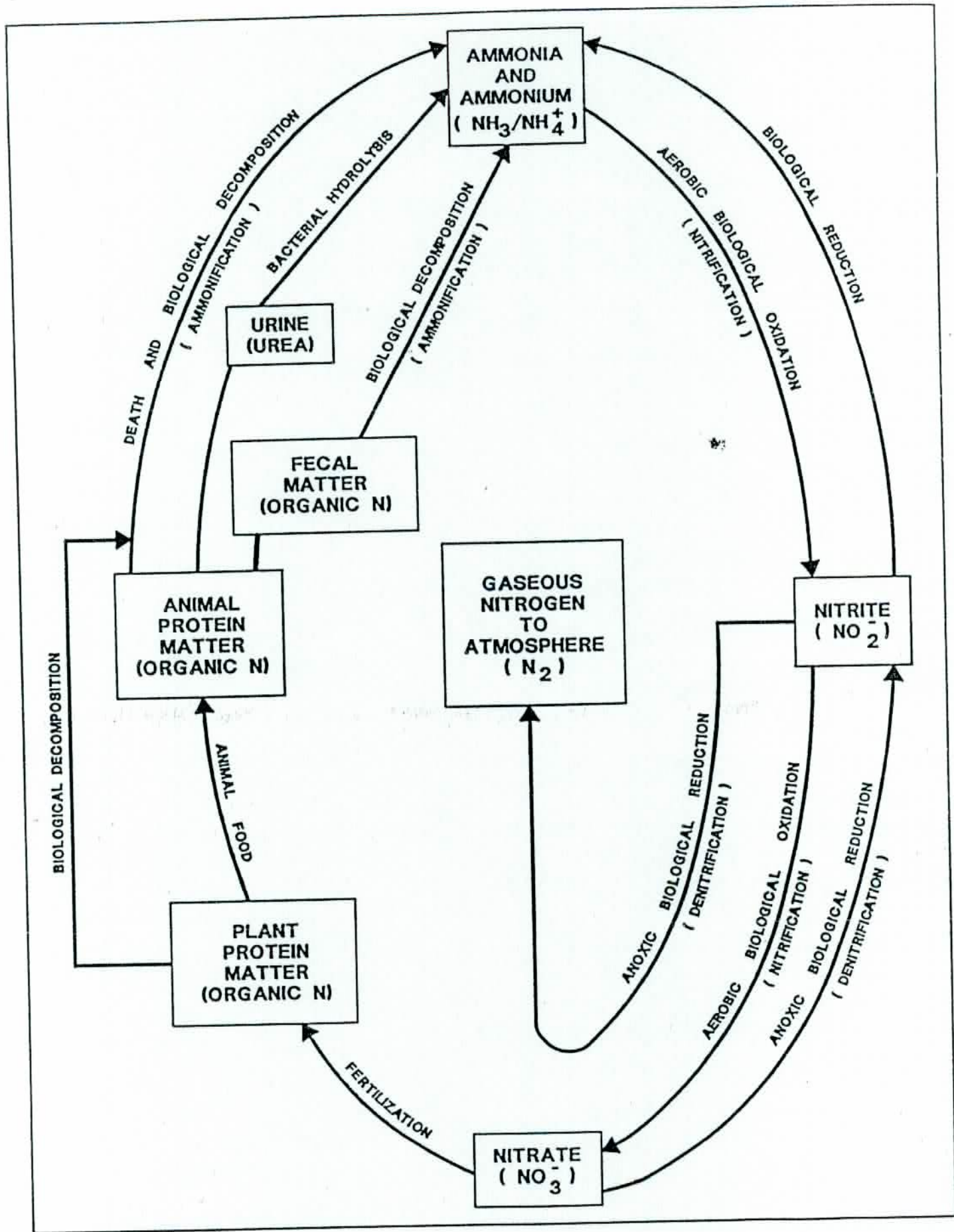


# Nitrogen Cycle

## Nitrification Process

*ifm*



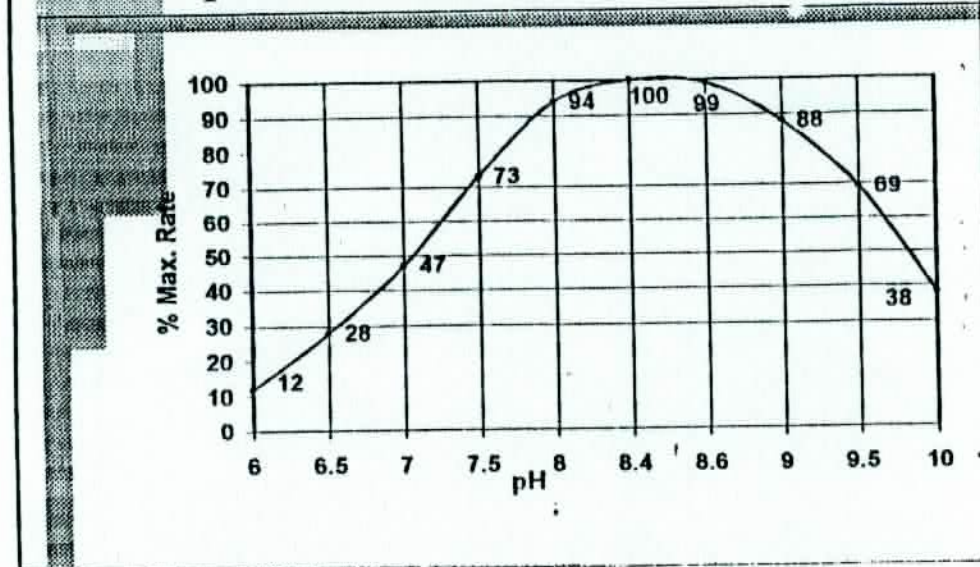
**NITROGEN CYCLE IN WASTEWATER TREATMENT**

## *Nitrification*

- *Nitrifying bacteria, Nitrosomonas and Nitrobacter, are as different from the bacteria found in the 1000 and 2000 Series of products as plants are from animals.*
- *The process involves the conversion of an inorganic food source to an inorganic end product, i.e.,  $\text{NH}_4$  to  $\text{NO}_2^-$  to  $\text{NO}_3^-$ .*

## Nitrification

### *pH vs. Nitrification Rate*



Note the significant decrease in the maximum attainable rate of nitrification between the pH range of 6.9 - 7.2, where most municipal mixed liquors operate, and a pH of 6.5.

A nitrification induced pH drop from 7.0 to 6.5, caused by insufficient alkalinity, could result in process failure.



## Nitrification

### Alkalinity

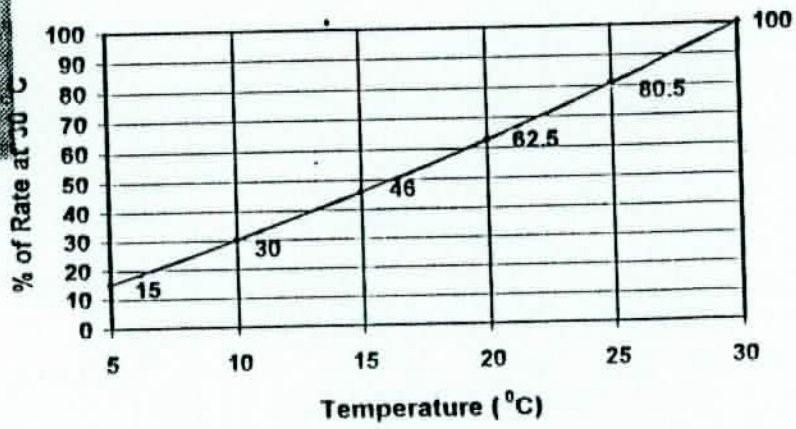
- Carbonate,  $\text{CO}_3^{2-}$ , is the 1<sup>o</sup> carbon source for nitrifiers.
- Nitrification produces an acidic anion, nitrate ( $\text{NO}_3^-$ )
- Inadequate buffering will result in a potentially inhibitory drop in pH.
- 7.14 lbs of alkalinity ( $\text{CaCO}_3$ ) is consumed per pound of  $\text{NH}_4\text{-N}$  converted to  $\text{NO}_3^-$ .

Nitrifiers, like plants, derive carbon from inorganic sources. Therefore, the use of carbonate-based chemicals is recommended for amending alkalinity deficiencies in non-nitrifying systems.

The classic alkalinity ratio prevents a *drop* in pH. If the pH in a non-nitrifying system is in the 7.5 - 8.0 range, there may be some room to absorb a small drop in pH before inhibition becomes a concern. This can reduce chemical costs.

*Nitrification*

*Temp. vs. Nitrification Rate*



Biological reaction rates, like chemical reaction rates, decrease approximately 50% for every 10 °C decrease in temperature.

## *BOD:TKN Ratios*

- *TKN measures organic nitrogen and ammonia.*
- *Most TKN may be converted to ammonia.*
- *The ratio is important for separate stage processes.*

A separate-stage process is one in which carbonaceous BOD removal and nitrification occur in separate aeration basins.

*Nitrification*

*BOD:TKN Ratios*

<b>BOD:TKN Ratio</b>	<b>Nitrifier Fraction</b>	<b>Nitrification Rate</b>	<b>Nitrification Effluent</b>
<b>&gt; 3.0</b>	<b>Low</b>	<b>Low</b>	<b>Clear</b>
<b>2.0 - 3.0</b>	<b>Moderate</b>	<b>Moderate</b>	<b>Clear</b>
<b>&lt; 2.0</b>	<b>High</b>	<b>High</b>	<b>Turbid</b>