

# [Nitrogen into another organic compound (moir, 2011).](https://assignbuster.com/nitrogen-into-another-organic-compound-moir-2011/)

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Nitrogen cycle involves the movement of chemical substances between organisms and our surrounding. Nitrogen cycle needs to be made known to all people because nitrogen is very important to all living organisms. Nitrogen is the most abundant element on planet Earth. Nearly 78% of atmosphere is made up of nitrogen gas.

In human, nitrogen can be found in amino acids, in nucleic acids, in adenosine triphosphate (ATP), and in other compounds. Nitrogen is a necessary part of several cells and processes. Plants also need nitrogen to make chlorophyll so that they can get their own food. Atmospheric nitrogen cannot be used directly by plants and animals because it is so unreactive, so it needs to be converted first. However, plants can take nitrogen compound such as nitrates directly. Then, the animals will eat these plants, therefore providing them with nitrogen source. The conversion of nitrogen can perform in few ways.

Some of the processes in nitrogen cycle are nitrogen fixation, nitrification, assimilation, ammonification, and denitrification . The first step in nitrogen cycle is the nitrogen fixation process. The nitrogen will first deposit into the soil and water surface by precipitations such as rain or snow. Once in the soils and water surface, nitrogen goes through few changes. Two atoms of nitrogen will then separate and combine with hydrogen, forming ammonia (NH4+). Nitrogen fixation is done mostly by symbiotic bacteria, and some of it can also occur by the strike of lightning (Bernhard, 2010). These bacteria contain an enzyme called nitrogenase that helps in combining nitrogen gas with hydrogen and producing ammonia.

The bacteria will then convert it into another organic compound (Moir, 2011). Majority of biological nitrogen fixation occurs by the activity of Mo-nitrogenase, which can be found in widely in bacteria and some Archaea (Moir, 2011). One example of free-living bacteria is Azotobacter. The symbiotic nitrogen-fixing bacteria like Rhizobium often live in the root nodules of legumes.

They will form a symbiotic relationship, specifically mutualistic relationship with the plant by producing ammonia in order to get carbohydrate. The result of this relationship, the legumes will increase the nitrogen content of nitrogen-poor soils. The next step in nitrogen cycle is nitrification process.

Even though ammonia can be used by some plants, most of the nitrogen taken up by plants need to be converted from ammonia into nitrite (NO2-) and then into nitrate (NO3-) (Harison, 2003). Soil-living bacteria and other nitrifying bacteria help in the conversion of ammonium to nitrate (Bernhard, 2010). This nitrate can then be used by orher species of phytoplankton. Larger organisms such as fish and whale take in nitrogen by eating these phytoplanktons. Bacteria such as Nitrosomonas species helps in the oxidation of ammonium, from ammonia to nitrites at the very first stage (Bernhard, 2010). Meanwhile, the oxidation of nitrites into nitrates is done by Nitrobacter species (Bernhard, 2010).

The conversion of ammonia is important because ammonia gas is very poisonous.  The third stage of the nitrogen cycle is assimilation. The uptake of nitrogen compound by the organisms like plants, fungi, and bacteria that cannot fix the nitrogen gas, for all sort of things is known as assimilation. The nitrogen compound is converted into more simpler complexes such as amino groups and nitrogen-containing compounds.  Example of nitrogen compound is nitrate, nitrite, ammonia, and ammonium. Nitrate and nitrite are absorbed by the plants from the soil through their root hairs.

If nitrate is absorbed, it is first reduced to nitrite ions and then ammonium ions for incorporation into amino acids, DNA (deoxyribonucleic acid), and chlorophyll (Smil, 2000). Chlorophyll is the green pigment in the leaves function in photosynthesis process by absorbing the light energy from the sunlight and convert the light energy into chemical energy. The plant provides amino acids to the bacteroids so ammonia assimilation is not needed and the bacteroids pass amino acids (with the newly fixed nitrogen) back to the plant, thus forming an interdependent relationship ( Willey & Joanne, 2011). Herbivores will consume the plants and the nitrates and nitrites inside the plant automatically being transfer into their body.

The fourth stage of the nitrogen cycle is ammonification, also known as mineralization. Ammonification is also referred as the decaying process. Animal wastes died plants and animals will release nitrogen in the organic form. Saprotrophic fungi and bacteria convert the nitrogen into ammonium ions (NH4) through ammonification process.

The saprotrophs need the ammonium to produce their own proteins and other nitrogen-containing organic compounds. Ammonium is an important source of nitrogen for many plant species, especially those growing on hypoxic soils. However, it is also toxic to most crop species and is rarely applied as a sole nitrogen source. (Britto & Kronzucker, 2002). Ammonium ions produced can be used by plants in another biological process. There are a few enzymes involved in this stages. For example, Gln Synthetase (Cytosolic & Plastic), Glu 2-oxoglutarate aminotransferase (Ferredoxin & NADH-dependent) and Glu Dehydrogenase. The ammonia secreted is crucial for the next step of the nitrogen cycle, either for nitrification or assimilation.

The last stage in nitrogen cycle is denitrification. Denitrification is the elimination of nitrogen compounds by reducing the nitrates or nitrites, results in the escape of nitrogen back to the environment. Through denitrification, dinitrogen (N2) and nitrous oxide gas (NO2) is converted from an oxidized form of nitrogen such as nitrite (NO2-) and nitrate (NO3-). Similar to nitrogen fixation, denitrification is carried out by a diverse group of prokaryotes, and there is recent evidence that some eukaryotes are also capable of denitrification (Risgaard-Petersen et al. 2006). In general, some species of bacteria are involved in the complete reduction of nitrate to N2, and many enzymatic pathways has been identified in the reduction process.

Two examples of denitrifying bacteria involved in this step which is Pseudomonas and Clostridium that take place in aerobic conditions such as deep soils and deep water. Aerobic conditions typically occur in anoxic environments, where the concentration of the oxygen is very low. The conversion of nitrate to dinitrogen in the following sequence: NO3- ? NO2- ? NO ? N2O ? N2 Both nitrous oxide (N2O) and nitric oxide (NO) gases that are released into the air will give impacts to the environment. Nitric oxide contributes to a photochemical haze (smog) due to the action of ultraviolet radiation on atmosphere polluted with and oxides of nitrogen. While the nitrous oxide is crucial as it is one of the greenhouse gas that contributes to the global climate change.

Greenhouse gas (GHG) are gases in the atmosphere that take in and release the radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Once the nitrogen compounds converted to dinitrogen, it will be released to the environment. The nitrogen is unlikely to be converted back to another form because it presents in the form of gases and is rapidly lost to the atmosphere.

Denitrification is an irreversible process and it is the only process that will remove nitrogen from the ecosystems.