

# AMMONIA

## NH<sub>3</sub>

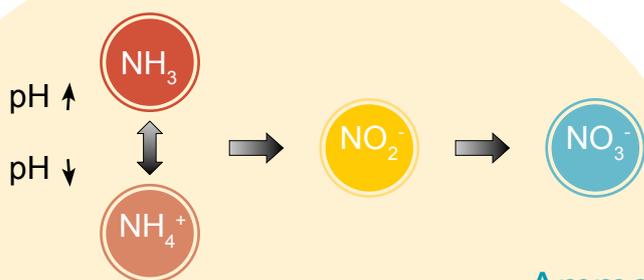
### Ammonia & Fish

Urea (eventually degrading to ammonia and bicarbonate) and ammonia are the main nitrogenous breakdown products of protein catabolism in animals. Most biological membranes are permeable to ammonia but relatively impermeable to ammonium ions. As such, toxicity of total ammonia (the sum of NH<sub>3</sub> and NH<sub>4</sub><sup>+</sup>) increases with pH as the proportion of NH<sub>3</sub> increases with pH. In 35 freshwater fishes studied the average **acute toxicity** value for ammonia is **2.79 mg NH<sub>3</sub>/l** (Randall & Tsui, 2002). Elevated ammonia levels in the water lead to intoxication of the fish affecting its central nervous system and causing convulsions and death.



### Ammonia & Plants

Ammonia/ammonium is a paradoxical nutrient for plants. It is a natural nitrogen source but it may also result in toxicity symptoms in high concentrations. Symptoms of ammonium toxicity may already appear with external NH<sub>4</sub><sup>+</sup> concentrations above 0.1 to 0.5 mmol/l (1.8 to 9 mg/l) resulting in chlorosis of leaves (often related to competition with Mg<sup>2+</sup> uptake), overall suppression of growth and even death (Britto & Kronzucker, 2002).



### Ammonia & Aquaponics

In an aquaponics setup it is **best practice to convert ammonia** (over nitrite) to nitrate with the aid of nitrifying bacteria in a biofilter, since NO<sub>3</sub> is less toxic to fishes and more readily assimilable by plants. Assess the well-functioning of your biofilter by monitoring the ammonia concentration on a weekly basis. In case of a suddenly increased ammonia concentration partially refresh the water from the system to dilute the amount of ammonia to below harmful levels (<1 mg NH<sub>3</sub>/l).

*References cited:*

Britto D.T., Kronzucker H.J. (2002) NH<sub>4</sub><sup>+</sup> toxicity in higher plants: a critical review. *Journal of Plant Physiology* 159: pp 567-584.  
 Randall D.J., Tsui T.K.N. (2002) Ammonia toxicity in fish. *Marine Pollution Bulletin* 45: pp 17-23.

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