

NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

Nitrogen cycle and its importance for living beings

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YEAR : 2020  
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## ACKNOWLEDGEMENT

In the completion of this project successfully many people supported me. I would like to thank our environmental science teacher Souvik Bhattacharya for helping me in enrichment of knowledge about nitrogen cycle. I would also like to thank my friends, classmates and relatives for supporting me while doing this project.

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## INTRODUCTION

Nitrogen is a colourless and odourless gas which is available in the environment in different forms. It is the most abundant element as approximately 78% of the atmosphere is nitrogen. It is important to all living beings including us. It plays an important role in plant growth as well as in producing amino acids which is essential for DNA. This nitrogen comes to our body when we intake the plants as food. When we die, this nitrogen again goes to the soil which is intaked by plants. So we can see that there is a series of processes by which nitrogen and it's compounds are interconverted in the environment and in the living organisms which is called the Nitrogen Cycle.

## NITROGEN CYCLE

The Nitrogen cycle is a repeating cycle of processes during which nitrogen moves through the atmosphere, soil, water, plants, animals and bacteria. In atmosphere, nitrogen exists as gas ( $N_2$ ), but in soil it exists as its oxides. In fertilizer it can be found in the form of ammonia or ammonium nitrate. There are different stages of nitrogen cycle which are described below.

Nitrogen Fixation: In this stage nitrogen moves from the atmosphere into the soil. The different process of nitrogen fixation in soil are

- 1) Sometimes lightening provides the activation energy for the reaction of gaseous nitrogen with oxygen to form different oxides of Nitrogen such as  $NO, NO_2$  etc.
- 2) By Industrial process a few amount of nitrogen compound is formed in the form of fertilizer such as ammonia.
- 3) But mostly nitrogen fixation occurs naturally by the bacteria. Some bacteria attach to plant roots and have a symbiotic relationship with plant. The bacteria get energy through photosynthesis and in return fix nitrogen into a form the plant needs. They fix nitrogen into a form the plant needs. For example root exudates from legume plants like peas, clover, soybeans etc serve as a signal to certain species of Rhizobium, which are nitrogen fixing bacteria. This signal attracts the bacteria to the roots. Some of these bacteria

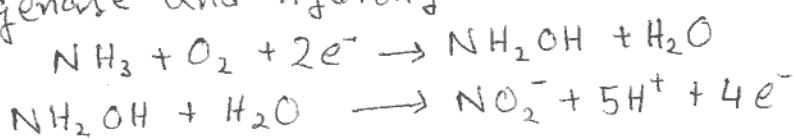
are aerobic, some are anaerobic. Some are phototrophic, some are chemotrophic. But they all have similar enzyme complex called nitrogenase which catalyzes the reaction of  $N_2$  to  $NH_3$  (ammonia). The fixed nitrogen is then carried to other parts of plants to form plant tissues.



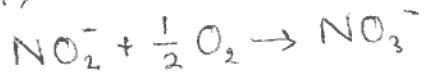
Nitrogen fixing nodules on a clover plant root

Nitrification: This stage also occurs in soil. During nitrification, the ammonia of the soil is converted into compounds like nitrites ( $NO_2^-$ ), Nitrates ( $NO_3^-$ ) etc. Most nitrification occurs aerobically and carried out exclusively by prokaryotes.

The first step is the oxidation of ammonia to nitrite, which is carried out by microbes known as ammonia-oxidizers. Aerobic ammonia oxidizers convert ammonia to nitrite via the intermediate hydroxylamine, a process that requires two different enzymes, ammonia monooxygenase and hydroxylamine oxidoreductase.



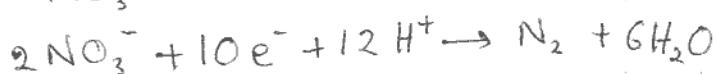
The second step of nitrification is the oxidation of nitrite ( $\text{NO}_2^-$ ) to nitrate ( $\text{NO}_3^-$ ). This step is carried out by a completely separate group of prokaryotes, known as nitrite-oxidizing bacteria. Some of the genera involved in nitrite oxidation include Nitrospira, Nitrobacter, Nitrococcus and Nitrospina.



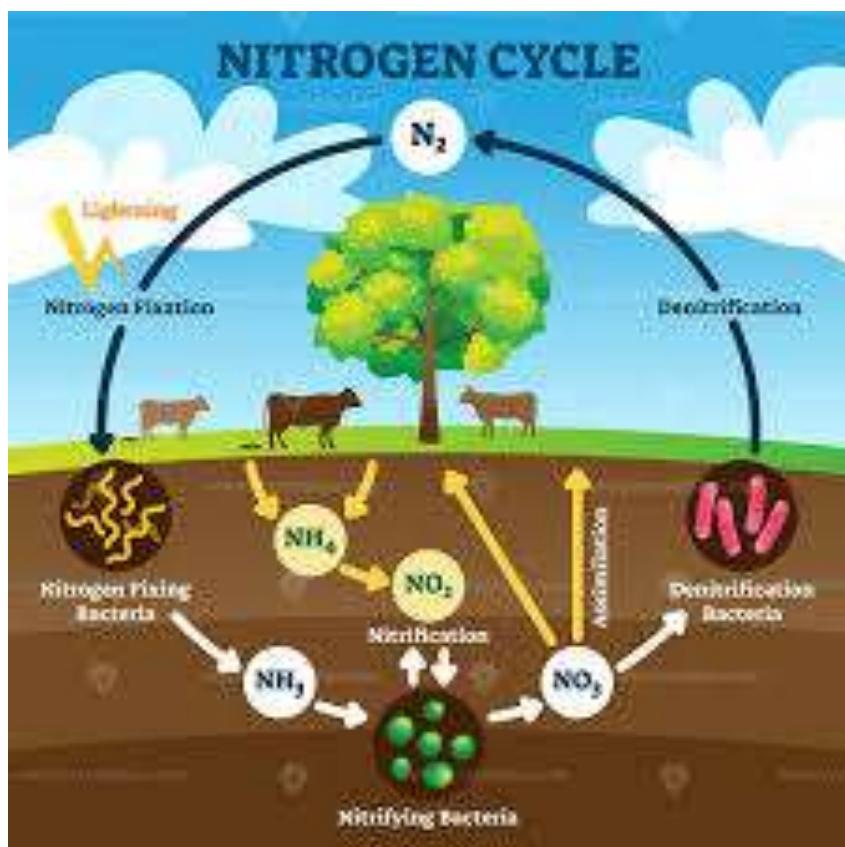
The process of nitrification is important to plants, as it produces an extra stash of available nitrogen that can be absorbed by the plants through their root systems.

Assimilation: Primary producers - plants take in the nitrogen compounds from the soil with the help of their roots, which are available in the form of ammonia, nitrite ions, nitrate ions or ammonium ions and are used in the formation of the plant and animal proteins. This way, it enters the food web when the primary consumers eat the plants. Thus nitrogen enters in all animal body to fulfill their nitrogen requirement.

Denitrification: Denitrification is the process that converts nitrate to nitrogen gas, thus removing bioavailable nitrogen and returning to the atmosphere. Nitrogen gas ( $\text{N}_2$ ) is the ultimate end product of denitrification, but other intermediate gaseous forms of nitrogen exist. Some of these gases, such as nitrous oxide ( $\text{N}_2\text{O}$ ), are considered greenhouse gases, reacting with ozone and contributing to air pollution.



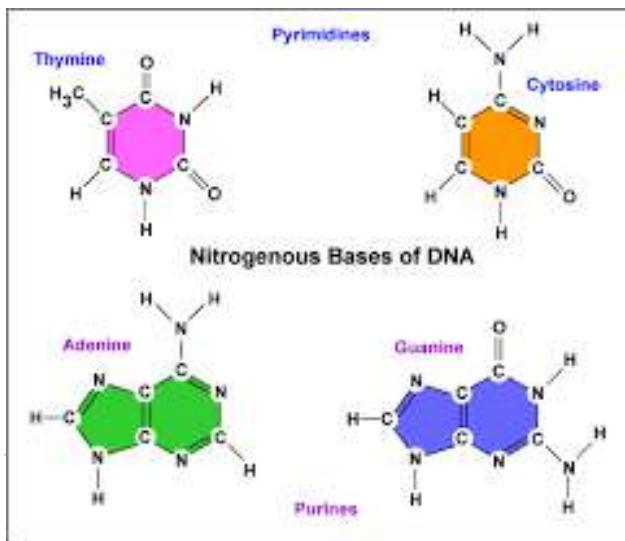
When an organism excretes waste or dies, the nitrogen in its tissues is in the form of organic nitrogen (e.g. amino acids, DNA). Various fungi and prokaryotes then decompose the tissue and release inorganic nitrogen back into the ecosystem as ammonia in the process of ammonification. The ammonia then becomes available for uptake by plants and other microorganisms for growth. Similar to nitrogen fixation, denitrification is carried out by a diverse group of prokaryotes. Some denitrifying bacteria include species in the genera *Bacillus*, *Paracoccus*, and *Pseudomonas*.



Nitrogen cycle

## IMPORTANCE FOR LIVING BEINGS

- 1) All human tissue - muscles, skin, hair, nails and blood - contains protein. Normal growth, cell replacement and tissues repair require nitrogen, and our body's metabolic process need proteins in the form of enzymes. Our body is continually recycling from amino acids, breaking amino acids not used for protein synthesis into components including nitrogen for energy.
- 2) Nitrogen is very essential for DNA which transfers genetic information to subsequent generations of organisms. The four nitrogen bases found in DNA are adenine, cytosin, guanine and thymine



- 3) Nitrogen also makes nonprotein compounds, such as the heme in hemoglobin, which transports oxygen in red blood cells to all parts of the body.
- 4) Nitrogen is essential for plants to grow and survive. Without proteins - some as structural units,

Others as enzymes — plants die. Nitrogen makes up a large part of chlorophyll, which plants need for photosynthesis.

- 5) Nitrogen is essential for plants to grow and survive. Nitrogen forms part of energy-transfer compounds such as ATP (adenosine triphosphate), which lets cells conserve and use energy released via metabolism.
- 6) Plants lacking in nitrogen turn yellow and stop growing and they bear smaller-than-average fruits and flowers. This is called chlorosis.



A young cabbage plant exhibiting nitrogen deficiency

## CONCLUSION

Nitrogen is arguably the most important nutrient in regulating primary productivity and species diversity in both aquatic and terrestrial ecosystems. Microbially driven processes such as nitrogen fixation, nitrification and denitrification, constitute the bulk of nitrogen transformations, and play a critical role in the fate of nitrogen in the earth ecosystems. However, as human populations continue to increase, the consequences of human activities continue to threaten our resources and have already significantly altered the global nitrogen cycle.

## BIBLIOGRAPHY

I have taken help from the following websites for my knowledge about nitrogen cycle and some associated picture.

- 1) <https://www.nature.com/scitable/knowledge/library/the-nitrogen-cycle-processes-players-and-human-15644632>
- 2) <https://www.frontiersin.org/articles/10.3389/frym.2019.00041>
- 3) [https://en.wikipedia.org/wiki/Nitrogen\\_cycle](https://en.wikipedia.org/wiki/Nitrogen_cycle)
- 4) [https://en.wikipedia.org/wiki/Nitrogen\\_deficiency#:~:text=of%20potato%20growth.,Detection,are%20said%20to%20be%20chlorotic](https://en.wikipedia.org/wiki/Nitrogen_deficiency#:~:text=of%20potato%20growth.,Detection,are%20said%20to%20be%20chlorotic)

# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

NAME : MAINAK SAHA  
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YEAR : 2020  
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Project :-

Air pollution in cities

and

measures to control it

-: Contents Of this Project :-

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## Introduction:-

Most cities world wide suffer from serious air quality problems, which have received increasing attention in the past decade. A major problem probable reason for the air quality problems in urban population growth, combined with change in land use due to increasing urban areas. The urban population growth is the result of -  
 i) drift to the cities and ii) excess of births over deaths -  
 in the cities ~~on~~ themselves - especially due to high birth rate in the developing countries.

Mainly responsible for the migration to the cities is a deep structural change, especially in the non-industrialized countries. This structural change is the consequence of -  
 i) Economic opening up  
 ii) new trading partners  
 iii) Change of political conditions eg democratisation -

Structural change takes a rapid course in some countries dubbed 'tigers'. It is not surprising that the expected urban population growth from 1992 until 2010 is much higher for Lagos, Bombay or Dhaka than Tokyo or New York.

Urban population growth has many consequences. One of them is higher emission of air pollutants. Even though ~~are~~ for most air pollutants, the emission rate per inhabitant is at present higher in industrialized countries, the tendency is at

obvious that this rate will in future be higher in the so called developing countries.

## ■ What is air pollution:—

Air pollution is the presence of substances in the atmosphere that are harmful to the earth, health of humans and other living beings, or cause damage to the climate or to materials such that gases like ammonia, carbon monoxide, sulfur dioxide etc. particulates (both organic and inorganic), and biological molecules.

It may cause diseases, allergies and even death to human. It may also cause harm to other living beings such as animals and food crops; and may damage the natural or built environment. Both human activities and natural processes can generate air pollution.

## General ~~Gas~~ Quantity of Elements in air:—

Elements	Quantity
$\text{N}_2$	78.11 %
$\text{O}_2$	20.6 %
$\text{CO}_2$	0.03 - 0.04 %

Other materials like vapour, helium, Neon,  $\text{O}_3$ ,  $\text{C}_6\text{H}_6$ , Hydrogen etc. — 0.96 - 0.97 %

this diagram represents the general quantity of elements in air. If there be any increase or decrease in the quantity of these elements in air, then the air becomes pollute ~~to~~ air.

### ☐ Pollutants for air pollution in cities:-

An air pollutant is a material in the air that can have adverse effects on human and the eco ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made pollutants are classified as primary & secondary.

#### i) Primary pollutants:-

Primary pollutants are usually produced by processes such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhausts or sulfur dioxide released from factories.

#### ii) Secondary Pollutants:-

Secondary pollutants are not emitted directly. Rather they form in the air when primary pollutants react or interact. Ground level  $O_3$  is a prominent example of a secondary pollutant.

Some pollutants may both primary and secondary; they are both emitted directly and formed from other primary pollutants.

Pollutants emitted into atmosphere by human activities:-

### i) Carbon di oxide ( $\text{CO}_2$ ):-

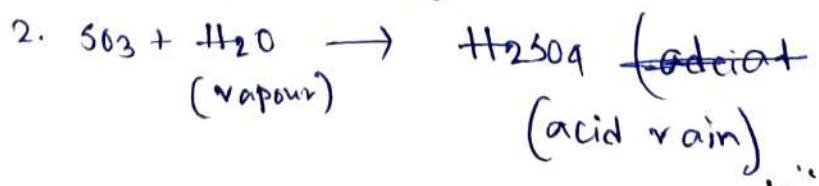
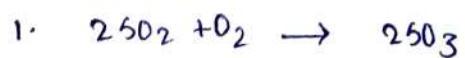
Because of its ~~rate~~ role as a green-house gas it has been described as the leading ~~pe~~ pollutant and worst climate ~~pollutant~~ pollutant?

$\text{CO}_2$  is a natural component of atmosphere, essential for plants and given off by human. This question of terminology has practical effects, for example as determining whether the U.S. clean air act is deemed to regular  $\text{CO}_2$  emissions.  $\text{CO}_2$  currently forms about 410 ppm. of earth's atmosphere, compared to about 280 ppm in preindustrial times, and billions of metric tons of  $\text{CO}_2$  are emitted annually by burning of fossil fuels.

### ii) Sulfur Oxide ( $\text{SO}_x$ ):-

Particularly  $\text{SO}_2$ , a chemical compound produced by volcanoes and various industrial processes. Coal and petroleum often contain sulfur compounds and their combustion generates  $\text{SO}_2$ .

Further oxidation of  $\text{SO}_2$ , usually in the presence of a catalyst such as  $\text{NO}_2$ , form  $\text{H}_2\text{SO}_4$  and thus acid rain is formed.



## 5) Nitrogen Oxides (NO<sub>x</sub>):-

Nitrogen oxides, particularly NO<sub>2</sub>, are expelled from high temp combustion, and also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above on a plume downwind of cities. NO<sub>2</sub> is a chemical compound which is one of the most prominent air pollutants. This reddish-brown toxic gas has a characteristic, sharp, biting odor.

## Carbon Monoxide (CO):-

CO is product of combustion of fuel such as natural gas, coal or wood. It creates a smog type formulation in the air that has been linked to many lung diseases and disruptions to environment and animals.

## Chlorofluoro Carbons (CFC):-

Harmful to O<sub>3</sub> layer, emitted from products are currently banned from use. These are gases which are released from A.C., refrigerators, aerosol sprays etc on release into the air, CFCs rise to the stratosphere where they come in contact with other gases and damage the O<sub>3</sub> layer. This allows harmful U.V. rays to reach earth surface. This can cause skin cancer, eye-diseases etc.

## Results of Air pollution / Effects of air pollution on atmosphere and living beings:-

People experience a wide range of health affects from the being exposed to air pollution. Effects can be broken down into short term effect and long term effect.

### i) Short term effect:-

which are temporarily includes illness such as pneumonia or bronchitis. They also include discomfort such that irritation to the nose, throat, eyes or skin. Air pollution always cause headaches, dizziness, and nausea. Bad smell made by factories, ~~an~~ garbage or a sewer system are considered air pollution too. These orders are less serious but still unpleasant.

### ii) long term effect:-

This kind of effects remains last and can affect for an ~~at~~ entire life time. They can even lead to a person's death. Long term health effect from air pollution includes heart diseases, lung cancer, and respiratory diseases, such as emphysema. This can also damage people's nerves, brain, kidney, liver etc. Nearly 2.5M people die worldwide each year from the effects of ~~outd~~ outdoor or indoor air pollution.

## Effects on environments:—

The entire ecosystem ~~as~~ and environment can suffer effects from air pollution. Haze, like smog, is a visible type of air pollution that obscures shapes and colours. Hazy air pollution can even muffle sounds.

Air pollutant particles eventually fall back to Earth. Air pollution can directly contaminate the surface of ~~bodies~~ bodies of water and soil which can kill ~~crops~~ crops. It can kill young trees and other plants.

$\text{SO}_2, \text{NO}_x$  in the air, can create acid rain when they mix with water and  $\text{O}_2$  in the atmosphere. These air pollutants come mostly from coal-fired powerplants and motor vehicles. When acid rain falls to earth, it damages plants by changing soil composition degrades water quality in rivers, lakes and streams.

## Global Warming:—

Global warming is an environmental phenomenon caused by natural and ~~an anthropo~~ anthropogenic air pollution. It refers to rising air and ocean temperatures around the world. This temp. rise is at least partially caused by an increase in the amount of greenhouse gases in the atmosphere. Green house gas traps heat energy from the atmosphere.

$\text{CO}_2$  is a green house gas that has the biggest effect on global warming.  $\text{CO}_2$  is emitted into the atmosphere by burning fossil fuels (coal, gasoline, and natural gases). Human have come to rely on fossil fuels to power cars and planes, heat home etc.

Except this methane, nitrous oxides, hydrofluorcarbons chlorofluoro carbons (CFC) are emitted by industries and coolers, which have been outlawed in many places because they deplete the  $\text{O}_3$ -layer which helps UV rays to come to earth surface and increase ground level temp and atmospheric temperature of Earth.

### Smog and Soot:-

These are two most prevalent type of air pollution; smog or 'ground level ozone' as it is more wokily called, occurs when emissions from combusting fossil fuels react with sunlight.

soot, ~~or~~ or 'particulate matter' is made up of tiny particles of chemicals, soils, smoke, dust ~~or~~ or allergens, in the form of ~~as~~ gas or solids, that are carried in the air.

### Sulfurous Smog:-

- Sulfural Smog is also called "London smog" as it first formed in London.

- Sulfurous smog results from a high concentration of sulfur oxides in the air and is caused

(9)

by the use of sulfur becoming fossil fuels, particularly coal.

- This type of smog is aggravated by dampness and a high concentration of suspended particulate matter in air.

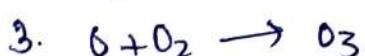
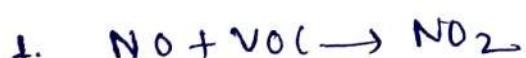
### Photochemical Smog:-

- Photochemical smog is also known as "Los Angeles" smog due to its first location.

- Photochemical smog occurs most prominently in urban areas that have large no. of automobiles (nitrogen oxides are the primary emissions).

- Photochemical (Summer smog) forms when pollutants such as NO<sub>x</sub> and organic compounds react together in the presence of sunlight, O<sub>3</sub> is formed.

- This smog causes a light brownish atmosphere, plant damage, damage of eye, respiratory system etc.



## Effects on human by air pollution:-

### i. Lung Cancer:-

While previously lung cancer was associated with those who smoke excessively, new evidence suggests that air pollution can also be carcinogenic. Adhesives and chemicals used in furniture and computer equipment can release formaldehyde fumes, which are a known cause for cancer.

### ii. Cardiovascular Problems:-

Breathing in polluted air for long periods can increase the risk of heart diseases. Harmful air pollutants such as CO, NO<sub>2</sub>, O<sub>3</sub> can get mixed in the blood stream and cause cardiovascular disorders. Particulate is another pollutant that severely impacts the nervous system and cardiovascular activities.

iii) Except these air pollution can also have effects on the health of women during pregnancy, the new born child and also affect for shortened life span.

## Measures to control Airpollution:—

Following are the measures one should adopt to control air pollution —

### i) Avoid Using vehicles:

People should avoid using vehicles for shorter distances, they should prefer public modes of transport to travel one place to another. This not only prevents pollution, but also conserves energy.

### ii) Energy Conservation:

A large number fossil fuels are burnt to generate electricity. Therefore do not forget to switch off the electrical machines when not in use. Thus we can save the environment.

### iii) Use of clean energy resources:

The use of solar, wind and geothermal energies reduce air pollution at a large level. Various countries including India, have implemented the use of these resources as a step towards a clear environment.

### iv) Other airpollution measures include:

- By minimizing and reducing the use of fire and fire products
- Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled.

- Fuel substitution is another way of controlling air pollution. In many parts of India, petrol and diesel are being replaced by CNG (Compressed natural gas) fuel vehicles.
- Although there are many practices in India which focus on improving the quality of air, most of them are either forgotten or not being enforced properly. We have to use machines like Electrostatic precipitator, Scrubber, Catalytic converter etc. to control the quality of air ~~to~~ and to purify it.
- A very effective way to control air pollution is by diluting the air pollutants.
- The last and the best way to reducing the ill effects of air pollution is tree plantation. Plants and trees reduce a large number of pollutants in air.

Ideally, planting trees in areas of high pollution levels will be extremely effective. So we have to care for our nature and this environment to control such pollutions.

## -: Acknowledgements:-

I would like to acknowledge everyone who played a role to complete this project work, my mother, my friends and respected professors. Without them, I could never fulfill my project work.

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Mainak Saha,

Date:- 13.11.2020.

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# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

Air Pollution in Cities and Measures to control it.

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DEPARTMENT : MATHEMATICS

YEAR : 2020

SIGNATURE : Md. Javed Akhtar.

## Air Pollution:

Air Pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to the materials. There are different types of air pollutants; such as gases (ammonia, carbon-monoxide (CO), sulfur dioxide, nitrous oxides, methane, and chlorofluoro-carbons (CFC)), particulates (both organic and inorganic) and biological molecules. Air pollution may cause diseases, allergies and even death to humans; it may also cause diseases, allergies and damage the natural and built environment. Both human activity and natural processes can generate air pollution.

Air pollution is a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, COPD, stroke and lung cancer. The human health effects of poor air quality are far-reaching, but principally affect the body's respiratory system and cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure and individual's health status and genetics.

Overall, air pollution causes the deaths of around 7 million people worldwide each year and is the world's largest single environmental health risk.

## Pollutants:

An air pollutant is a material in the air that can have adverse effects on humans and the eco-system. The substances can be solid particulates, liquid or gases. Pollutants are classified as primary or secondary.



### The primary pollutants are:-

i) Carbon-di-oxide ( $\text{CO}_2$ ): Because of its role as a greenhouse gas it has been described as "The leading pollutant" and "the worst climate pollutant".  $\text{CO}_2$  currently forms about 410 parts per million (ppm) of earth's atmosphere, compared to about 280 ppm in pre-industrial times, and billions of metric tons of  $\text{CO}_2$  are emitted annually by burning of fossil fuels.

ii) VOCs (Volatile organic compounds): VOC's are well known outdoor air pollutant.

They are categorized as either methane ( $\text{CH}_4$ ) or non-methane (NMVOCs). Methane is an extremely efficient greenhouse gas which contributes to enhanced global warming.

iii) Nitrogen oxides (NO<sub>x</sub>): Nitrogen Oxides, particularly nitrogen dioxide, are expelled from high temp. combustion and are also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above or a plume downwind of cities. Nitrogen dioxide is a chemical compound with formula NO<sub>2</sub>. One of the most prominent air pollutants, this reddish-brown toxic gas has a characteristic sharp, biting odor.

v) Particulate Matter:

Atmospheric particulate matter or fine particles are tiny particles of solid or liquid suspended in a gas. In contrast, aerosol refers to combined particles and gas. Some particulates occur naturally, originating from volcanoes, dust storms, forest and grassland fires etc.



v) Radioactive pollutants: It is produced by nuclear explosions, nuclear events, war explosives and natural processes such as the radioactive decay of Radon.

v) Toxic metals, such as lead & mercury, especially their compounds. CFCs - harmful to the ozone layer, emitted from products are currently banned from use.

## Secondary pollutants include :

i) Particulates created from gaseous primary pollutants and compounds in photochemical smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulfur dioxide. Modern smog does not usually come from coal but from vehicular and industrial emissions that are acted on in the atmosphere by ultraviolet light from the sun to form secondary pollutants that also combine with primary emissions to form photochemical smog.



ii) Ground level ozone formed from  $\text{NO}_x$  and VOCs. Ozone ( $\text{O}_3$ ) is a key constituent of the troposphere. It is also an important constituent of certain regions of the stratosphere commonly known as the Ozone layer. Photochemical and chemical reactions involving it drive many of the chemical processes that occur in the atmosphere by day and by night. At abnormally high concentrations brought about by human activities (largely the combustion of fossil fuel), it is a pollutant and a constituent of smog.

iii) Peroxyacetyl nitrate ( $\text{C}_2\text{H}_3\text{NO}_5$ ) similarly formed from  $\text{NO}_x$  and VOCs.



## Air pollution in cities: Case study:

i) Delhi ranks highest in number of vehicles in India. According to the record in 1990, the number of cars in Delhi were more than the total of West Bengal & Gujarat. Due to this Delhi now become one of the most polluted cities in World. Residents of Delhi were suffering from burning eyes and respiratory problem. Using CNG in transport replacing old vehicles, making emission check up are being taken to prevent the air pollution. The Govt. use to imply norm to stipulate that Sulphur be controlled at 350 ppm. in diesel and 150 ppm in petrol. Aromated hydrocarbons should be contained at max 42% of fuel.

ii) Kolkata is in the grip of rising air pollution and multi pollutant crisis. Official ambient air quality monitoring has shown 61% increase in particulate matter in just four years 2010 to 2013. NO<sub>2</sub> levels exceeds by close to two times. With growing vehicle numbers and resultant congestion and diselisation air



Pollution is a growing concern in the city. Like Delhi in Kolkata the air quality became very much poor in winter and it enhances public health risk.

### Measures to Control Air pollution:



Different kinds of air pollution can be controlled by modern technology. Emission from factories and power plants can be made free from gaseous pollutants by 3 methods: →

i) Combustion Technique: Only oxidisable pollutants can be removed by this method. Emissions are burnt at very high temperature. This process is applied in petrochemical and plant industries.

ii) Absorption Technique: Here scrubbers with packing materials are used to absorb gaseous pollutants. A fine spray of water is applied that dissolves  $\text{NH}_3$ ,  $\text{SO}_2$  etc. Sometimes bed of lime is also employed to absorb  $\text{SO}_2$ .

iii) Adsorption Technique: Activated charcoal, a chief adsorption material is used in this technique. It can adsorb toxic vapourous gases and other harmful materials.

## Prevention of air pollution:

- i) Periodic changing of vehicles for pollution control.
- ii) Increased uses of CNG can lower the amount of pollutants.
- iii) ESP, (Electrostatic precipitator): To remove the suspended particulate matter from gas stream, the electrical forces are applied within the chamber in precipitator. ESPs can remove 99% of the particulate pollutants from the chimney exhaust. ESPs work very efficiently in power plants, paper mills, carbon black plants, cement mills etc.
- iv) Control Air pollution through law: There have been several legislative measures to prevent and control different type of air pollution. Ex: → Bengal Smoke Nuisance act (1905), The motor vehicle act (1938), The environmental act (1981),
- v) Tree plantation: Trees help reduce air pollutants significantly. Trees remove the particulate matter a large amount. Trees also decrease levels of  $\text{CO}_2$ , benzene,  $\text{SO}_2$ , etc. Trees also slow down polluted air from being carried by wind.
- vi) Raise Awareness: Awareness raising can be most effective step in their attitudes towards mitigating the problem of poor air quality index -
- vii) No smoking: Cigarette smoke contains upto 70% carcinogenic substances.

Acknowledgement: For the compilation of this project ~~we~~  
I am very grateful to our teacher and I took help from  
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Md. Javed Akhter.

Signature of the Student.

Date: 14/11/20

.....  
Signature of professor



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Overall, air pollution causes the deaths of around 7 million people worldwide each year and is the world's largest single environmental health risk.

## Pollutants:

An air pollutant is a material in the air that can have adverse effects on humans and the eco-system. The substances can be solid particulates, liquid or gases. Pollutants are classified as primary or secondary.



### The primary pollutants are:-

i) Carbon-di-oxide ( $\text{CO}_2$ ): Because of its role as a greenhouse gas it has been described as "The leading pollutant" and "the worst climate pollutant".  $\text{CO}_2$  currently forms about 410 parts per million (ppm) of earth's atmosphere, compared to about 280 ppm in pre-industrial times, and billions of metric tons of  $\text{CO}_2$  are emitted annually by burning of fossil fuels.

ii) VOCs (Volatile organic compounds): VOC's are well known outdoor air pollutant.

They are categorized as either methane ( $\text{CH}_4$ ) or non-methane (NMVOCs). Methane is an extremely efficient greenhouse gas which contributes to enhanced global warming.

iii) Nitrogen oxides (NO<sub>x</sub>): Nitrogen Oxides, particularly nitrogen dioxide, are expelled from high temp. combustion and are also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above or a plume downwind of cities. Nitrogen dioxide is a chemical compound with formula NO<sub>2</sub>. One of the most prominent air pollutants, this reddish-brown toxic gas has a characteristic sharp, biting odor.

v) Particulate Matter:

Atmospheric particulate matter or fine particles are tiny particles of solid or liquid suspended in a gas. In contrast, aerosol refers to combined particles and gas. Some particulates occur naturally, originating from volcanoes, dust storms, forest and grassland fires etc.



v) Radioactive pollutants: It is produced by nuclear explosions, nuclear events, war explosives and natural processes such as the radioactive decay of Radon.

v) Toxic metals, such as lead & mercury, especially their compounds. CFCs - harmful to the ozone layer, emitted from products are currently banned from use.

## Secondary pollutants include :

i) Particulates created from gaseous primary pollutants and compounds in photochemical smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulfur dioxide. Modern smog does not usually come from coal but from vehicular and industrial emissions that are acted on in the atmosphere by ultraviolet light from the sun to form secondary pollutants that also combine with primary emissions to form photochemical smog.



ii) Ground level ozone formed from  $\text{NO}_x$  and VOCs. Ozone ( $\text{O}_3$ ) is a key constituent of the troposphere. It is also an important constituent of certain regions of the stratosphere commonly known as the Ozone layer. Photochemical and chemical reactions involving it drive many of the chemical processes that occur in the atmosphere by day and by night. At abnormally high concentrations brought about by human activities (largely the combustion of fossil fuel), it is a pollutant and a constituent of smog.

iii) Peroxyacetyl nitrate ( $\text{C}_2\text{H}_3\text{NO}_5$ ) similarly formed from  $\text{NO}_x$  and VOCs.



## Air pollution in cities: Case study:

i) Delhi ranks highest in number of vehicles in India. According to the record in 1990, the number of cars in Delhi were more than the total of West Bengal & Gujarat. Due to this Delhi now become one of the most polluted cities in World. Residents of Delhi were suffering from burning eyes and respiratory problem. Using CNG in transport replacing old vehicles, making emission check up are being taken to prevent the air pollution. The Govt. use to imply norm to stipulate that Sulphur be controlled at 350 ppm. in diesel and 150 ppm in petrol. Aromated hydrocarbons should be contained at max 42% of fuel.

ii) Kolkata is in the grip of rising air pollution and multi pollutant crisis. Official ambient air quality monitoring has shown 61% increase in particulate matter in just four years 2010 to 2013. NO<sub>2</sub> levels exceeds by close to two times. With growing vehicle numbers and resultant congestion and diselisation air



Pollution is a growing concern in the city. Like Delhi in Kolkata the air quality became very much poor in winter and it enhances public health risk.

### Measures to Control Air pollution:



Different kinds of air pollution can be controlled by modern technology. Emission from factories and power plants can be made free from gaseous pollutants by 3 methods: →

i) Combustion Technique: Only oxidisable pollutants can be removed by this method. Emissions are burnt at very high temperature. This process is applied in petrochemical and plant industries.

ii) Absorption Technique: Here scrubbers with packing materials are used to absorb gaseous pollutants. A fine spray of water is applied that dissolves  $\text{NH}_3$ ,  $\text{SO}_2$  etc. Sometimes bed of lime is also employed to absorb  $\text{SO}_2$ .

iii) Adsorption Technique: Activated charcoal, a chief adsorption material is used in this technique. It can adsorb toxic vapourous gases and other harmful materials.

## Prevention of air pollution:

- i) Periodic changing of vehicles for pollution control.
- ii) Increased uses of CNG can lower the amount of pollutants.
- iii) ESP, (Electrostatic precipitator): To remove the suspended particulate matter from gas stream, the electrical forces are applied within the chamber in precipitator. ESPs can remove 99% of the particulate pollutants from the chimney exhaust. ESPs work very efficiently in power plants, paper mills, carbon black plants, cement mills etc.
- iv) Control Air pollution through law: There have been several legislative measures to prevent and control different type of air pollution. Ex: → Bengal Smoke Nuisance act (1905), The motor vehicle act (1938), The environmental act (1981),
- v) Tree plantation: Trees help reduce air pollutants significantly. Trees remove the particulate matter a large amount. Trees also decrease levels of  $\text{CO}_2$ , benzene,  $\text{SO}_2$ , etc. Trees also slow down polluted air from being carried by wind.
- vi) Raise Awareness: Awareness raising can be most effective step in their attitudes towards mitigating the problem of poor air quality index -
- vii) No smoking: Cigarette smoke contains upto 70% carcinogenic substances.

Acknowledgement: For the compilation of this project ~~we~~  
I am very grateful to our teacher and I took help from  
Wikipedia & UNO-official website.

Md. Javed Akhter.

Signature of the Student.

Date: 14/11/20

.....  
Signature of professor



**RAMAKRISHNA MISSION RESIDENTIAL COLLEGE**



NARENDRAPUR

**ENVIRONMENTAL STUDIES**

**project file**

**UG\2nd Semester**

NAME : Meghnad Chatterjee

COLLEGE ROLL NO : HIUG\242\19

DEPARTMENT : history

YEAR : 2020

SIGNATURE : Meghnad Chatterjee

### 3 AIR POLLUTION AND ITS CONTROL

⇒ Air pollution definition:-

Air pollution is the release of pollutants such as gases, particles, biological molecules, etc. into the air that is harmful to human health and the environment.

⇒ What is air pollution?

Air pollution refers to any physical, chemical or biological change in the air. It is contamination of air by harmful gases, dust and smoke which affects plants, animals and human drastically.

There is a certain percentage of gases present in the atmosphere. An increase in the or decrease or these gases is harmful to survival here resulted in an increase in the earth's temperature which is known as global warming.

⇒ type of Air pollutants:-

There are two types of air pollutants 1. primary. 2. secondary.

1. primary Pollutants:- The pollutants that directly causes air pollution are known as primary pollutants sulphur dioxide emitted from ~~factories~~ factories is a primary pollutants.

2. Secondary Pollutants:- The pollutants formed by the intermixing and reaction of primary pollutants are known as secondary pollutants. Smog, formed by the intermixing of smoke and fog is the secondary pollutants.

⇒ causes of Air pollution:-

Following are the important cause of air pollution.

⇒ Burning of fossil fuels:- The combustion of fossil fuels.

⇒ Automobiles:- the gases emitted from vehicles such as jeeps trucks cars buses pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

⇒ Agriculture Activities:- Ammonia is one of the most hazardous gases emitted during agricultural activities. Pesticide and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

⇒ Factories and Industries:-

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbon and chemicals. These are released into the air degrading its quality.

⇒ Mining Activities:-

In the mining process the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only

pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

### ⇒ Domestic Sources:-

The household cleaning products and paints ~~can~~ contain toxic chemicals that released in the air the smell of the chemicals present in the paints. It not only pollutes the air also affects breathing.

### ⇒ EFFECTS OF AIR POLLUTION:

The hazardous effects of air pollution on the environment include.

⇒ Diseases:- Air pollution has released in several respiratory disorders and heart diseases. Among them, the cases of lung ~~cancer~~ cancer have increased in the last few decades. Children living near polluted area are more prone to pneumonia and asthma. Many people die every year due to the direct or indirect effects of air pollution.

⇒ Global warming :-

Due to the emission of greenhouse gases there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming. This has resulted in sea levels. Many areas are submerged underwater.

⇒ Acid Rain:- The burning of fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic and fall as acid rain which damaged human animal and plants life.

⇒ Ozone layer depletion:- The release of chlorofluorocarbon halon. and hydrochlorofluorocarbon in the atmosphere is the major causes of depletions at the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.

## ⇒ EFFECT ON ANIMALS:-

The air pollution suspend on the water bodies and affects the aquatic life. Pollution also compels the animal to leave their habitat and shift to a new place. This renders them stray and has led to the extinction of a large number of animal species.

## ⇒ Air pollution control:-

Following are the measures one should adopt to control air pollution.

### \* Avoid using vehicles:-

people should avoid using vehicle for shorter distances. Rather they should prefer public modes to transport to travel from one place to another. This not only prevents pollution but also conserves energy.

### \* Energy conservation :- A large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical application when not in use. You can save the use of energy efficient devices such as CFLs also.

control pollution] to a greater level.

\* use of clean energy resources:-

The use of solar, wind and geothermal energies reduce air pollution at a larger level various countries including India have implemented the use of these resources as a step towards a cleaner environment.

⇒ other air pollution control measures include:

1. By minimizing and reducing the use of fire and fire products.
  2. Since industrial emissions are one of the major causes of air pollution the pollutants can be controlled or treated at the sources itself to reduce its effects. For example, if the reactions of a certain raw materials can be substituted with other material.
-

RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

### PROJECT TITLE:

**Nitrogen Cycle and its Importance for Living Beings**

NAME : Minhaj Fahim

COLLEGE ROLL NO : STUG/086/19

DEPARTMENT : Statistics

YEAR : 2020

SIGNATURE :

## ACKNOWLEDGEMENT

In the completion of this project successfully, I would like to thank our environmental science teachers, Souvik Bhattacharya for helping me in the enrichment of knowledge about this topic. I would also like to thank all my classmate and friends for supporting me.

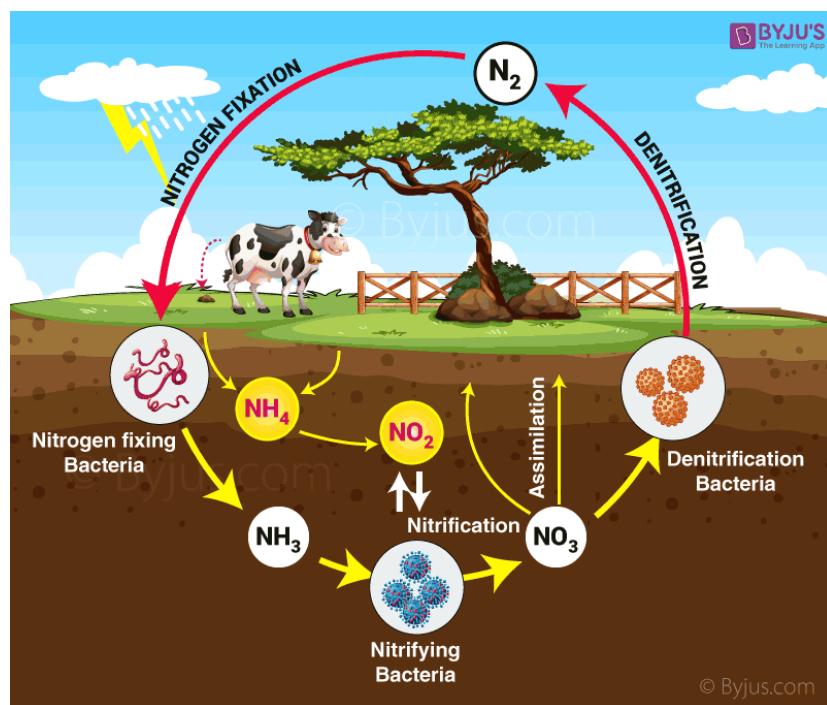
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# NITROGEN CYCLE

The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical form as it circulates among atmosphere, terrestrial and marine ecosystems. The conversion of nitrogen can be carried out through both biological and physical processes. Important processes in the nitrogen cycle include fixation, ammonification, nitrification, and denitrification.

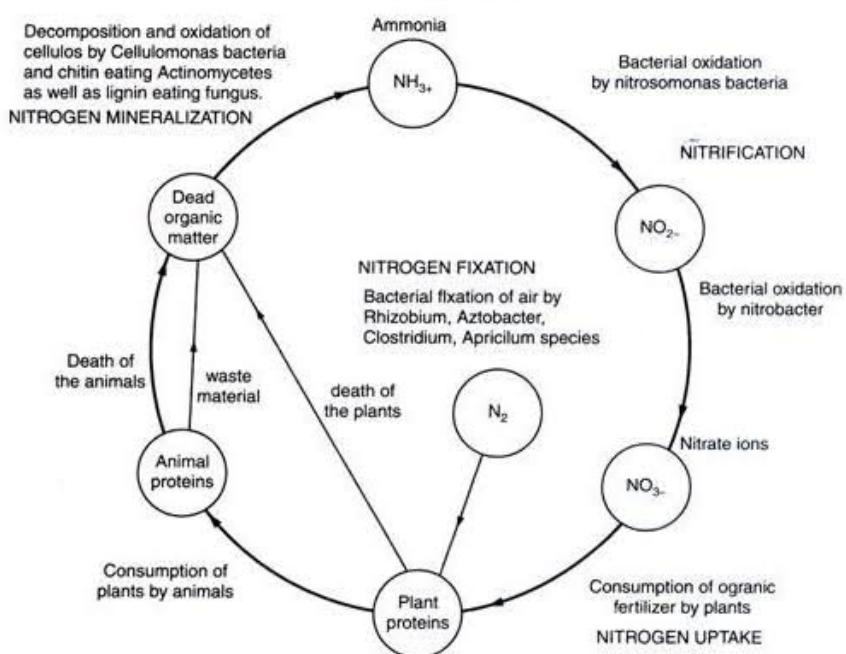
The majority of Earth's atmosphere (78%) is atmospheric nitrogen, making it the largest source of nitrogen. However, atmospheric nitrogen has limited availability for biological use, leading to a scarcity of usable nitrogen in many types of ecosystems.



(2)

The nitrogen cycle is of particular interest to ecologists because nitrogen availability can affect the rate of key ecosystem processes, including primary production and decomposition. Human activities such as fossil fuel combustion, use of artificial nitrogen fertilizers and release of nitrogen in wastewater have dramatically altered the global nitrogen cycle. Human modification of the cycle can negatively affect natural systems and even humans.

### NITROGEN CYCLE



The nitrogen cycle

## STAGES OF NITROGEN CYCLE :

Nitrogen is present in the environment in a wide variety of chemical forms including organic nitrogen, ammonium, nitrite, nitrate, nitrous oxide, nitric oxide, or inorganic nitrogen gas. The process in the nitrogen cycle is to transform nitrogen from one form to the other.

### NITROGEN FIXATION

In this state, nitrogen moves from the atmosphere into the soil. It is the initial step of the cycle. Atmospheric nitrogen ( $N_2$ ) which is primarily available in an inert form is converted into the usable form - ammonia ( $NH_3$ )

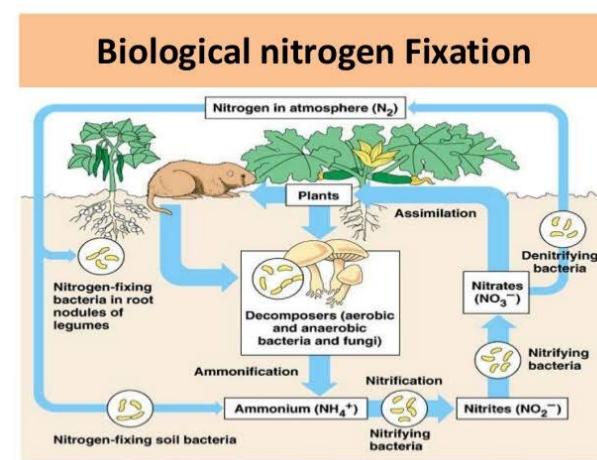
During the process of Nitrogen fixation, the inert form of nitrogen gas is deposited into soil from the atmosphere and surface waters mainly through precipitation. After the nitrogen undergoes a set of changes, in which two nitrogen atoms get separated and combine with hydrogen to form ammonia.

The entire process of Nitrogen fixation is completed by symbiotic bacteria which is known as Diazotrophes. Azotobacter and Rhizobium also play a major role in this process.

Nitrogen fixation can occur either by the atmospheric fixation - which involves lightning or industrial fixation by manufacturing ammonia under high pressure and temperature.

### Types of Nitrogen Fixation:

1. Atmospheric fixation: A natural phenomenon where the energy of the lightning breaks the nitrogen oxide into its oxides and then used by plants.
2. Industrial nitrogen fixation: It is a man-made alternative that aids in nitrogen fixation by the use of ammonia.
3. Biological nitrogen fixation: We already know that nitrogen is not usable directly from air for plants and animals. Because of the bacteria like Rhizobium and blue green algae transform the unusable form of the nitrogen into other compounds that are more readily usable.



## ASSIMILATION

Primary producers - plants take in the nitrogen compounds from the soil with the help of the roots, which are available in the form of ammonia ions and are used in the formation of the plant and animal protein. This way it enters the food web when the primary consumers eat the plant. Utilization of various N sources is carefully regulated in all organisms.

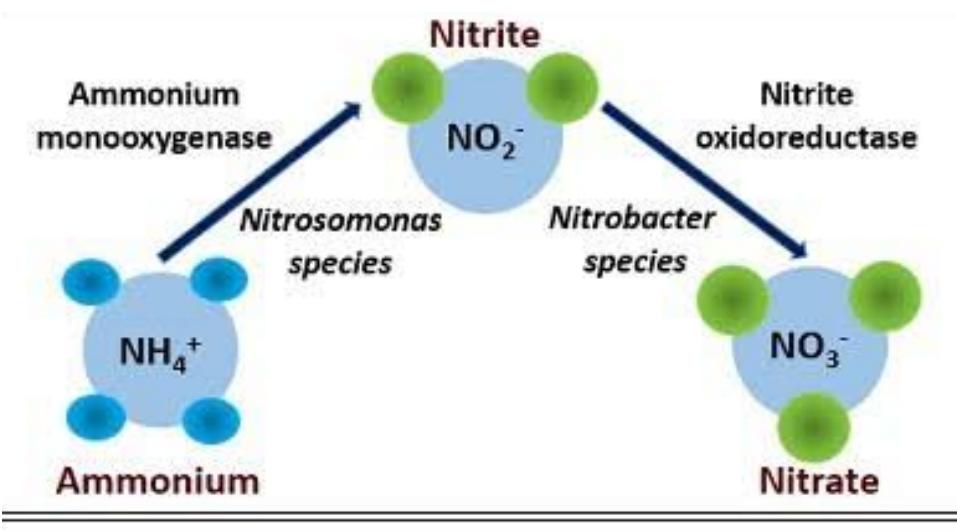
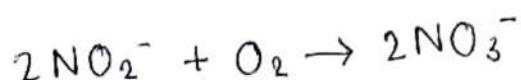
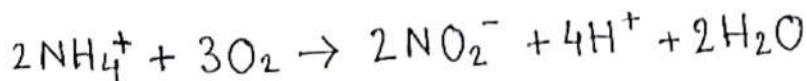
## AMMONIFICATION

When plants or animals die, the nitrogen present in the organic matter is released back into the soil. The decomposers namely bacteria and fungi present in the soil convert the organic matter back into ammonium. This process of decomposition produces ammonia, which is further used for biological processes.

## NITRIFICATION

In this process, the ammonia is converted into nitrate by the presence of bacteria in the soil.

Nitrates are formed by the oxidation of Ammonia with the help of Nitrosomonas bacteria bacterium species. Later the produced nitrates are converted into nitrates by Nitrobacter. This conversion is very important as ammonia gas is toxic for plants. The reaction involved:



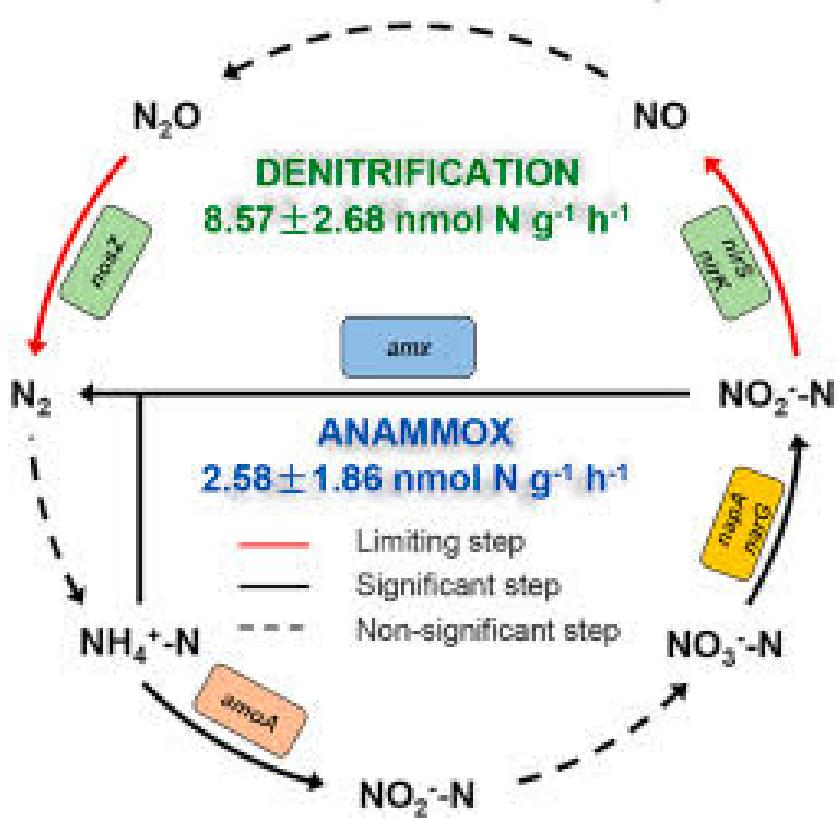
**Overall Nitrification Reaction**

## DENITRIFICATION

Denitrification is the process in which the nitrogen compounds make its way back into the atmosphere by converting nitrate ( $\text{NO}_3^-$ ) into gaseous nitrogen (N).

This process of the nitrogen cycle is the final stage and occurs in the absence of oxygen.

Denitrification is carried out by the denitrifying bacterial species - Clostridium and Pseudomonas, which will break nitrate to gain oxygen and gives out free nitrogen gas as byproduct.



## IMPORTANCE OF NITROGEN CYCLE

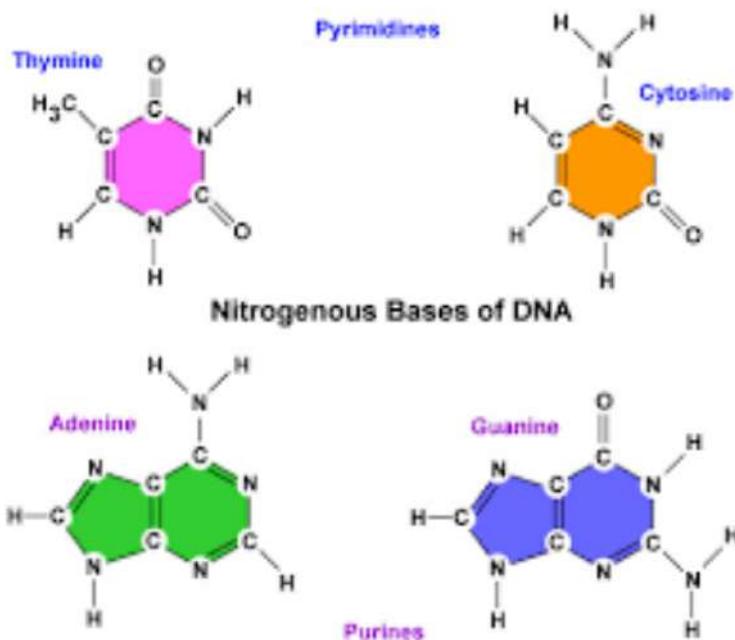
Nitrogen constitutes many cellular components and is essential in many biological processes. For instance, the amino acids contain nitrogen and form building blocks that make up various components of the human body such as hair tissue and muscles.

### POINTS :-

1. Helps plants to synthesise chlorophyll from the nitrogen compounds.
2. Helps in converting inert nitrogen gas into a usable form for the plants through the biochemical process.
3. In the process of ammonification the bacteria help in decomposing the animal and plant matter, which indirectly helps to clean up the environment.
4. Nitrates and nitrites are released into the soil which helps in enriching the soil with necessary nutrients required for cultivation.

5. Nitrogen is an integral component of the cell and it form many crucial compounds and important biomolecules.

Nitrogen is also cycled by human activities such as combustion of fuels and the use of nitrogen fertilizers. These processes, increase the levels of nitrogen containing compounds in the atmosphere. The fertilisers containing nitrogen are washed away in lakes and rivers and results in eutrophication.



## CONCLUSION

- Nitrogen is abundant in the atmosphere but it is unusable to plants and animals unless it is converted into nitrogen compounds. It is the most important nutrient in regulating primary productivity and species diversity, in both aquatic and terrestrial ecosystems. Microbially driven processes such as nitrogen fixation, nitrification and denitrification constitute the bulk of nitrogen transformation and its critical role in the Earth ecosystem. However 'Human activities' continue to threaten and alter the global nitrogen cycle.

## BIBLIOGRAPHY :

In order to complete this assignment I have taken help of the following resources:

- Wikipedia.org
- Britannica.com
- MicrobiologySociety.org
- Byjus.com.

# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

COVID-19 PANDEMIC AND ROLE OF COMMON  
PEOPLE TO CONTROL IT

NAME : MRINMOY MUKHERJEE  
COLLEGE ROLL NO : PHUG / 204 / 19  
DEPARTMENT : PHYSICS  
YEAR : 2020  
SIGNATURE :

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## INTRODUCTION

On December 2019, the Chinese authorities notified the world that a virus was spreading in their communities. In the following months, it spread to other countries doubling within days.

This virus was called,

"Severe Acute Respiratory Syndrome-Related Coronavirus -2 (SARS-CoV-2)"

that causes the disease COVID-19, which is the shortform for "Coronavirus Disease - 2019".

On March 11, 2020, the World Health Organisation (WHO) made an announcement declaring the COVID-19 as a "PANDEMIC".

Coronaviruses are large family of viruses which are common in people and many different species of animals like bats and cats. Common coronavirus in humans causes upper respiratory tract infection called common cold.

Rarely coronaviruses that infect animals evolve and transmit to humans, knowning a new kind of coronavirus which then spread and infect among people. Some of the examples are - SEVERE ACUTE RESPIRATORY SYNDROME (SARS) in 2003 which likely transmitted from a species of bats.

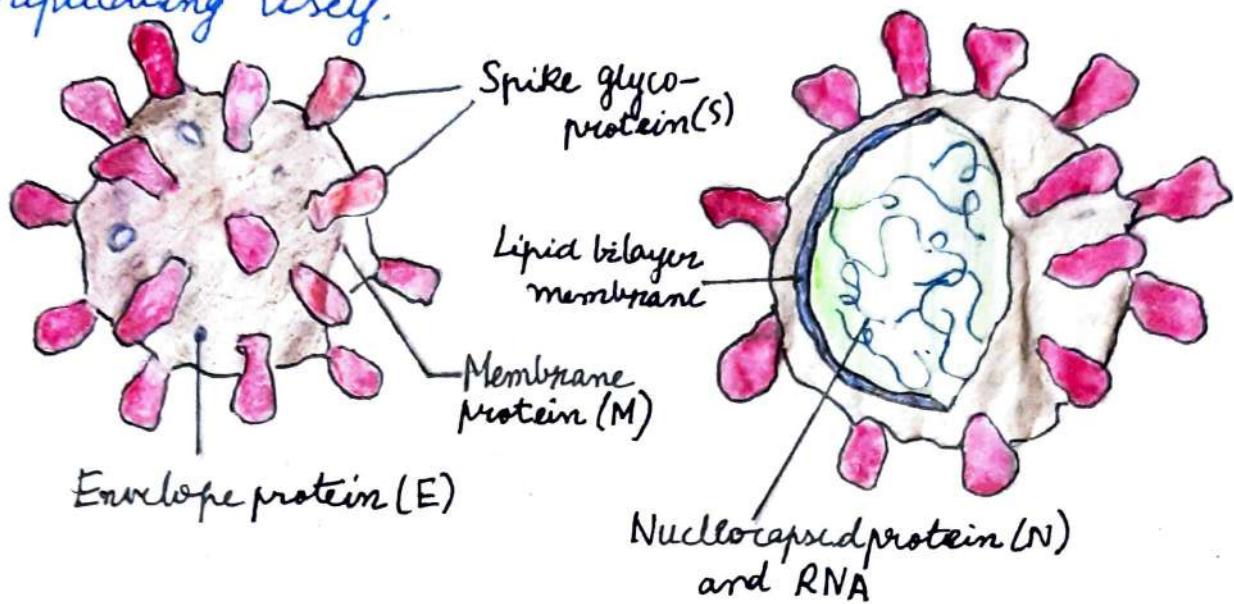
And MIDDLE EAST RESPIRATORY SYNDROME (MERS) in 2012 which most likely transmitted from camels and bats.

Medical authorities deduced that virus SARS-CoV-2 originated from a wet market in Wuhan, China (though there are some controversies surrounding it).

In order to understand this pandemic that affected the lives of billions around the world, we need to first understand what SARS-CoV-2 really is.

## SARS-CoV-2

SARS-CoV-2, just like any virus, is a hull around genetic material (RNA) and a few proteins. It's not even a living thing it enters a host cell and starts replicating itself.



Structure of SARS-CoV-2 (Fig-1)  
(order of  $10^{-7}$  -  $10^{-9}$  m)

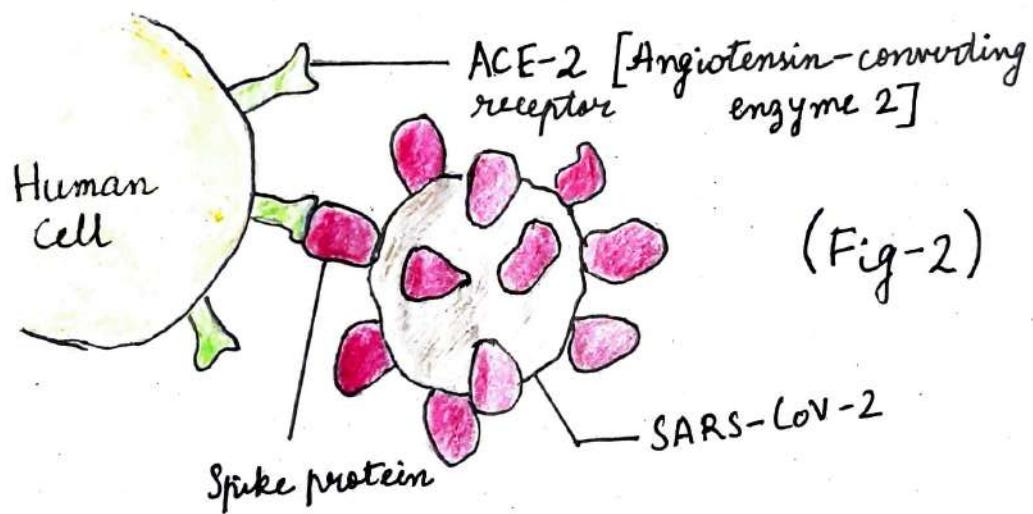
The main way of spreading of SARS-CoV-2 is droplet infection. When some infected person coughs, or sneezes, the droplets coming from the nose and mouth carry the virus which stay suspended in the air for a while till it reaches a healthy person. That person, having droplets in their fingers, if touches his/her eyes or nose, transmits the virus in themselves.

The virus makes its way into the lungs, spleen and intestines, where it shows its dramatic effect.

MECHANISM:- The lungs are lined with billions of epithelial cells bordering our organs which suffer the first attack of SARS-CoV-2. The virus carries

several antigens both on the surface and internally. The body responds to all of them. These antigens are - spike proteins ( $S_1, S_2$ ), receptor binding domain (RBD) and nucleocapsid (N).

The spike proteins ( $S_1, S_2$ ) of the SARS-CoV-2 connects with a specific receptor of the epithelial cell membrane called ACE2 receptor to inject the genetic material into the cell. The genetic material instructs the cell to replicate the SARS-CoV-2, until the cell exhausts its resources and dies. The SARS-CoV-2 moves out of the infected cell to the surrounding healthy cells. This process is exponential and soon most of the cells in lungs gets infected.



The immune system responds to this infection. But as immune cells pour in to fight the virus, SARS-CoV-2 affects the immune cells too. The immune cells communicate via proteins called cytokines. Nearly every important immune reaction is controlled by these proteins. The infected immune cells overreact and call in more immune cells than required, wasting resources and in-

turn destroying the healthy cells. This destruction of healthy cells may become so bad that it can result in permanent damage of the lungs and life long disabilities even after recovery from the infection. In most cases, the immune system slowly regains control and soon recovery begins. But some cases, the epithelial lining which protects the lungs is gone due to SARS-CoV-2. This means the alveoli of the lungs are open to infection by bacteria. This causes pneumonia and the patients require ventilators to breath. The immune system being exhausted by producing millions of antibodies against SARS-CoV-2, it is not much effective to bacterial attack from outside. Death is imminent.

[Summary of the mechanism is presented here as detailed analysis is beyond the scope of this project.]

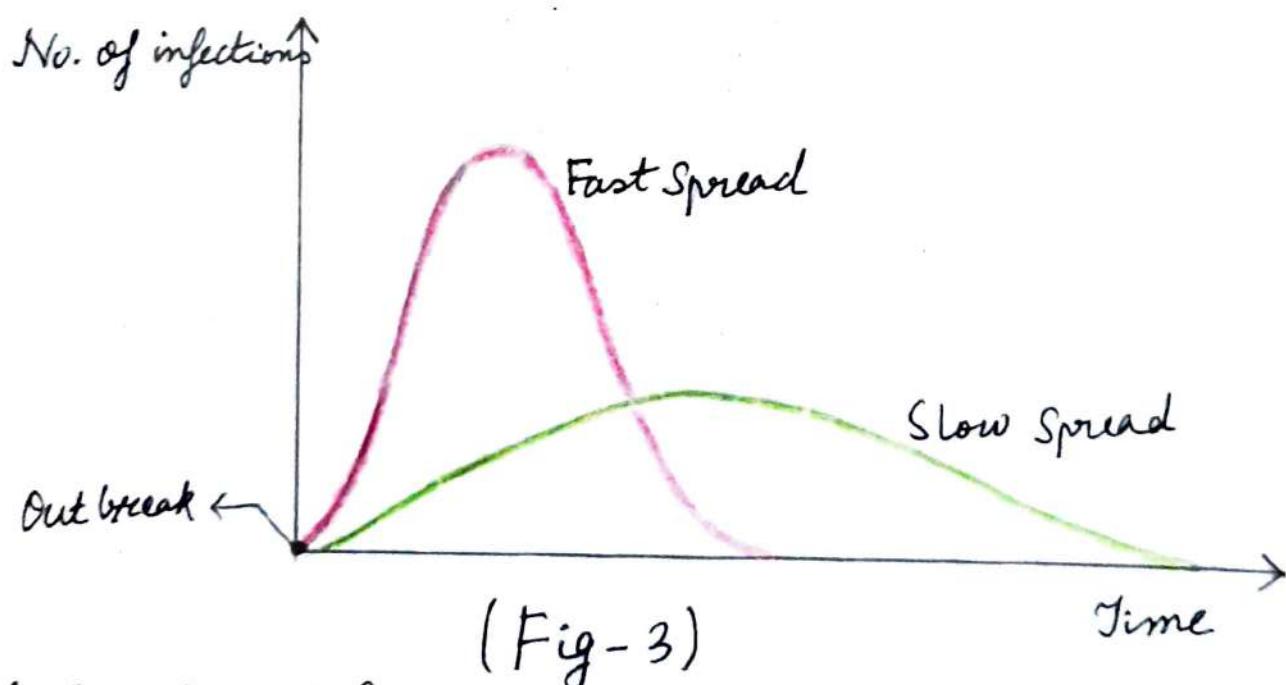
Now we will discuss in the upcoming pages about the pandemic caused by SARS-CoV-2. And how it can be controlled by common people like us. and also recent developments.

## COVID-19 PANDEMIC

The pandemic caused by SARS-CoV-2 is called the COVID-19 Pandemic.

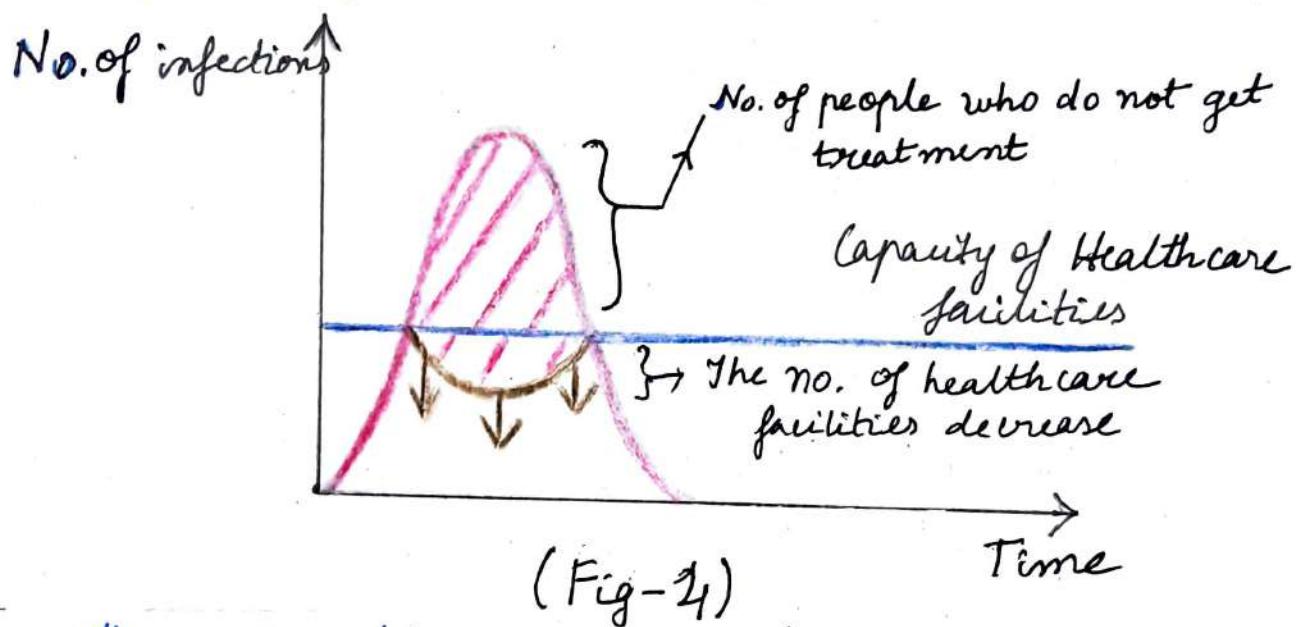
After getting infected, a person usually feels sick after 5-6 days and the symptoms start to appear. But within that period, the infected person already starts to spread the virus by droplet infection. That's how the virus has been so effective in spreading across the world so quickly. The mortality rate during an ongoing pandemic is hard to pin down as it increases or decreases depending on how we handle it.

PANDEMIC CURVE:- There are two futures for the COVID-19 pandemic. That is,  
Fast Spread or Slow Spread.



A Fast Spread Pandemic is dangerous and costs many lives while a Slow Spread Pandemic is less lethal and can easily

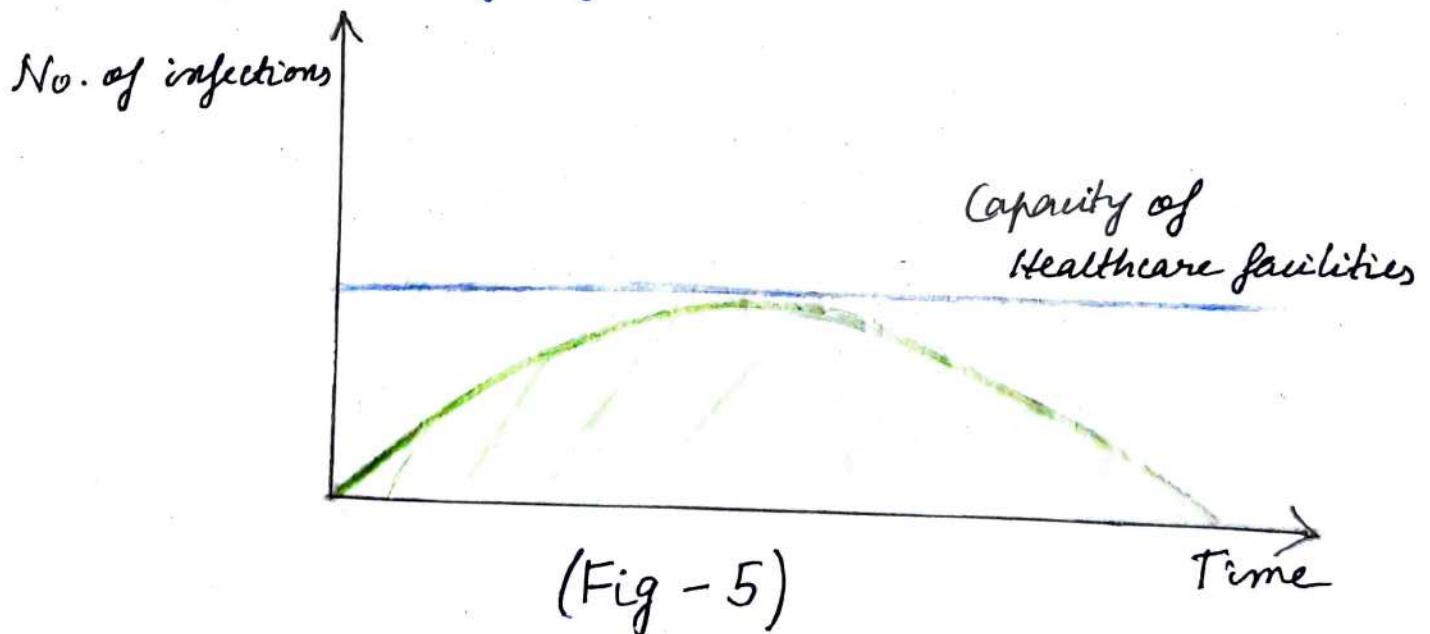
be managed. The worst case scenario of a Fast Spread Pandemic begins when there are rapid spread of virus as there are not enough countermeasures to slow it down. During a fast spread pandemic, no. of people getting infected within a short period of time is large, which is more than what the healthcare systems can handle. Resources like medical staff, medical equipments are limited and not enough to help everybody, causing large number of avoidable deaths



This puts a huge pressure on healthcare facilities who are at the frontline, fighting this pandemic. What happens is that many of the healthcare personals such as doctors, nurses, etc. get sick themselves, further reducing the capacity of the healthcare systems. This is shown by the downward arrow in brown. This limits the resources to save people even further, increasing no. of avoidable deaths. In this scenario, decisions have to make on whom to save and whom not to, which is always hard

and immortal. The scenario depicted in Fig-4 is a global health crisis which has huge negative effect on the society, further cause social and economic crisis. costing lives of billions of people all around the globe. This has happened to us before in the case of Spanish Flu, Black Plague, etc.. But this time, we are more aware and more equipped than we were in the past.

A Slow Spread Pandemic is not very dangerous and can easily be managed. Any pandemic can be converted to a slow spread pandemic by taking right measures at the initial stage of the outbreak.



This puts less pressure on the health care facilities and thus no. of avoidable deaths decreases and the patients lives are saved. There are two ways that the pandemic can be converted to slow spread

pandemic. They are :-

1. Vaccination

2. Taking measures.

(By common people and authorities)

Vaccination, as of now is unavailable. Though there are numerous groundbreaking research going on by Serum Institute of India (SII), Oxford, AstraZeneca, Gavi, etc., the vaccines are under trials. Developing the vaccine won't solve the problem as mass distribution to the infected is a feat in itself. It might even be late for the people. and the pandemic may take shape of the fast spread pandemic which is the worst case scenario. In order to avoid this, we need to take measures in order to check the rise of infection. This is where the role of the common people come at the time of this crisis. This will give some time for the researchers to develop the vaccine, all the while saving ourselves from the ongoing global crisis due to COVID-19 Pandemic.

## WHAT CAN WE DO?

In order to avoid the worst case scenario of a fast spread pandemic, it is therefore necessary that everyone of us take responsibility and convert this outbreak into a slow spread pandemic. We have to socially engineer our behaviour to act as a "social vaccine". This means two things:-

- ① Not Getting Infected    ② Not Infecting Others

Although it sounds trivial, the very best thing we can do is wash our hands for atleast 20 seconds. This is actually a powerful tool as it destroys the virus. Alcohol-based disinfectants are also effective like sanitizers with high alcohol content. Also, the soap makes the skin slippery and by the rocking motion of water, the dirt and viruses get washed off. All of this require a minimum of 20 seconds to work effectively.

In order to stop or minimise droplet infection, it is important to wear a mask and maintain social distancing. The biggest problem of this virus, is that after getting infected, the symptoms are not visible for many days, during which the asymptomatic person carries the viral load with himself, infecting everyone he comes in contact with.

This very idea of "knowing" whether we have the SARS-CoV-2 virus or not is blurred at initial stages. This is why COVID-19 pandemic was successful in spreading so quickly undetected. This where social distancing comes

in. Social Distancing implies that individuals maintain a distance from one another in public/social places. This reduces the chances of infections from asymptomatic people, i.e those who haven't fallen sick or showed any symptoms, but are very much infected.

This technique reduces infection and thus the number of cases of SARS-CoV-2 infection (caseload). This in turn does not put much pressure on the healthcare facilities, converting this outbreak to a slow spread pandemic. This very process of changing the fast spread pandemic to slow spread pandemic is called Flattening of Curve.

Hence, do not get infected by washing your hands properly for at least 20 seconds. Wear a mask to avoid droplet infection when outside, only for important purposes.

Even if one gets infected, then he or she must stay home and self-quarantine or inform the medical facilities immediately.

But those who feel they are healthy and do not think are infected shouldn't take the risk nor put someone at risk by going out and not taking precautions, as they may be asymptomatic.

It is not clear now, for how long the isolation or self quarantine should last. But it is taken as 14 days in practice.

Individuals should be at a minimum 6 feet distance from one another and should wear a mask properly.

Along with that, there must be proper and effective sanitation with the help of soaps and alcohol based disinfectants like sanitizers.

Hence, things we can do, as individuals, to check the spread of COVID-19 and slower the pandemic are:-

1. Properly wash our hands (atleast 20 seconds)
2. Wear mask properly (covering BOTH nose and mouth)
3. Maintain Social Distancing
4. Properly sanitize

Fighting this pandemic is truly in our hands. Taking measures will not only save our lives, but also provide support to the people who are in the frontline battle with the virus - health care personnels, police officers, suppliers, etc..

This is the least we could do as ordinary people.

## RECENT DEVELOPMENTS

These are some recent updates related to vaccine and SARS-CoV-2 virus:-

- D614G Mutation in SARS-CoV-2 :- While the virus is undergoing many mutations, one particular mutation called D614G is significant and dominant. When the virus enters an individual's body, it aims at creating copies of itself. When it makes an error in the copying process, we get a mutation. In this case, the virus replaced the aspartic acid (D) in the 614th position of amino acid with glycine (G). Hence, the name D614G. This particular mutation aids the virus in attacking more efficiently with ACE-2 receptor in the human host cell, thereby making it more successful in entering a human body than its predecessors.

- COVAX Facility :- Serum Institute of India (SII) said it had received additional funds that would allow to double its supply of COVID-19 vaccines in India and other countries as of the Gavi COVAX facility once the vaccines pass the trials. The SII will now be using the funds from the Bill & Melinda Gates Foundation as well as Gavi, The Vaccine Alliance to supply 200 million (20 crores) vaccines to these countries as early as first half of 2021.

The funding will help accelerate the manufacturing by SII for candidate vaccine licensed from AstraZeneca and Novavax, which will be able for procurement if they are successful in attaining full licensure and WHO prequalification.

Under COVAX Umbrella, Gavi is coordinating the COVAX facility which provides governments with the opportunity to benefit from the portfolio of COVID-19 candidate vaccines, using a range of technology platforms produced by more manufacturers across the globe with a bigger market to provide security of demand.

India is a Gavi beneficiary and will therefore receive a certain proportion of vaccines from the COVAX facility

## CONCLUSION

"We should think, not as individuals, but as a species" 11

In the concluding statement, I would like to emphasize on the big picture, the picture that is often ignored in our own personal struggles.

The pandemic has been harsh and painful to many including myself. It is not just a global health crisis, but also an economic crisis, a social crisis and a mental health crisis. Lockdowns implemented all around the world has put the human lives to a stop. This has brought about economic recession on verge of an economic depression, increasing unemployment, poverty and hunger. Many lives are destroyed and the "fight to normal" seems too long.

Due to the lockdown, my college was closed and online classrooms began which saved me from wasting a year. But those who were less fortunate lost their education as they did not have enough money to continue their classes online. Due to this pandemic, many government and government funded schools were shut down, which resulted in closure of midday meals which the poor children used to get for free. Hence, the children lost both their education and free midday meals.

The fight against COVID-19 pandemic is hard but necessary. Sooner this pandemic ends, better it is for many people. This is a social crisis where we need to stand with one another and fight to prevent it from causing more damage to us.

## ACKNOWLEDGEMENT

I would like to thank my college and my ENVS teacher for giving me this project. As this is an ongoing global crisis that needs more awareness than it actually has.

I am grateful in being part of this awareness movement to my teachers who found a brilliant and relevant topic to talk about.

I also thank my parents for giving me support during the making of this important project.

## BIBLIOGRAPHY

I have taken help from newspapers and journals which have provided deep insights into the topic of COVID-19 pandemic.

# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

NITROGEN CYCLE  
AND  
ITS IMPORTANCE IN  
HUMAN BEINGS

NAME : MRINMOY SAHA

COLLEGE ROLL NO : STUG / 170 / 19

DEPARTMENT : STATISTICS

YEAR : 2020

SIGNATURE : Mrinmoy Saha .

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## Acknowledgement:-

I would like to express my special thanks and gratitude to all the Associate professors of the Environmental Science department of my College RKMRC, Narendrapur (Autonomous)

Date

1/11/2020

Moinmonoy Saha  
STUG/170/119.

## Introduction

Nitrogen is one of the important elements in biological compounds, mainly of nucleic acid and protein and therefore it is essential for life. Atmosphere contains about 78% nitrogen, but free nitrogen cannot be utilised by most of the organisms, except a few blue green algae and some bacteria.

Nitrogen atoms are constantly moving in a giant circle from the air, through the soil, into the bodies of plants and animals and eventually back to the air. This known process is called the nitrogen cycle. All living things need nitrogen to develop and grow.

## Stages of Nitrogen Cycle

### Nitrogen Fixation

In this stage, nitrogen moves from the atmosphere into the soil. Earth's atmosphere contains a huge pool of nitrogen gas ( $\text{N}_2$ ). To be used by plants, the  $\text{N}_2$  must be transformed through a process called nitrogen fixation. Fixation converts nitrogen in the atmosphere into forms that plants can absorb through their root systems.

A small amount of nitrogen can be fixed when lightning provides the energy needed for  $\text{N}_2$  to react with oxygen,

producing nitrogen oxide ( $\text{NO}$ ) and

nitrogen di-oxide ( $\text{NO}_2$ ). These forms of nitrogen then enter soils through rain or snow. Nitrogen can also be fixed through the industrial process that creates fertilizers.

The bacteria gets energy through photosynthesis and in return, they fix nitrogen into a form the plant needs. The fixed nitrogen is then carried to other parts of the plant and it's used to form plant tissues, so the plant can grow. Other bacteria

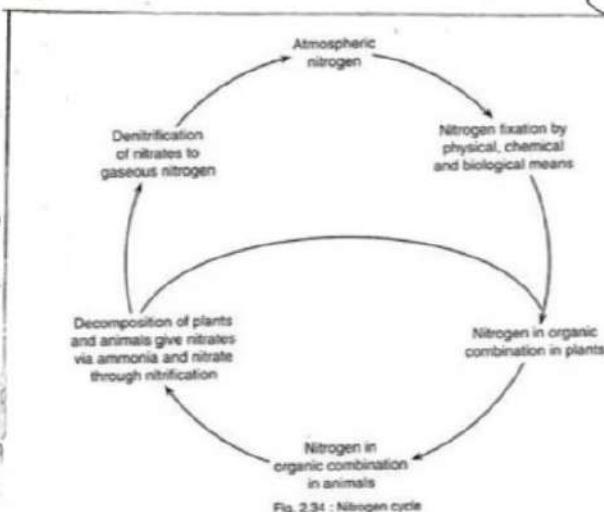
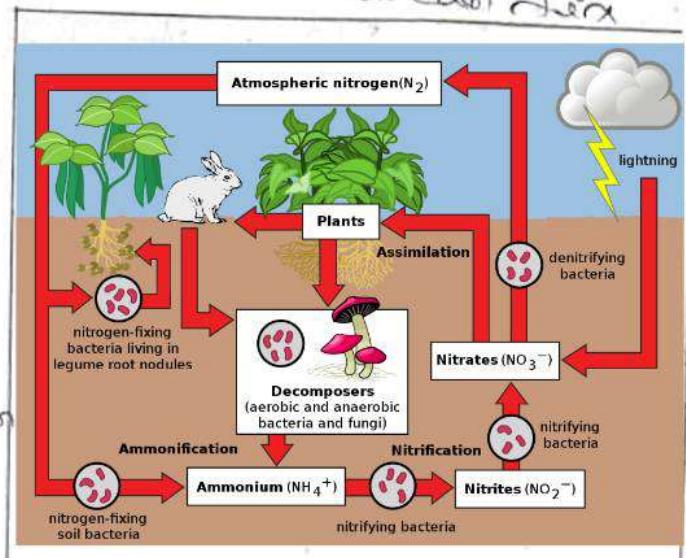


Fig. 2.34 : Nitrogen cycle

live freely in soils or waters and can fix nitrogen without their symbiotic relationship. These bacteria can also create forms of nitrogen that can be used by organisms.

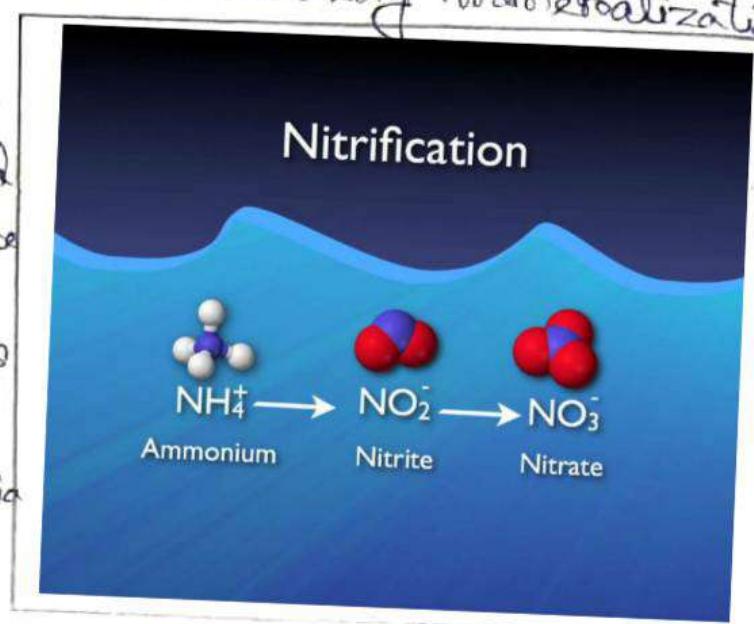


## Mineralization

This stage takes place in the soil. Nitrogen moves from organic materials, such as manure or plant materials to an inorganic form of nitrogen that plants can use. Eventually, the plant's nutrients are used up and the plant dies and decomposes. This becomes important in the second stage of nitrogen cycle. Mineralization happens when microbes act on organic material; such as animal manure or decomposing plant or animal material and begin to convert it to a form of nitrogen that can be used by plants. All plants under cultivation.

## Nitrification

The third stage, nitrification also occurs in soils. During nitrification the ammonia is converted to compounds called nitrites,  $\text{NO}_2^-$  and nitrates  $\text{NO}_3^-$ . Nitrate can be used by plants and animals that consume the plants. Some bacteria in the soil can turn ammonia into nitrite. Although nitrite is not usable by plants and animals directly, other bacteria can change nitrites into nitrate - a form that is usable by plants and animals. This reaction provides energy for the bacteria engaged in this process.



## Immobilization

The fourth stage of the nitrogen cycle is immobilization. Sometimes described as the reverse of mineralization. These two processes together control the amount of nitrogen in soils. Just like plants, micro-organisms living in the soil require nitrogen as an energy source. These soil micro-organisms pull nitrogen from the soil when the residue of decomposing plants do not contain enough nitrogen. When the micro-organisms take up ammonia ( $\text{NH}_4^+$ ) and nitrate ( $\text{NO}_3^-$ ) available to the plants and may cause nitrogen deficiency or a lack of nitrogen. Immobilization therefore ties up the nitrogen in micro-organisms. However, immobilization is important because it helps control and balance the amount of nitrogen in the soil by tying it up, or immobilizing the nitrogen in micro-organisms.

## Denitrification

In the fifth stage of the nitrogen cycle, nitrogen returns to the air as nitrates are converted to atmospheric nitrogen ( $\text{N}_2$ ) by bacteria through the process we call denitrification. This results in an overall loss of nitrogen from soils as the gaseous form of nitrogen moves into the atmosphere, back where we began our story.

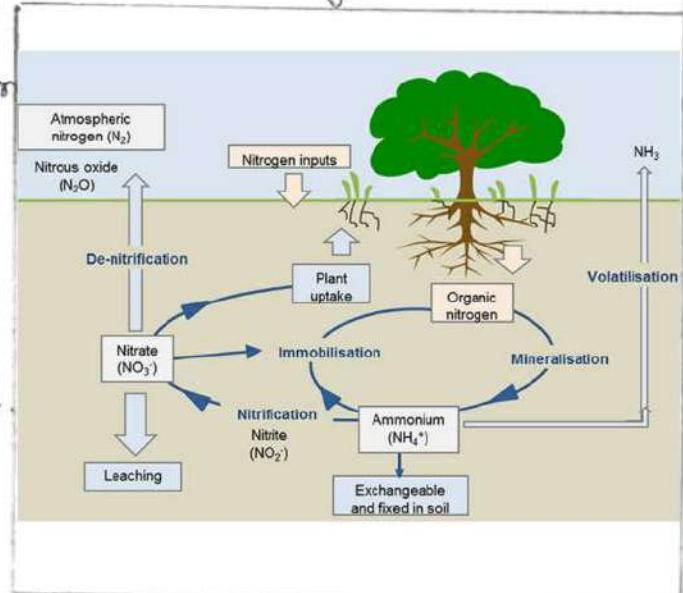
## Importance of Nitrogen in our life:-

### ② Nitrogen is key to LIFE:-

Nitrogen is a key element in the nucleic acids DNA and RNA which are the most important of all biological molecules and crucial for all living things. DNA carries the genetic information, which means the instructions for how to make up a life form. When plants do not get enough nitrogen they are unable to produce amino acids. Without amino acids, plants cannot make the special protein that the plant cells need to grow. Without enough nitrogen, plant growth is affected negatively.

With too much nitrogen plants produce excess biomass or organic matter such as stalks and leaves but not enough root structures.

In extreme cases plants with very high levels of nitrogen absorbed from soils can poison farm animals that eat them.



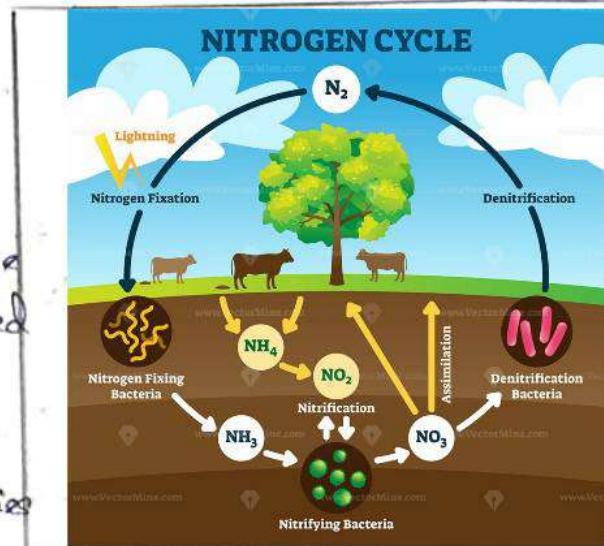
## b) Nitrogen is crucial for Life

The cycling of nitrogen through the ecosystem is crucial for maintaining productive and healthy ecosystems with neither too much nor too little nitrogen. Plant production and biomass (living material) are limited by the availability of nitrogen. Understanding how the plant-soil nitrogen cycle works can help us make better decisions about what crops to grow and where to grow them. So we have an adequate supply of food. Knowledge of nitrogen cycle can also help us reduce pollution caused by adding too much fertilizers to the soil.

Certain plants can uptake more nitrogen than others nutrients such as phosphorous, another fertilizer and can even be used as a 'buffer' or filter to prevent excessive fertilizers from entering waterways. For example, a study done by Haycock and Pimay showed that popular trees used as a buffer held on to 99% of the nitrate entering the underground waterflow during winters, while a river bank zone covered with a specific grass (*Lolium perenne L*) held up to 84% of the nitrate, preventing it from entering the rivers. As we have seen, not enough nitrogen in the soil leaves plants hungry, while too much of a good thing can be bad; excess nitrogen can poison plants and even livestock!

Pollution of our waters sources by surplus nitrogen and other nutrients is a huge problem, as a result life is being suffocated from decomposition of dead algal blooms.

Farmers and communities need to work to improve the uptake of added nutrients by crops and treat animal manure waste properly. We also need to protect the natural plant buffer zones that can take up nitrogen run off before it reaches water bodies. But, our current pattern of clearing trees to build roads and other construction worsen this problem because there are fewer plants left to uptake excess nutrients. By working toward a more complete understanding of the nitrogen cycle and other cycles at play in Earth's interconnected natural systems we can better understand how to better protect Earth's precious natural resources.



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- 2) Latte, Parsons, Carron, Timothy (1997) : "Biological Oceanography"

**RAMAKRISHNA MISSION RESIDENTIAL COLLEGE**



**NARENDRAPUR**

**ENVIRONMENTAL STUDIES**

**PROJECT TITLE : AIR POLLUTION IN CITIES  
AND MEASURES TO CONTROL IT**

**NAME : MURSED ALAM**  
**COLLEGE ROLL NO : BNUG/098/19**  
**DEPARTMENT : BENGALI**  
**YEAR : 2020**  
**SIGNATURE :**

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## Air Pollution in cities and measures to control it:-

From the beginning of human civilization, men started to exploit the nature. In twenty first century massive urbanisation not only making disaster to the nature but creating major issues to the men also. in cities this pollution is intensified, specially air pollution. Air pollution is creating major health issues which is a major problem in the planet.

### Air Pollution - :

Air pollution is the presence of substance in the atmosphere that are harmful to the health of humans and other living beings, or caused damage to the climate or different objects.

### Air Pollutants in the cities and sources - :

As cities are filled with industries and cars, and people. It is the source almost all kind of pollutants.

Different Pollutant and Sources are :—

① carbon dioxide ( $CO_2$ ) :

$CO_2$  is the main 'green housegas' which causes 'global warming'. It reduce the  $O_2$  level in air.

It is mainly produced by car and industries due to burning of fossil fuel.

② Sulfur oxide ( $SO_x$ ) :

$SO_x$  in atmosphere converted to  $H_2SO_4$  in moist. It causes acid rain. It is also Poisous.

It is mainly produced by fossil fuel. Cars and petrochemical industries are common source of it.

③ Nitrogen Oxide ( $NO_x$ ) :

$NO_x$  is a common 'green housegas' and Poisous too.

It is mainly produced by cars

④ carbon monoxide ( $CO$ ) :

$CO$  is very Poisous gas which cause in intated in large amount fossil fuel.



AIR POLLUTION BY CARS

## ⑤ volatile organic compounds (VOC) :-

VOC are well known outdoor air pollutant. They are the organic compound generally used as solvents - Benzene, Isoprene : terpenes, methanol etc. They are very poisonous even if taken in small amounts. It is proven that they cause cancer.

$\text{CH}_4$  is also a VOC which is not poisonous but it is a green house gas.

Mainly house holds, cars, and chemical industries paint are primary source of VOC.

## ⑥ SPM Suspended Particulate matter:-

Nowadays SPM is major pollutant in urban areas. It is the suspended dust Particell asbestos, ash and other harmful Particells suspended in air as a aerosol.

## ⑦ Other:-

CFC, Phosphine, Smoke etc are also air Pollutant



AIR POLLUTION BY CARS

## Cause of Pollution in air in cities:

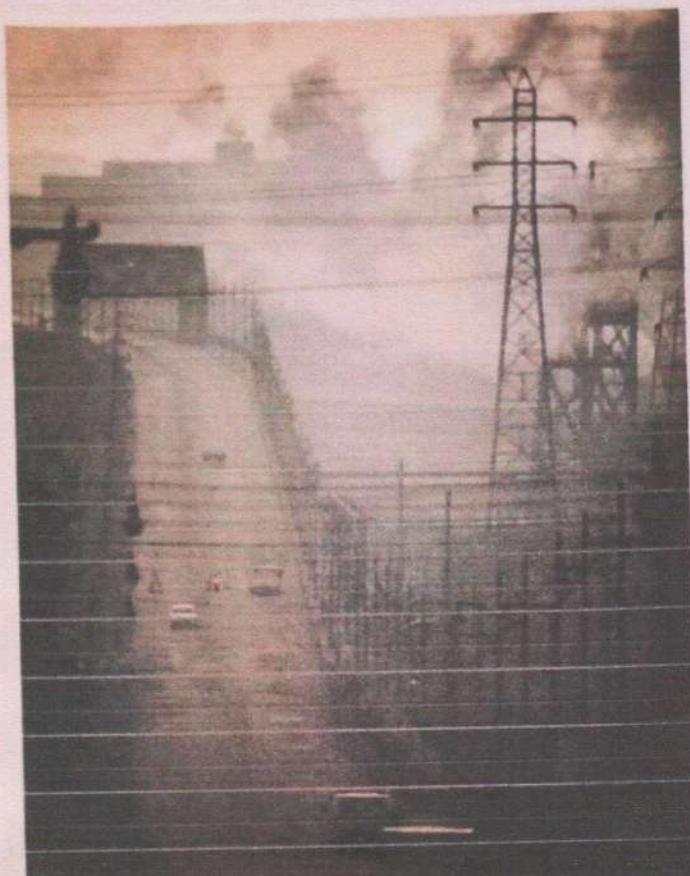
- i) cities have very high population densities.
- ii) large numbers of cars and industries spread in small area.
- iii) Less regulation of pollution sources.
- iv) very poor tree to land ratio.

## Effects of air pollution:-

There are many adverse effects of air pollution which are following:

i) Smog: Smok + fog = Smog, smog is a mix effect of air pollution, man-made smog is derived from coal combustion, vehicular emissions, industrial emissions, and photochemical reaction.

Due to photochemical reaction Smog is composed of ground level ozone ( $O_3$ )



SMOG



AFTER AND BEFORE SMOG

PAN (Peroxyacetyl nitrate) - Smog is a major problem for the cities like 'Los Angeles', 'New Delhi', 'Beijing', 'Lahore' etc.

One of the most dangerous type smog is Photo Chemical Smog. It is the chemical reaction of Sunlight  $\text{NO}_x$ , VOC in atmosphere which leaves PAN ground level ozone.

Smog continues to harm human health in cities. It is harmful for senior citizens, children, and people with heart and lung conditions such as emphysema, bronchitis and asthma. Smog is responsible for an estimated 9500 premature death in the year 2016 alone.

Smog also causes cancer.

## ② Heat Island:

DUE TO HIGH CONCENTRATION OF GREEN HOUSE GASES AND LOW TREE TO LAND RATIO, CITY AREAS ARE NOW HEATED ABOVE THE HARMFUL TEMPERATURE. THIS IN TURN STORM AND DESTABILIZE NORMAL RAIN MIND.

## ③ Health effects:-

### a) World health Mortality:

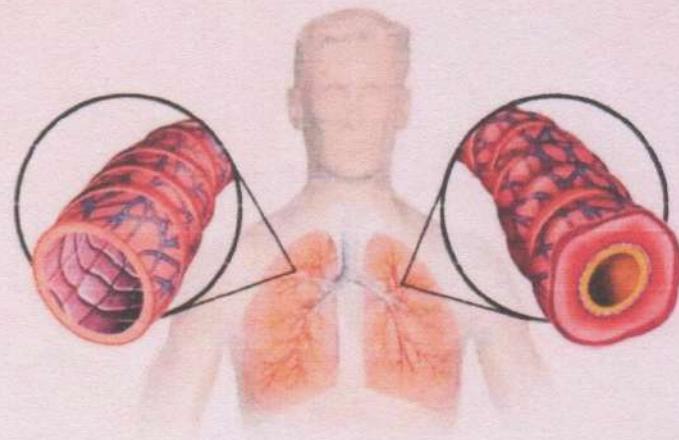
World Health Organization estimated found that, ambient air pollution exposure is a risk factor correlation with increased total mortality from cardiovascular diseases (age: 12% to 14% per 10  $\mu\text{g}/\text{m}^3$  increase)

### b) cardiovascular disease:-

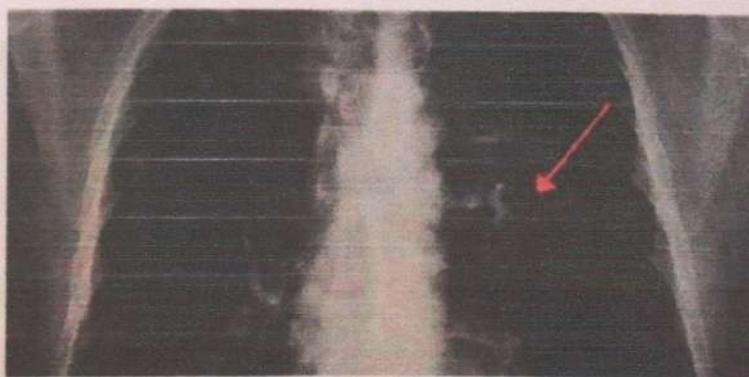
that, ambient air pollution exposure is a risk factor.

### c) Lung disease:-

Research has demonstrated increased risk of developing asthma and COPD from increased traffic related air pollution. Additionally, air pollution has been associated with increased hospitalization



ASTHMA



LUNG CANCER

8-9 Feb  
mortality from asthma and COPD

Chronic obstructive pulmonary such as chronic bronchitis and emphysema.

#### d) Cancer :-

A review of evidence regarding whether ambient air pollution exposure is a risk factor for cancer in 2007 found solid data to conclude that long term exposure to SPM and VOCs increase overall risk of cancer by 6%.

#### e) Effects children and other animals:-

Due to pollution children are highly affected many disease and death happen every year due to air pollution.

Little animals and birds are also very effected, destroying the ecological balance.

#### 4) Economical effects:-

Air Pollution costs the world economy 5 trillion per year as a result of productivity losses and degraded quality of life, according to a study by the World Bank.

## Measures to control Air Pollution :

Various pollution control technologies and strategies are available to reduce air pollution which are following :-

### A) Land-use planning:

Use land in proper manner increase forest areas in cities, removing heavy industry and regulation population density due Air Pollution in cities.

### B) Reduction of fossil fuel:

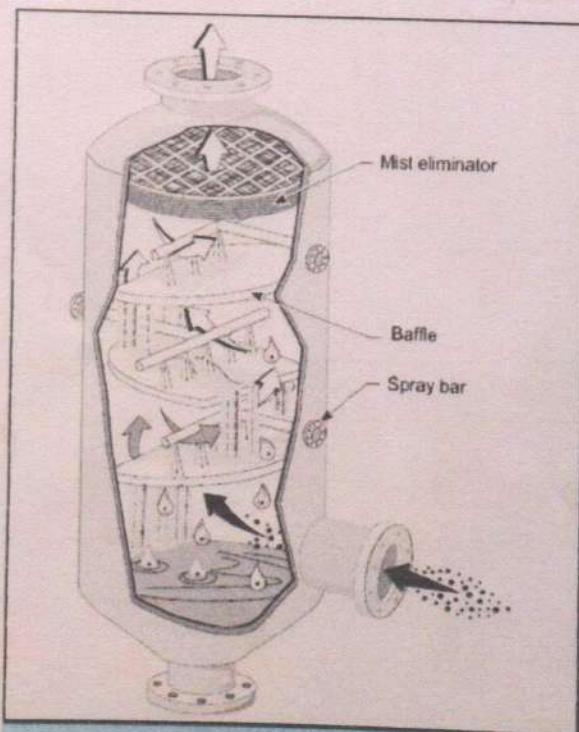
Various efforts are taken to reduce fossil fuel. To reduce air pollution in cities we increase the number of solar panels.

### C) Plantation of Trees:

Trees are very good natural used controller of pollutants. Several varieties like shade plant, epica pulm aglow etc. not only absorb  $\text{CO}_2$  but also absorb VOCs.



ELECTROSTATIC PRECIPITATOR



BAFFLE SPRAY SCRUBBER

## D) Control Device :-

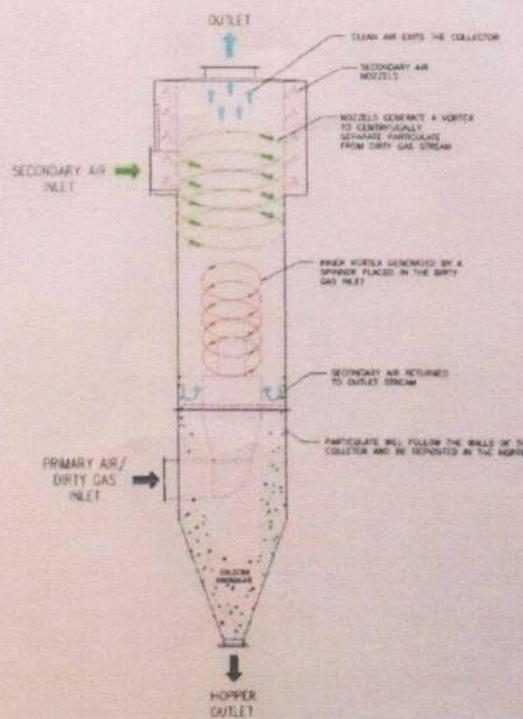
The following items are commonly used as pollution control devices in industries and transportation. If those devices can be used we can reduce the level of pollution.

### I) Particulate control :-

- Mechanical collectors (dust cyclones, multi cyclone)
- Electrostatic Precipitation (ESP) is a particulate control device clean air using induced electrostatic charge.
- Bag house are designed to handle heavy dust loads a dust collector consist of a blower, dust filter - cleaning system which removes dust.
- Particulate scrubber is a wet scrubber which remove gasses like  $\text{SO}_x$ ,  $\text{NO}_x$  and  $\text{CO}_2$  as well as SPM.



BAGHOUSE



DUST CYCLONE AIR CLEANER

## • Scrubber :-

Scrubber system are a diverse group of air pollution control device that can be used to remove some particulate and gasses from industrial exhaust streams.

There are different types of scrubber which are:-

- > Baffle spray scrubber
- > cyclonic spray scrubber
- > Ejector venturi scrubber
- > mechanically aided scrubber
- > spray tower
- > wet scrubber

### • Nox Control :-

There are different tools to control Nox emission which are

- > Low NOx burners
- > Selective non-catalytic reduction
- > Selective catalytic reduction
- > NOx scrubbers
- > Catalytic converter.

### • VOC abatement :-

many plants abt VOCs we also can use activated carbon filters planes ; thermal oxidizers etc to reduce it.

### • SO<sub>2</sub> control :-

as  $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$   
 is useful.

### ⇒ controlling Vehicle Emission:-

Vehicle Emission can be control by using new engines biofuel ; we also need to make electric cars add. Even system employed in Delhi is also very good technique.

### E) Public Awareness:-

Public Awareness is the key to stop any kind of environmental pollution. Because human is the main cause of pollution if people are educated to stop pollution then it is just matter of a wised people.

### G) Governmental and geo Political steps:-

Governmental of many countries as well as UN have taken steps to reduce air pollution. If the law steps are efficiently implemented then we can easily reduce air pollution in cities.

### Conclusion:-

Cities are the economic life lines of any country. Educational, economic, industrial power houses are majorly located in cities but air pollution causing lot of damage. So we need to reduce air pollution as much and as soon as possible to improve our lives.

## Acknowledgement:

I am very my deep sense of  
gratitude to sir for giving me the option  
to write on air pollution in cities. Project  
I am also very thankful to Wikipedia and  
National Geography community in the internet  
for serving me with gigantic databases.

Date : 13 Nov 2020

Muhabed Alaim  
Signature of the  
Student

CERTIFICATE

certified that the project work submitted  
by Munsed Alam is done under the super-  
vision of my honourable Sir as a part  
of curriculum for the partial fulfillment  
of the class - UG 2nd Semester.

Date - ..

Signature of the  
Teacher

# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE:

Water Pollution and measures to control it.

NAME : NIHAL SHARMA

COLLEGE ROLL NO : ECUG/027/19

DEPARTMENT : ECONOMICS

YEAR : 2020

SIGNATURE : 

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## Acknowledgement

I would like to express my special thanks of gratitude to my teachers, Souvik Bhattacharya and Naryana Maity as well as our Principal Maharaj Shastrajnana dasji who gave me the golden opportunity to do this wonderful project on the topic, "Water Pollution and Measures to control it" which also helped me to do a lot of research and I came know about so many new things. I am really thankful to them.

Secondly, I would like to thank my parents and my friends as well who helped a lot in finishing this project in this limited time.

Thanks, to everybody once again for helping me make this project which taught me a lot of things and gave me a new perspective about the world and how to live in it.

## Introduction

Water is one of the most vital natural resources on earth and has been around for a long time. In fact, the same water which we drink has been around in one form or the other since the time of dinosaurs.

The earth has more than two-thirds of its surface covered with water. This translates to just over 1 octillion times/litre of water distributed in the oceans, rivers, lakes and streams.

That is a lot of water, however, less than 0.3% is accessible for human consumption. As commercialization and industrialization has progressed, that number continues to dwindle down. Furthermore, inefficient and outdated practices, lack of awareness and a plethora of other circumstances have led to water pollution.

### What is water pollution?

Water pollution can be defined as the contamination of water bodies. Water pollution is caused when water bodies such as rivers, lakes, oceans, ground water, and aquifers get contaminated with industrial and agricultural effluents.

When water gets polluted, it adversely affects all life forms that directly or indirectly depend on this source. The effects of water contamination can be felt for years to come.

## Sources of water pollution

The key causatives of water pollution in India are:-

- Urbanization



- Deforestation



- Industrial effluents



- Social and Religious Practices



- Use of detergents and fertilizers



- Agricultural run-offs - Use of insecticides and pesticides.



## Control measures of Water pollution

### 1. Use less Plastic

It is very difficult to break down plastic after it is produced. Much of the plastic we consume ends up in the world's water supply, where it is even harder to fish out and safely throw away.

If you can use as few plastic items as possible, you are helping the environment. Plastic waste also spreads decay in the water supply.

### 2. Reuse Items

Whenever you buy something that is not recyclable, such as plastics, it is better to reuse this item as many times as possible. This habit limits your consumption and many less of those products will end up in the world's rivers, lakes, and oceans.



### 3. Recyclable Options

If there are two options for a particular item, try to pick the one that is easily recyclable. Glass bottle are much better for the environment than plastic, for example.

### 4. Do not dispose oils in the sink.

While there is nothing wrong in consuming oils in food, or applying them on your body, it is a bad idea to dispose of grease, fat and used cooking oil in the sink or down the drain.

It is better to dispose of oils in the garbage, or collect all your excess oil in one bottle and then throw that away.



### 5. Cleaning Chemicals

Similar to oils, cleaning chemicals are hazardous when they enter the water supply. If you are emptying containers of house hold cleaning supplies, do it in the trash can not gi



### 6. Handle Toxic Chemicals Properly

The toxic chemicals like ammonia, bleach, paint, paint thinner, and many other chemicals are becoming a severe problem, and if these are dumped down the drain or the toilet, the effects add up. Therefore proper disposal of these is important.

### 7. Shop to Stop Water Pollution

Try to avoid buying products that contain persistent and dangerous chemicals in the first place. Nowadays, companies are selling non-toxic cleaners and bio-degradable cleaners and pesticides.

### 8. Do not throw Away Medicines

Never throw away medicines in the water supply, either. Even if you do not need them, it is a bad idea to flush pills, liquid or powder medications or drugs down the toilet or ~~or~~ crush them in your kitchen sink disposal.

### 9. Avoid Toilets for Throwing household Items

Do not throw household items, such as dust clothes, tissues, dental floss, wrappers, and other paper goods in the toilets when you are done with them. Toilet paper is specifically made in a way that breaks down easily in water pipes, but the fiber-reinforced cleaning products that pollute the system.

### 10. Garbage disposal

Even though most homes have a garbage disposal system in the sink, it is better to use it rarely as possible. This system can break down solid objects, but those items are harmful to the water supply. It is better to throw them in a trash can when possible.



### 11. Dish washing or Laundry

Only use your dishwasher or washing machine when it is close to being full. Using these machines to clean one or two dishes or a few pairs of clothes is an incredible waste of water. The less amount of water you use during washing, the less you promote water pollution.

### 12. Limit the use of Detergent and Bleaches,

while it is okay to use detergents and bleaches in dishwashers and washing machines, it is better to limit your use as much as possible.

13. Use Phosphate-Free Detergent

Phosphates present in cleaners are harmful chemicals. Phosphates lead to algae blooms and reduce the oxygen in the water that kills fish and other aquatic animals.

14. Use Environmentally Friendly Detergents

Whenever possible, get environmentally detergents, soaps and dishwashing liquids as these are less harmful to the environment.



15. Gardening

While everyone wants a nice garden in their home, it is incredible how much water we waste during that growth. Installing a rainwater harvesting pit because it can catch rainfall throughout the year and later use the water for gardening purpose.

### 16. Avoid Pesticides

If you need to overhaul your garden, attempt to do so using without any herbicides or pesticides. These are very harmful to the environment.



### 17. Conserve Soil.

When chemicals get into the soil they spread through the water because of the topsoil getting carried by the falling rain. This is normal, but if the soil is exposed to excess phosphates or harmful substances, it can cause serious damage to the ground.



### 18' Do regular car maintenance

In case you have a car, truck, or other mechanical device, you should try to take it for maintenance after regular intervals. Oil and other fluids that leak from motor vehicles end up in the local water system or running off into creeks and streams. This ensures the item is running efficiently and not polluting the environment that much. Remember pollution in the air does have an eventual impact on our water supply.



### 19. oil spill

The waste that gathers up when you are working on your car or other mechanical devices is harmful to the environment.



## 20. Cellar Drains or Septic Tanks.

If you have a cellar drain or septic tank, be sure that it is not draining directly into your sewage system. This can cause serious issues and pollution in the system.



## 21. Just Do Not Litter

If you are visiting an area where there is a nearby lake, river, or ocean, do not throw any type of litter or trash into or near the water, because eventually it will mix up with water supply.



## 22. Use water Sparingly

Turn off the tap while you are brushing your teeth. Bathing actually uses a lot more water than showering. Install a water-efficient toilet. Every bit water you conserve is a way to help environment.



## 23. Plant Fauna at Lakes or Rivers

If you live in an area where a lake or river is present, you might want to think about planting some local fauna near water. Trees are also helpful. They reduce erosion that washes pollution into the water and help protect the nearby water supply from pollutants. It also limits the CO<sub>2</sub> in the water, which balances out its pH level.

## 24. Clean Up Litter

Cleaning up litter is a way to help and conserve the environment.



### 25. Stop Chemical Pollution

If you notice someone throwing chemicals into water, or hear about such an incident, talk to your local authorities about the matter so that proper action is taken.

### 26. Eat Organic Food More

Sticking to an organic diet reduces the amount of chemical pollution that ends up in the water. Organic food is tend to be produced with few synthetic chemicals.



### 27. Choose Food Wisely

The food we choose to eat has severe impact on the quality of the environment. The chemicals used to grow food, the fuel used for transportation of crops, and the fuel used to run farm equipment on industrial farms ultimately impact the environment.

### 28. Buy Sustainable Meats

While you enjoy a hamburger from time to time, it is essential to think the impact of factory farms on our water supply. These farms produce huge amount of waste, which ends up harming the nearby water supply.

29. Best is cutting down meat consumption

Animals that are raised for meat takes lots of water for the food and grains they need, as well as the to keep them alive. Moreover, the antibiotics and solid waste both tend to end up in groundwater and rivers.



30. Stop Immersion of Ashes in the river

While it is a common practice, especially in the Hindu religion, to immerse the ashes of a deceased person into the holy water of sacred river Ganga, it pollutes the river water and adversely affects the water quality.



### Conclusion

Hence, Preventing water pollution and conserving water are important to assure a continuing abundance of water that is safe to use for ~~our~~ ourselves and future generations. Water pollution is any human-caused contamination of water that reduces its usefulness to humans and other organisms in nature.

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# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

### PROJECT TITLE:

CORONA PANDEMIC AND ROLE OF  
COMMON PEOPLE TO CONTROL IT

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DEPARTMENT : CHEMISTRY  
YEAR : 2020  
SIGNATURE : *Xilarun Koley*

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## Introduction

The Corona Virus pandemic is the biggest global health crisis of our time and the greatest challenge we have ever face since World war-II. Corona virus disease (COVID-19) is an highly infectious disease caused by a newly discovered corona virus (SARS-CoV-2) and has taken the form of Pandemic within just a period of 3 months since the first identified case in Wuhan, China, in the month of December, 2019. We have now reached the tragic milestone of 1 million deaths and the human family is suffering under an almost-intolerable burden of loss.

But the Pandemic is much more than a health Crisis now, it's also an unprecedent socio-economic crisis. Drawing on our experience with other outbreaks such as - Ebola, HIV, SARS, TB and malaria, as well as so others COVID-19 pandemic is the most awful of ever.

In this project I have tried to summarize all the details of outbreak, casualties, issues of COVID-19 pandemic and role of the commoners in this situation.

## Corona Virus and outbreak of Corona Pandemic.

In actual COVID-19 is a viral fever and the virus that is causing the disease is named as Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2). Before the nomenclature it has been provisionally called as "2019 Novel - Corona virus (2019-N-CoV-2)". SARS-CoV-2 is a particular strain of virus that belongs to the huge coronavirus family (It is a  $\beta$ -Coronavirus, a particular genus of the family). Other infectious Coronavirus causes respiratory infection or diseases mostly during seasonal change, but some strains also cause severe diseases like - MERS (Middle East Respiratory Syndrome) and SARS (Severe Acute Respiratory Syndrome). COVID-19 is one new name in the list of severe diseases caused by the family. The symptoms of COVID-19 viral fever are listed in the figure 1.

RNA viruses generally have very high mutation rates compared to DNA viruses because viral RNA-polymerases lack the proofreading ability of DNA-polymerases. This is one reason why it's difficult to make effective vaccines to prevent diseases caused by RNA viruses — diversity is their strength. This is the very problem with Coronavirus.

The present death rate in Coron Virus is only 2% in India and only 1% worldwide but the infection rate is awfully fast and it follows an exponential relation (ref: <https://www.worldometers.info/>). This is the terrible problem that transformed the outbreak in small region to a pandemic worldwide. We can get it by taking account simple mathematical calculations of such exponential trend. Say, at a particular time period death rate from COVID-19 is on an average 3% only. But say today no. of active cases = 5000 and if the graph increases exponentially then active cases will reach almost 11 lakh at the end of the week and hence deaths or closed

Cases which were 150 at the beginning of the week, become almost 3000 at the end of the week which is really a big number. This is the scenario in the initial few months of corona virus outbreak and this is clearly visible from graphs of worldometer in fig

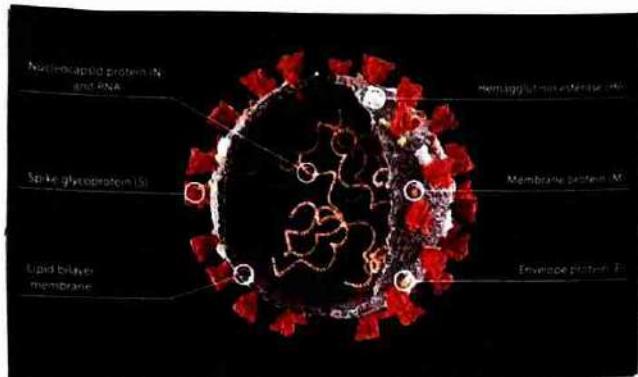


Fig1: CoronaVirus structure.

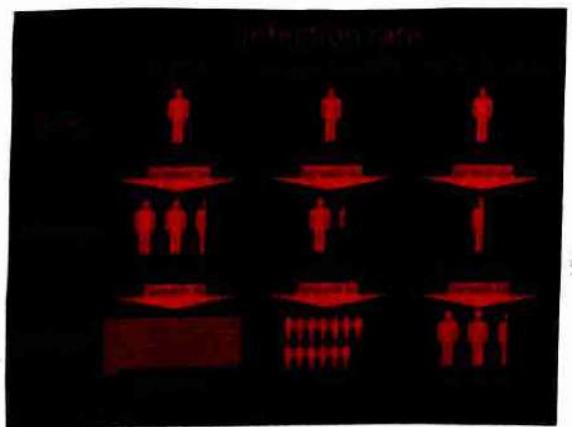


Fig2: Exponentially increasing infection.

- |                                                                                                                                                                                                          |                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• fever.</li> <li>• Dry cough.</li> <li>• Tiredness</li> <li>• Aches and Pains</li> <li>• Sore Throat</li> <li>• Diarrhoea.</li> <li>• conjunctivitis.</li> </ul> | <ul style="list-style-type: none"> <li>• Difficulties in Breathing</li> <li>• chest pain.</li> <li>• Loss of Taste or Smell</li> <li>• A rash on Skin.</li> </ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Fig3:  
Major and minor symptoms of covid-19.

### Total confirmed COVID-19 cases

The number of confirmed cases is lower than the number of total cases. The main reason for this is limited testing.

Our World in Data

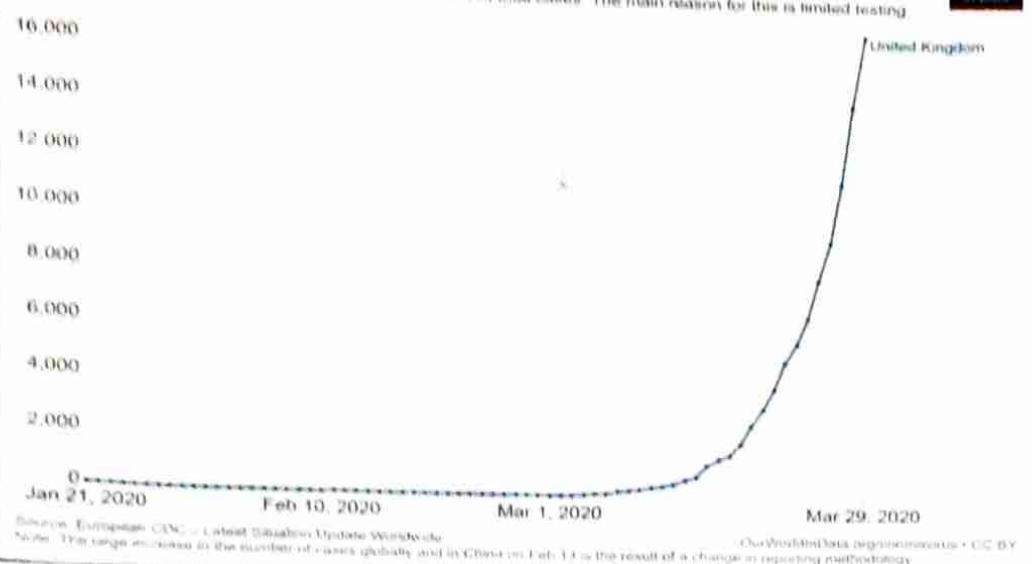


Fig 4: Total covid case statistics of UK

### Total Coronavirus Cases in Italy

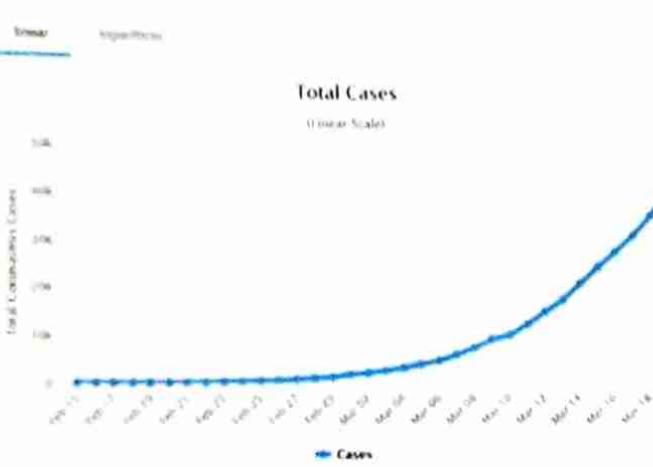


Fig 5: Total covid case statistics of Italy

### Total Coronavirus Cases in the United States

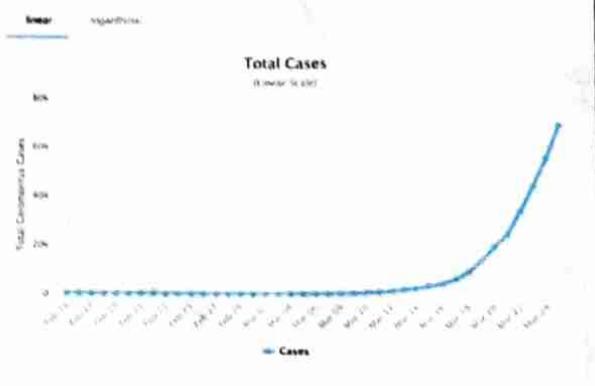


Fig 6: Total covid case statistics of USA

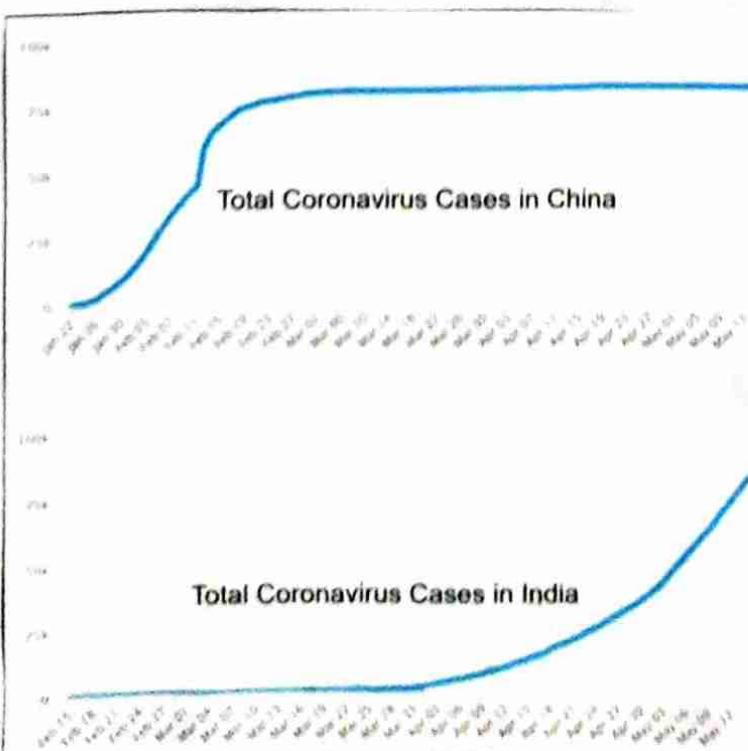


Fig 7:

Total covid case statistics - China v/s India  
 → It's important to notice that China is gradually taking control over infection from Feb.

Now we need to know the basic difference between the terminologies - 'Endemic', 'Outbreak', 'Epidemic', 'Pandemic'. Although I have used the term 'outbreak of Pandemic', we can term a spread in little area as 'outbreak'.

- 'Endemic' is something that belongs to a particular region of a country.
- 'Outbreak' is greater-than-anticipated increase in the number of endemic cases. It can also be a single case in a new area.
- An 'Epidemic' is a spread of disease that affects a large number of people within a community population or region.
- A 'pandemic' is an 'Epidemic' that's spreaded over multiple countries or continents.

The first case of coronavirus was identified in Wuhan, China in the month of December, 2019 and within the month of January the disease broke into China to an alarming proportion and could not be kept bounded within China. Just in next 2 months a dangerous outbreak took place in Italy, Spain, France, Germany, UK followed by India, America, Brazil and many others. This is quite obvious for such an awful disease as I have already shown a rough calculation in the earlier section. In this way corona virus broke in the entire world in form of a Pandemic just within 4 months. In general in case of such biological-diseases outbreak graph i.e. the daily active cases' graph takes a saturation point after a certain time and the exponential increase rate stops and decrease in active cases starts. But there is no sign of saturation point on the daily active cases' graph and death rate is still fluctuating daily. (fig)

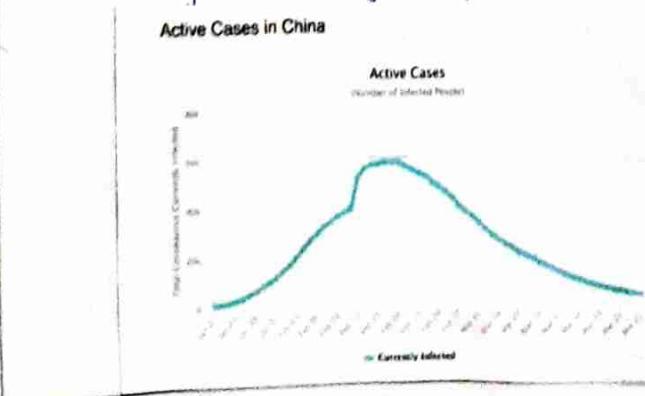


Fig 8: Active case statistics of china.

- There is a saturation point on the graph indicating China has managed to take control over the infection rate.

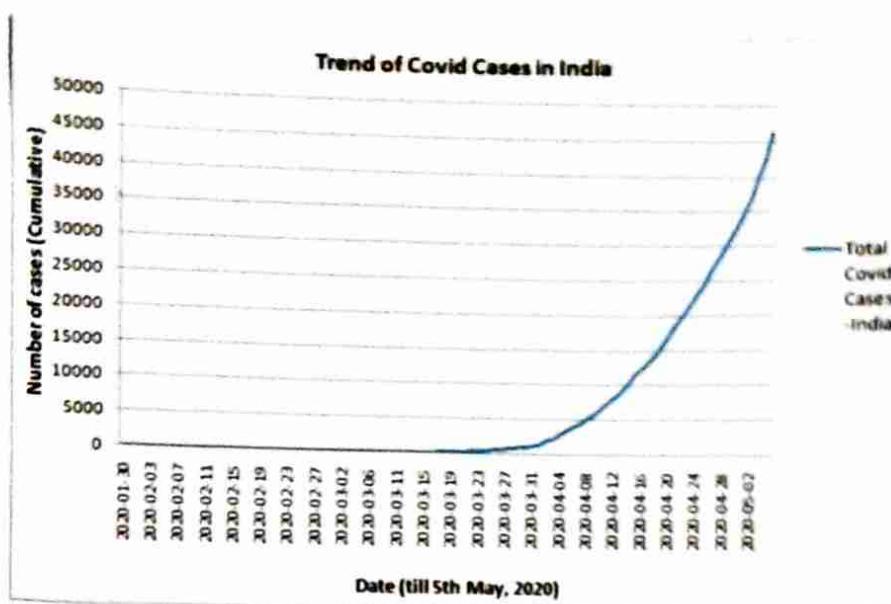


fig 9: Trend of covid cases in India (upto May)

→ The exponential trend can be realised from the fact that upto middle of March, 2020 there was no significant no. of cases and only within 1 month it turned to almost 20000 and within 15 days more it reached a milestone of 50K.

Scenario in India is indeed critical now. The very first covid-19 case was identified in the end of January, 2020. In the next month few more cases were identified but yet it was not out of control. In March almost every states in India declared a 15 days lockdown. Under lockdown all the educational, institutes, official fields, business sectors, markets and malls, transportation services were closed completely declared to remain completely closed except the hospitals and medical stores i.e. nothing but health services were allowed. But because of increasing covid-19 cases the lockdown period was continued in phases for about 6 months. But remembering the economical crisis called in by corona virus situation complete lockdown was not adorable anymore and conditionally unlock terms were introduced. In this meanwhile WHO stated that complete control over coronavirus may take a whole year or even a decade. Thus, slowly offices, transportation services, markets, and other essentials were opened under too many conditions and mass gathering was

declared as punishable. Proper masks, sanitizers, gloves, and many other protections were instructed to be used while going outside. However, dramatically enough, the 3rd phase of covid-19 broke in India in this conditionally unlock situation. Now India is in the top list of daily death rate and total active cases in the world. Maharashtra is reported to be the worst affected state till today (21st Oct, 2020). Let me represent today's worldometer data of coronavirus in the world and in India separately.

<u>Cases:</u>	<u>World wide</u>	<u>India</u>
1. No of active cases.	91,73,297 (99% mild 1% critical)	7,98,538
2. No of deaths. (closed cases)	11,23,117 (9%)	1,15,197
3. No. of total corona virus cases yet identified.	9,06,57,596.	75,97,063
4. No. of total recovered cases.	3,03,61,182 (96%)	67,33,328

## Present and Future crises

Corona virus is a global crisis and the biggest challenge we have ever faced. From world's most sophisticated European healthcare system to the world's largest spending healthcare system in US, every country affected by corona pandemic is struggling to control it. Today we have already faced one million loss of lives worldwide due to Corona virus. Besides health crises many other crises have been caused by the coronavirus pandemic. I would like to mention only 9 vital in the list.

1. Health system crises: i) the covid-19 has had a major impact on the capacity of health systems to continue the delivery of essential health services. While health system around the world are being challenged by increasing demand for covid-19 patients, it is critical to maintain preventive and curative services, especially for the most vulnerable population such as - children, older persons, people living with chronic conditions. Countries need to achieve the optimal balance between fighting covid-19 pandemic and maintenance of essential health services.

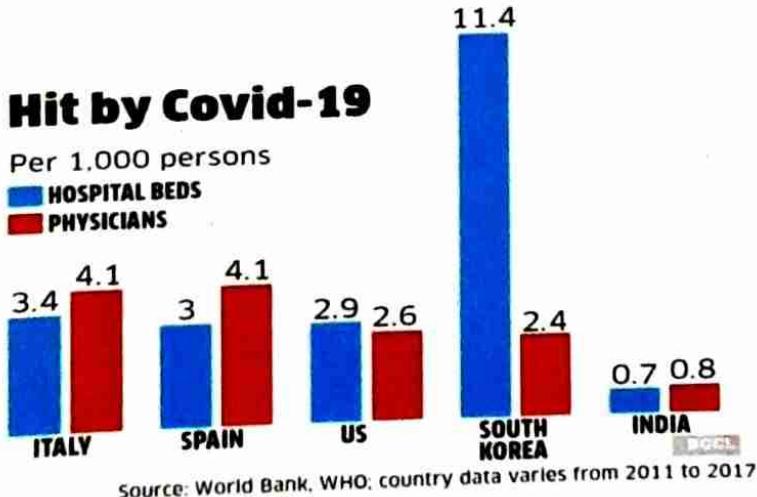


fig 10:  
physician  
Hospital beds,  
per 1000 patients  
in different  
countries.

→ In India, the scenario is very critical and notable especially in this covid-situation.

Furthermore, ii) SARS-CoV-2 seems to have an impact on the long term health issues, iii) In many hospitals lack of proper maintenance ~~therefore~~ is causing infection to Non-COVID patients (being admitted), iv) out of fear, in many cases doctors and

health workers have resigned from their job when the whole society is very much dependent on them in this deadly situation.

## 2. Social Crises:

Commoners in the society are facing many Social crises other than health crises. The main strategy to bring back covid-19 situation under control is social distancing. People should maintain social distancing even in this unlock situation as much as possible. But in many cases people are totally violating the simple social distancing rule intentionally or unintentionally. This is not fair. However in many cases social distancing can't be performed rigidly. But if commoners of the society are not aware enough to wear atleast a mask then the health conscious persons should be afraid of going outside for their essential commodities indeed.

Again, in many cases the opposite picture can be observed too. People are being totally unsocial in name of social distancing. COVID patients are being non-cooperated in every each and every step. Many where COVID patients are reported to die because of non-cooperation of the society. Even an ambulance is refusing a patient to carry hospital if the patient is covid positive.

Our doctors, nurses, technicians, medical staff, administrators, food service workers, pharmacists, security guards, our military deployed to setup hospitals and deliver aid, are fighting day and night with the COVID patients. In return the ~~ungrateful~~ ungrateful society is treating them as villains again in name of Social distancing. If such brutality continues to happen we will never be able to tackle the situation.

### 3. Economical crises.

The indirect effect of coronavirus pandemic on world economy is crucial. During the pandemic, the economic downturn has greatly affected people from the lower socio-economic stratum (SES). The distressing media visuals of migrant labourers going to their native places from cities on foot during the lockdown has been critically debated. Remittance of money to home country, which many migrant Indian workers popularly do, is another way of poverty reduction, economic development and increase in GDP. About 139 billion \$ was remitted to low and middle income countries in the year 2019. The disruption caused by COVID-19 has had a significant impact on these remittance flows. Importantly, remittances are projected to fall by about 23% in India in 2020 (fig 12). Due to Covid situation, International Transportation was totally stopped for a period of almost 2-3 months. In this situation supply of many essential commodities decreased greatly, hence prices of essential commodities raised by leaps and bounds. The Economic distress created by coronavirus pandemic may take years to become normal again even if the COVID-19 virus infection is brought under control.

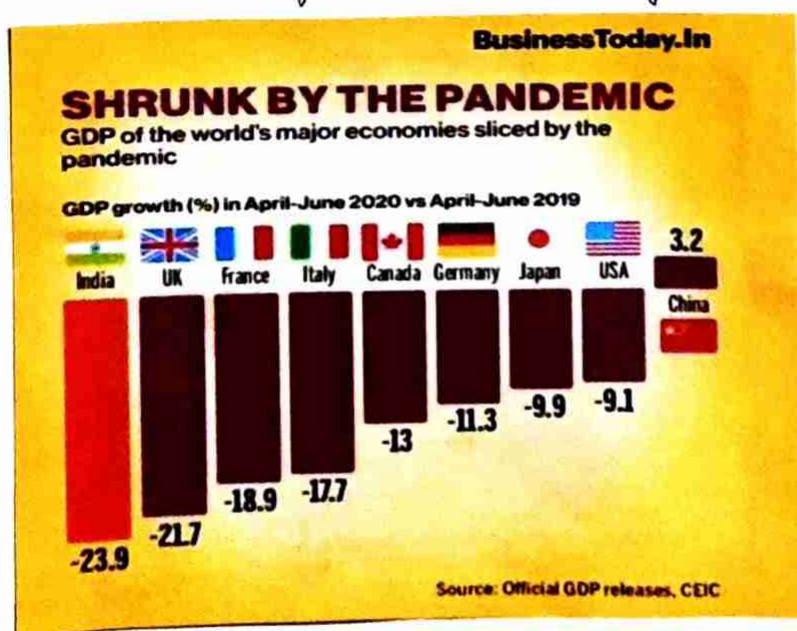


Fig 11:  
Decumfall in  
GDP in COVID-  
Situation  
(countrywise)

→ Scenario in India is the most critical, whereas, China could keep hold on their GDP even in the Pandemic situation.



Fig 12:

Migrant labourers  
on the way to  
home land on foot.  
even in this  
COVID situation.

#### 4. Educational crises.

Schools, colleges, and other educational institutes are remained closed since the 1st phase lockdown was declared in March, 2020, all over the India. After a gap of one month all the institutes were compelled to start online classes. Until then people in India were mostly ~~unac~~ ignorant of such online classes on virtual media.

In this new method of learning, too many limitations are there indeed. But there was not better solution than virtual platform to carry on the distance learning in such a critical situation when everyone should keep in mind ('social distancing') what ever he does. However many students from financially poor background can not afford the costly electronic devices required for such E-learning programme. Holding proper examinations on virtual media is very difficult. Perhaps, many educationalists stated that sooner or latter such virtual media learning method had to be taken into play.



Fig 13:

Distance Learning  
through E-media.

## Role of Common People To Control It

The overall development, economy, mentality of a country depends on the people of that country and their awareness. And hence in such a pandemic situation the role that the commoners have to perform is vital. According to the guideline of WHO; the Role of commoners should be like as follows:

### To keep oneself safe:

1. While outing, maintaining at least 1m distance with others.
2. Make wearing a mask, gloves as normal part of being around other people.
3. clean your hands before and after wearing gloves.
4. for the health workers special equipments made for covid-19 situation is a must.
5. One must regularly and thoroughly clean one's hands with alcohol based sanitizers.
6. Avoid touching own eyes, mouth, nose.
7. One must cover mouth with tissue or at least bent elbow when sneeze or cough.

### To keep Environment Safe:

1. Avoid 3 C's: closed, crowded, contact.
2. one must avoid crowded indoor settings and meet people outside home.
3. clean and disinfect surfaces regularly that are regularly touched or used.
4. ventilate perfectly the environment.

### To do if one feel unwell:

1. one should know the full range of symptoms of covid-19.
2. One need to stay in home-isolation even if one have minor symptoms such as — cough, headache, mild fever and need to undergo a covid test.
3. If one have a breathing problem then one need to seek medical attention as soon as possible.
4. Keep up to date on latest information from trusted sources.
5. One should be smart and shouldn't be panic.

## Conclusion.

To conclude this project I must mention the other side of the same coin. Due to COVID-19 situation, vehicles plying on road decreased to great extent, international planes, jets were postponed and all the industrial fields were totally closed. The nature had a positive impact for all these reasons. The pollution reduced to a fairly low level. The water in the down stream of the river Ganga was found to be the least polluted in recent decades. Air pollution reduced too. As long as human being is there on the earth, such new genre of viruses will be coming again and again on earth, and for the first time we felt the importance of the development of the health system. Services is above all the social superstition and political ups and downs. Also we developed many online services, technologies, and methods regarding distant learning.

The tendency to have fast foods and junk foods, which is very common to young generation, is expected to have decreased at least a bit.

Already our scientists across the world has already involved in the research of a permanent remedy i.e. a proper vaccine for this highly infectious disease and many where the process has proceeded by more than one step. Hopefully we may have the vaccine of coronavirus within the end of 2020 and would be readily available in market within next summer.

We have seen a huge damage to entire mankind brought about by this Corona Pandemic. The only hope that about the end of these all is the Vaccine and the only thing that can end this biological war, is the developed science and Researches. Hence our present generation can take a lesson from this situation that they need to grow their future science more than ever to fight against such upcoming wars.

## Acknowledgement

The success and final outcome of this project required a lot of guidance and assistance from many one and I am extremely privileged to have these all along with the completion of my project. I am grateful to Ramakrishna Mission Residential College (Autonomous) for providing me an opportunity to materialize this project. I must mention the assistance and support provided by my friends that helped me in every step from beggi starting to end of this project.

Thanking you.

→ Nilarun Koley

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# Nitrogen Cycle and its importance for living beings.

## Introduction :-

Nitrogen or N, using its scientific abbreviation, is a colourless, odorless element. Nitrogen is in the soil under our feet, in the water we drink, and in the air we breathe. In fact, Nitrogen is the most abundant element in Earth's atmosphere: approximately 78% of the atmosphere is nitrogen! Nitrogen is important to all living beings, including us. It plays an important role in plant growth: too little nitrogen and plants cannot thrive, leading to low crop yields; but too much nitrogen can be toxic to plants. Nitrogen is necessary for our food supply, but excess nitrogen can harm the environment.

## Why is Nitrogen important?

The delicate balance of substances that is important for maintaining life is an important area of research, and the balance of nitrogen in the environment is no exception. When plants lack nitrogen, they become yellowed, with stunted growth, and produce smaller fruits and flowers. Farmers may add fertilizers containing nitrogen to their crops, to increase

Crop growth. Without nitrogen fertilizers, scientists estimates that we would lose up to one third of the crops we rely on for food and other types of agriculture. But we need to know how much nitrogen is necessary for plant growth, because too much can pollute waterways, hurting aquatic life.

## Nitrogen is key to life!

Nitrogen is a key element in the nucleic acids DNA and RNA which are the most important of all biological molecules and crucial for all living things. DNA carries the genetic information, which means the instructions for how to make up a life form. When plants don't get enough nitrogen, they are unable to produce enough amino acids (Substances that contain nitrogen and hydrogen and make up many of living cells, muscles and tissues). Without amino acids plants cannot make the special proteins that the plant cells need to grow. Without enough nitrogen plant growth is affected negatively. With too much nitrogen plant produce excess biomass or organic matter, such as stalks and leaves, but not enough root structure. In extreme cases, plants with very high levels of nitrogen absorbed from soils can poison farm animals that eat them.

## What is Eutrophication and can it be prevented?

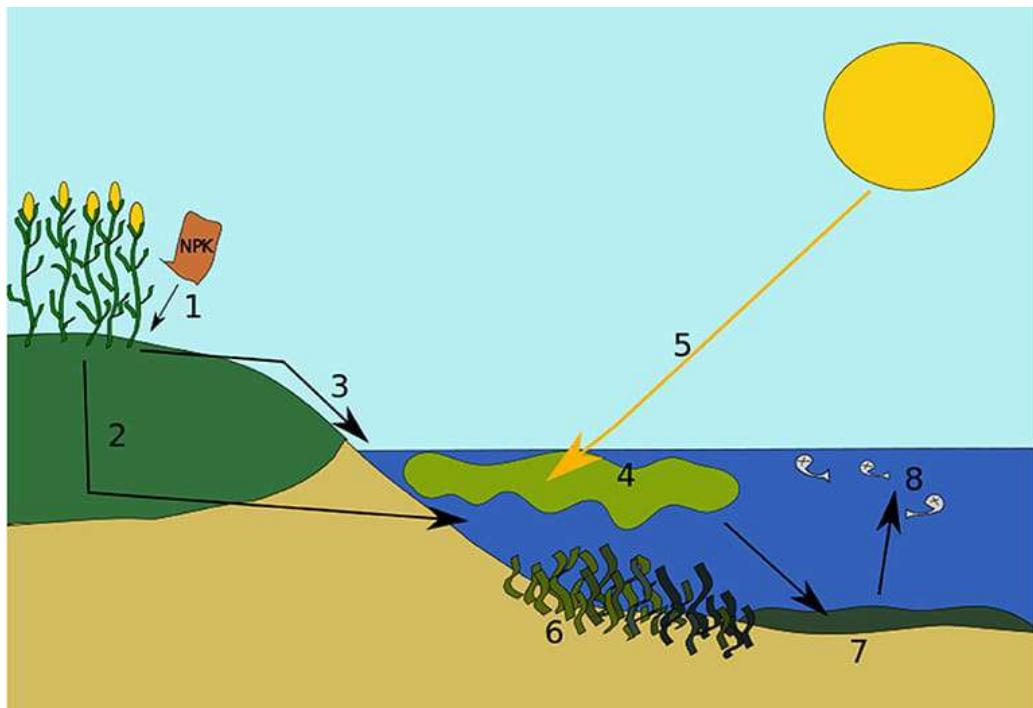
Excess nitrogen can also leach - or drain - from the soil into underground water sources, or it can enter aquatic systems as above ground run-off. This excess nitrogen can build up, leading to a process called eutrophication.

Eutrophication happens when too much nitrogen enriches the water, causing excessive growths of plants and algae.

Too much nitrogen can even cause a lake to turn bright green or other colours, with a "bloom" of smelly algae called phytoplankton. When phytoplankton dies, microbes in the water decompose them. The process of decomposition reduces the amount of dissolved O<sub>2</sub> in the water, and can lead to a 'dead zone' that does not have enough Oxygen to support most life forms.

Organisms in the dead zone die from lack of oxygen.

These dead zones can happen in freshwater lakes and also in coastal environments where river full of nutrients from agricultural run-off flow into oceans.



- ① Excess nutrients end up in the soil and ground.
- ② Some nutrients become dissolved in water and leach or leak into deeper soil layers. Eventually, they get drained into a water body, such as a lake or pond.
- ③ Some nutrients run off from over the soil and ground directly into the water.
- ④ The extra nutrients cause algae to bloom.
- ⑤ Sunlight becomes blocked by the algae.
- ⑥ Photosynthesis and growth of plants under the water will be weakened or potentially stopped.
- ⑦ Next, the algae bloom dies and falls to the bottom of the water body. Then, bacteria begin to decompose or break up the remains, and use up oxygen in the process.

⑧ The decomposition process cause the water to have reduce oxygen, leading to 'dead zones'. Bigger life form like fish cannot breathe and die. The water body has now undergone eutrophication.

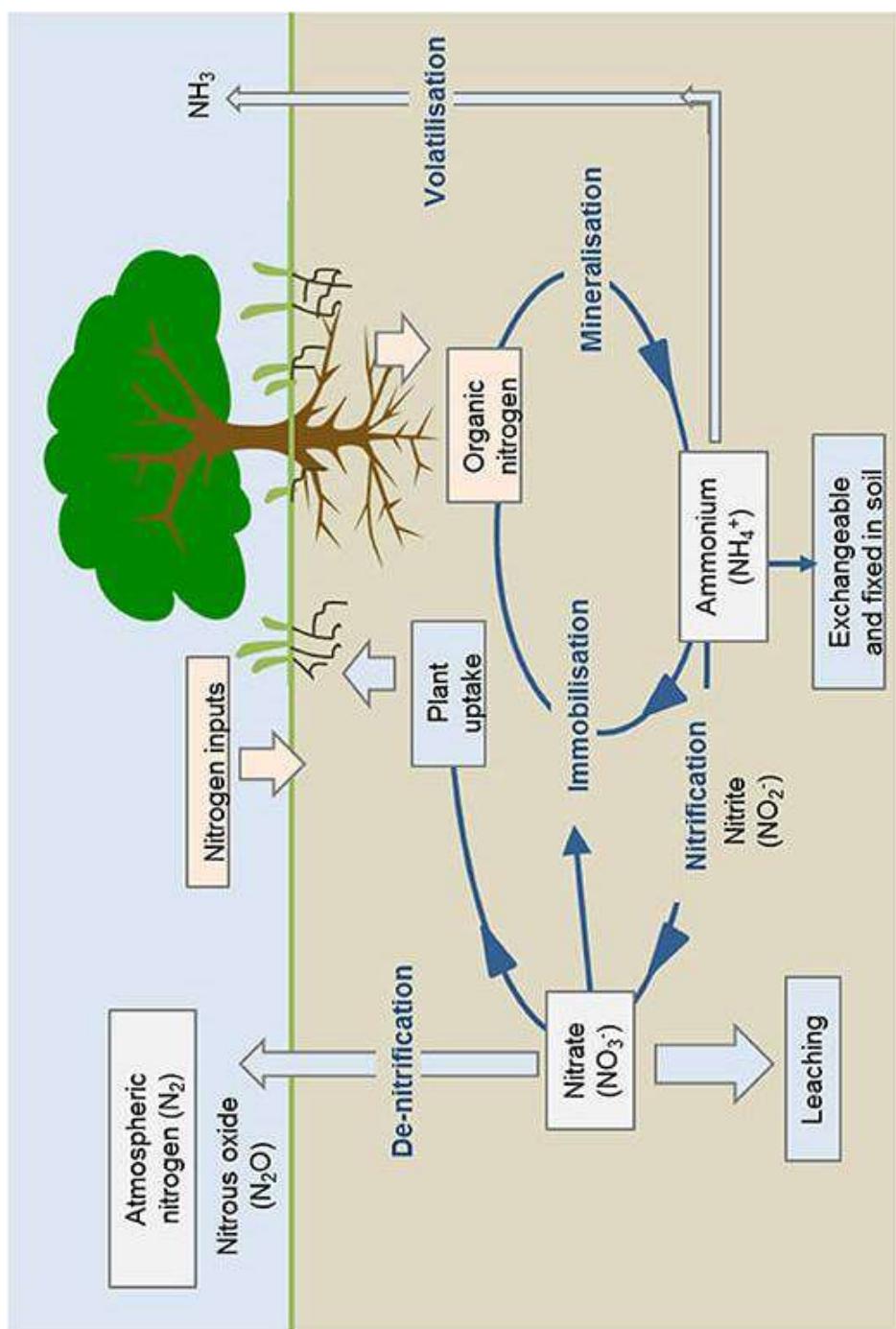
Can eutrophication be prevented? Yes! People who manage water resources can use different strategies to reduce the harmful effects of algal blooms and eutrophication of water surfaces. They can re-route excess nutrients away from lakes and vulnerable coastal zones, use herbicides (chemicals used to kill unwanted plant growth) or algaecides to stop the algal blooms, and reduce the quantities or combinations of nutrients, used in agricultural fertilizers, among other techniques. But, it can often be hard to find the origin of the excess nitrogen and other nutrients.

Once a lake has undergone eutrophication, it is even harder to do damage control. Algaecides can be expensive and they also do not correct the source of the problem: the excess nitrogen or other nutrients that caused the algae bloom in the first place! Another potential solution is called ~~as~~ bioremediation, which is the process of purposefully changing the food web in an aquatic ecosystem to reduce or control the amount of phytoplankton. For example, water managers can introduce organisms that eat phytoplankton, and these organisms can help reduce the amounts of phytoplankton, by eating them!

What exactly is the nitrogen cycle?

The nitrogen cycle is a repeating cycle of processing during which nitrogen moves through both living and non-living things: the atmosphere, soil, water, animals, plants and bacteria. In order to move through the different parts of the cycle, nitrogen must change form. In the atmosphere nitrogen exists as a gas ( $N_2$ ), but in the soil it exists as nitrogen oxide ( $NO$ ) and Nitrogen Dioxide ( $NO_2$ ) and when used as a fertilizer, can be found in other forms, such as ammonia,  $NH_3$ , which can be processed even further into a different fertilizer, ammonium nitrate, or  $NH_4NO_3$ .

There are five stages in the nitrogen cycle, and we will now discuss each of them in turn: fixation or volatilization, mineralisation, nitrification, immobilization and denitrification. In this image, microbes in the soil turn nitrogen gas ( $N_2$ ) into what is called volatile ammonia ( $NH_3$ ), so the fixation process is called volatilization. Leaching is where certain forms of nitrogen becomes dissolved in water and leaks out of the soil, potentially polluting waterways.



## Stage 1 : Nitrogen fixation

In this stage, nitrogen moves from the atmosphere which contains a huge pool of nitrogen gas ( $N_2$ ). But this nitrogen is 'unavailable' to plants, because the gaseous form cannot be used directly by plants without undergoing a transformation. To be used by plants, the  $N_2$  must be transformed through a process called nitrogen fixation. Fixation converts nitrogen in the atmosphere into forms that can be absorbed by the plants through their root systems.

A small amount of nitrogen can be fixed when lightning provides the energy needed for  $N_2$  to react with oxygen, producing nitrogen oxide,  $NO$  and nitrogen dioxide,  $NO_2$ . These forms of nitrogen then enter soil through rain or snow. Nitrogen can also be fixed through the industrial process that creates fertilizer. This form of fixing occurs under high heat and pressure, during which atmospheric nitrogen and hydrogen are combined to form  $NH_3$ , which may then be processed further, to produce ammonium nitrate ( $NH_4NO_3$ ), a form of nitrogen which can be added to soils and used by plants.

Most nitrogen fixation occurs naturally in the soil, by bacteria. Some bacteria attach to plant roots and have a symbiotic (beneficial for both the plants and the bacteria) relationship with the plant. The bacteria get food from the plant, and in return, they fix nitrogen into a form the plant needs. The fixed nitrogen is then carried to other

parts of the plants and is used to form plant tissues, so the plant can grow. Other bacteria live freely in soils or water and can fix nitrogen without this symbiotic relationship. These bacteria can also create forms of nitrogen that can be used by organisms.

### Stage 2: Mineralisation.

This stage takes place in the soil. Nitrogen moves from organic materials such as manure or plant materials to an inorganic form of nitrogen that plant can use. Eventually, the plant's nutrients are used up and the plant dies and decomposes. This becomes important in the second stage of the nitrogen cycle. Mineralisation happens when microbes act on organic materials such as animal manure or decomposing plant or animal and begin to convert it to a form of nitrogen that can be used to plants. All plants under cultivation, except legumes get nitrogen from soil. Legumes get nitrogen through fixation that occurs in their root nodules, as described above.

The first form of nitrogen produced by the process of mineralization is  $\text{NH}_3$ . The  $\text{NH}_3$  in the soil then reacts with water to form  $\text{NH}_4^+$ . The ammonium is held in the soil and is available for use by plants that do not get nitrogen through the symbiotic nitrogen fixation.

### Stage 3: Nitrification.

The third stage, nitrification, also occurs in soils. During nitrification the ammonia in the soils, produced during mineralisation, is converted into compounds, called nitrate  $\text{NO}_3^-$  and nitrates,  $\text{NO}_2^-$ . Nitrates can be used by plants and animals that consume the plants. Some bacteria in the soil can turn ammonia into nitrites. Although nitrite is not usable by plants and animals directly, other bacteria change nitrites into nitrates — a form usable by plants and animals. These bacteria are nitrosomonas and nitrobacter.

### Stage 4: Immobilization

The fourth stage of the nitrogen cycle is immobilization. Sometimes reverse of mineralisation. These two processes together control the amount of nitrogen in soils. Just like plants, microorganisms living in the soil require nitrogen as an energy source. These organisms pull the residues from the soil when the residues of decomposing plants do not contain enough nitrogen. When microorganisms take in ammonium ( $\text{NH}_4^+$ ) and nitrate ( $\text{NO}_3^-$ ), these forms of nitrogen is no longer available to the plants and may cause nitrogen deficiency, or lack of nitrogen. Immobilization, therefore ties up nitrogen in microorganisms. However, immobilisation is important because it helps control and balance the amount of nitrogen in the soils by tying it up in microorganisms.

## Stage 5: Denitrification.

### Denitrification

In the fifth stage of the nitrogen cycle, nitrogen returns to the air as nitrates are converted to atmospheric nitrogen ( $N_2$ ) by bacteria through the process we call denitrification. This results in an overall loss of nitrogen from soils, as the gaseous form of nitrogen moves into the atmosphere, back where we began our story.

### Nitrogen is crucial for life :

The cycling of nitrogen through the ecosystem is crucial for maintaining productive and healthy ecosystems with neither too much nor too many little nitrogen. Plant production and biomass are limited by the availability of nitrogen. Understanding how the plant-soil nitrogen cycle works can help us make better decisions about what crops to grow and where to grow them, so we have an adequate supply of food. Knowledge of the nitrogen cycle can help us also reduce pollution caused by adding too much fertilizer to soils. Certain plants can uptake more nitrogen or other nutrients such as phosphorus, another fertilizer, and can prevent excessive fertilizer from entering waterways.

As you have seen, not enough nitrogen in the soils leaves plants hungry, while too much of a good thing can be bad; excess nitrogen can poison plants and even livestock! Pollution of our water sources by surplus nitrogen and other nutrients is a huge problem, as marine life is being suffocated from decomposition of dead algae blooms. Farmers and communities need to work to improve the uptake of added nutrients by crops and treat animals' manure waste properly. We also need to protect the natural plant buffer zones that can take up nitrogen runoff before it reaches water bodies. But, our current patterns of clearing trees to build roads and other construction worsen this problem, because there are fewer plants to uptake excess nutrients. We need to do further research to determine which plant species are best to grow in coastal areas to take up excess nitrogen. We also need to find other ways to fix or avoid the problem of excess nitrogen spilling over aquatic animals. By working toward a more complete understanding of the nitrogen cycle and other cycles at play in Earth's interconnected natural systems, we can understand how to better protect Earth's precious natural resources.

# RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

## ENVIRONMENTAL STUDIES

PROJECT TITLE: Nitrogen cycle and  
its importance for  
living beings.

NAME : Nityananda Mahato  
COLLEGE ROLL NO : MTUG/127/19  
DEPARTMENT : MATHEMATICS  
YEAR : 2020  
SIGNATURE : Nityananda Mahato

## Introduction

Though dinitrogen comprises 78% of the earth's atmosphere, it is not very abundant element in the earth's crust. Nitrates are all very soluble in water so they are not widespread on earth's crust, though deposits are found in a few desert regions. The largest is a 450 mile long belt along the coast of northern Chile where  $\text{NaNO}_3$  (Chile Salt Petre) is found together with small amounts of  $\text{KNO}_3$ ,  $\text{CaSO}_4$  and  $\text{Na}_2\text{SO}_4$  under a thin layer of sand and soil. This provided the main source of Nitrates for industrial use prior to World War I, when synthetic processes were developed for the manufacture of nitrates from atmospheric dinitrogen. A major deposit of salt petre  $\text{KNO}_3$  occurs in India.

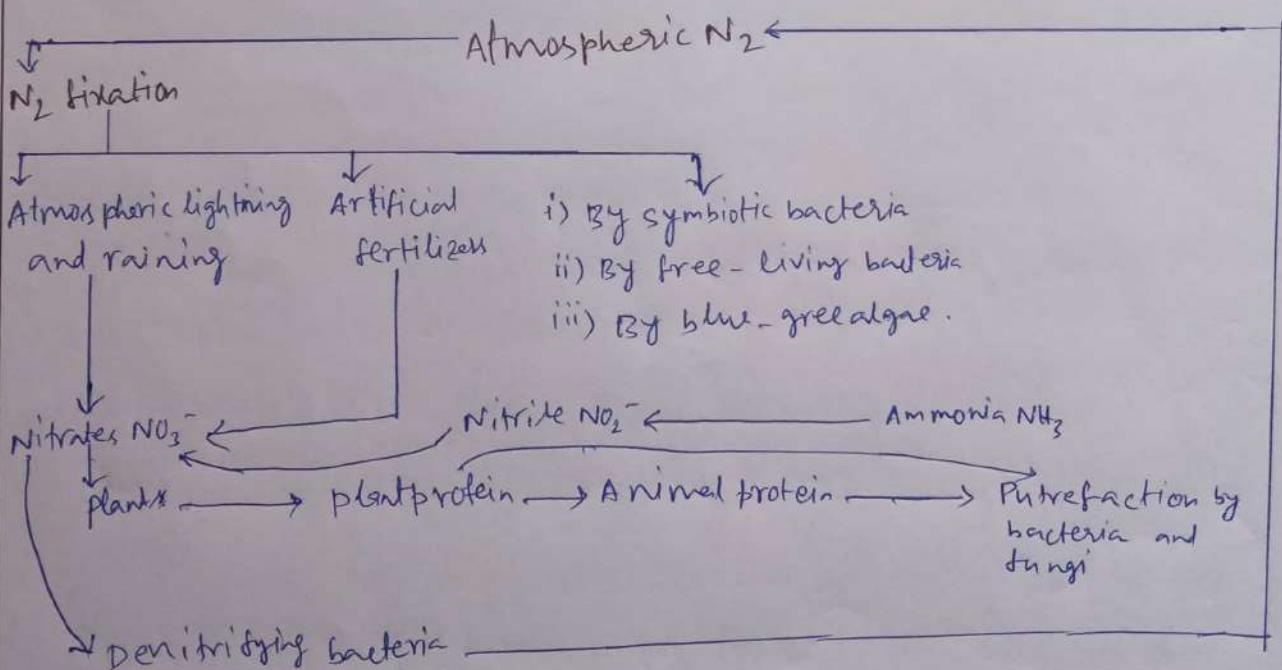
Nitrogen belongs to the group XV of the periodic table. The elements of this odd group all have five electrons in the outer shell. Nitrogen exhibits a very wide range of oxidation states -3 in ammonia  $\text{NH}_3$ , -2 in hydrazine  $\text{N}_2\text{H}_4$ , -1 in hydroxylamine  $\text{NH}_2\text{OH}$ , 0 in dinitrogen  $\text{N}_2$ , +1 in nitrous oxide  $\text{N}_2\text{O}$ , +2 in nitric oxide, +3 in nitrous acid  $\text{HNO}_2$ , +4 in ~~o~~ nitrogen dioxide  $\text{NO}_2$ , +5 in nitric acid  $\text{HNO}_3$ .

The  $\text{N}_2$  molecule contains a triple bond  $\text{N} \equiv \text{N}$  with a short bond length of  $1.09 \text{ \AA}$ . This bond is very stable and the dissociation energy is consequently very high ( $945.4 \text{ kJ/mol}$ ). Thus  $\text{N}_2$  is inert at room temperature.

There is a large number of amount of  $N_2$  gas in the atmosphere, but plants are unable to utilize this because  $N_2$  gas is so stable and unreactive. Fertile soil contains combined nitrogen mainly in the form of nitrates, nitrites, ammonium salts or urea  $(CO(NH_2)_2)$ .

Inside the plants, nitrate is first changed into ammonium form before being incorporated into various nitrogen containing compounds e.g. amino acids, purine, pyrimidine, ATP, proteins, enzymes, hormones, vitamins etc. Besides nitrogen is also component of co-enzymes, cytochrome, chlorophyll, RNA, DNA, alkaloid, latex etc.

The complete series of cyclical events by which circulation of nitrogen occurs amongst the living organism reservoirs in the atmosphere and the cycling pool in lithosphere is known as nitrogen cycle.



## # Plants:

Plants obtain nitrogen from the following process:

- i) atmospheric N<sub>2</sub>: Higher plants cannot utilize directly. Few groups of lower plants can only utilize N<sub>2</sub> and the process is known as biological N<sub>2</sub> fixation.
- ii) Nitrates, nitrites, ammonia in the soil: Among these nitrate is the chief form of nitrogen taken up by the plants from the soil.
- iii) Amino acids in the soil: Many soil microorganism make use of this form of nitrogen. sometimes it may also be taken up by higher plants commonly available forms are glycine, alanine, arginine etc.
- iv) organic nitrogen compounds from organic matter in the bodies of insects: Insectivorous plants fulfill their nitrogen requirement by trapping small insects and digesting them.

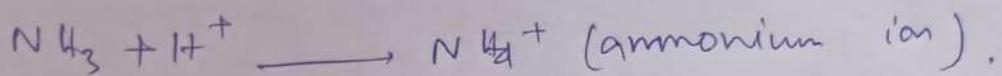
## # Release of nitrogen compounds from organic matter:

- i) decomposition and ammonification:- Proteins of dead bodies, nitrogen excretions, wastes are acted upon by decomposer micro-organisms like Bacillus ramosus, B. vulgaris, Actinomycetes, Clostridium species. They hydrolyse proteins and other complex substances. Amino acids and other simpler substances are formed. Amino acids are deaminated to ammonia and other organic acids. Ammonia does not exist in the gaseous state in the soil, it immediately combines with H<sup>+</sup> to form ammonium ion NH<sub>4</sub><sup>+</sup>.

Reaction:

Proteins hydrolysis  $\rightarrow$   $R_1H(NH_2)CO_2H$  (amino acid)

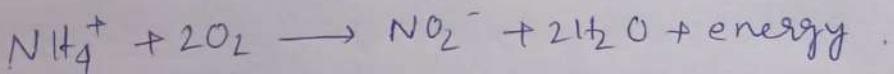
Amino acids deamination,  $NH_3 + \text{organic acid}$



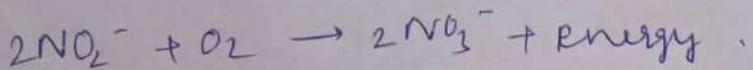
Same amount of  $NH_4^+$  can be absorbed by plant roots. The remaining is converted to nitrate by micro-organisms by process of nitrification.

ii) Nitrification: It is performed through two steps.

a) Nitrite formation: A number of micro-organisms like Nitrosomonas sp., Nitrococcus sp. oxidises ammonium ion to convert to nitrite, energy is released in the process.



b) Nitrate formation: Nitrite is oxidised to nitrate by a number of micro-organism like Nitrobacter sp., Nitrocystis sp.

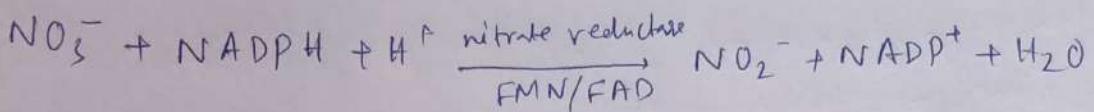


iii) Nitrate assimilation: Nitrate is the most important source of nitrogen of plants. It can accumulate in the cell sap of several plants and take part in producing osmotic potential. However it cannot be used as such by plants. It is first reduced to the level of ammonia before being incorporated into organic compounds.

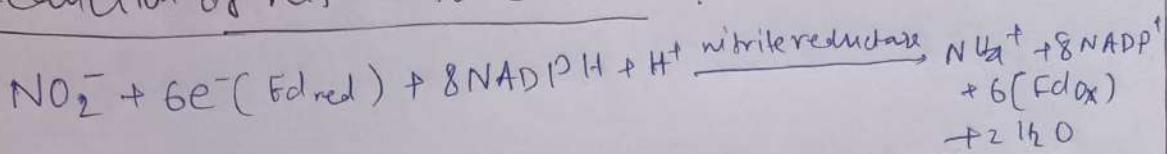
Ques Reduction:-

Reduction of nitrate occurs in two steps :-

i) reduction nitrate to nitrite:-



ii) Reduction of nitrite to ammonia:



the  $\text{NH}_4^+$  produced is metabolised by both reductive ammoniation or catalytic amidation.

Synthesis of amino acids: Ammonium ions are rapidly incorporated into amino acids or amides. These are two major processes by which majority of amino acids in plants are synthesised.

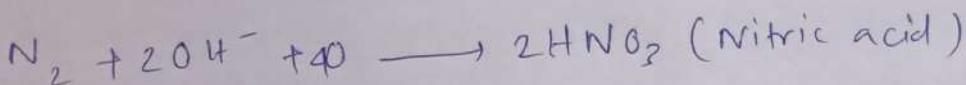
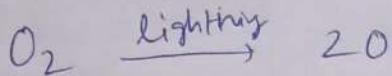
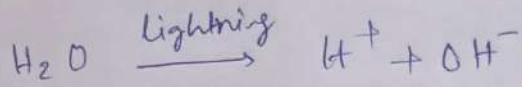
a) Reductive amination: In this process ammonium ion directly combines with  $\alpha$ -keto glutaric acid and forms glutamic acid in the presence of enzyme glutamate dehydrogenase.

b) Catalytic amidation: In presence of enzyme glutamine synthetase and ATP ammonium ions combine with glutamic acid to form amide glutamine. Glutamine transfers one of its amino groups to  $\alpha$ -keto glutaric acid in presence of reduced coenzyme to form two molecules of glutamic acid. The process is repeated.

Glutamic acid is the main amino acid from which 17 amino acids are formed through transformation.

Nitrogen fixation: It is the conversion of inert atmospheric nitrogen ( $N \equiv N$ ) into utilisable compounds of nitrogen like nitrate, ammonia, amino acids etc.

(i) Natural nitrogen fixation:



on ground the nitric acid reacts with alkali metals to form nitrites and nitrates which are water soluble. These are absorbed by plants through roots.

(ii). Industrial nitrogen fixation : In the fertilizer industry molecular nitrogen and hydrogen are made to combine at a temperature of  $300-400^\circ C$  and pressure of  $35-100$  MPa ( Haber-Bosch process ).

(iii) Biological nitrogen fixation: conversion of atmospheric nitrogen into inorganic or organic usable form by the agency of living organisms is called biological nitrogen fixation.

→ By free living nitrogen fixing bacteria:

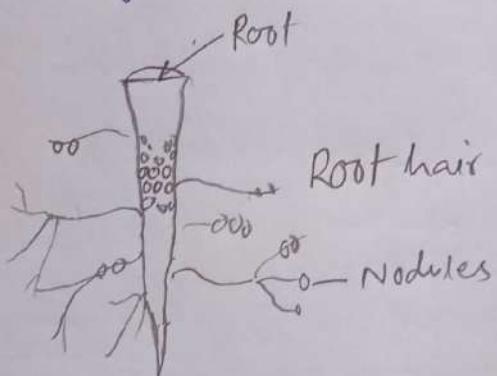
i) Aerobic - eg. Azotobacter sp. Beijerinckia sp.

ii) Anerobic - eg. Clostridium sp.

→ Free living nitrogen fixing blue green algae: eg. Anabaena sp., Nostoc sp.

→ Symbiotic nitrogen fixing bacteria: Rhizobium: Legume root association is the most common example of symbiotic N<sub>2</sub> fixation. Rhizobium lives in soil and forms root nodules in plants of family Leguminosae.

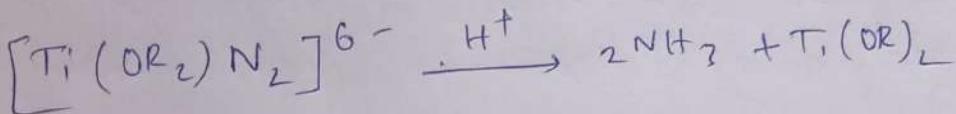
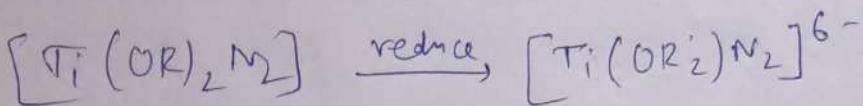
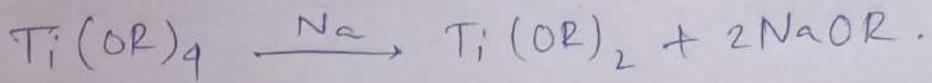
Nodules contain vascular bundles which transport the compounds produced due to N<sub>2</sub> fixation in nodule to the host plant body and carbohydrates from the host to the nodules. Oxidation of those carbohydrates provides the energy for bacterial respiration.



Nodules in the root of leguminous plant.

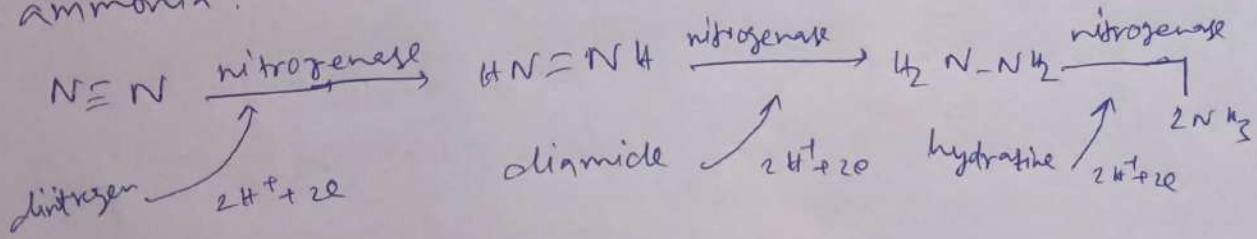
There is a considerable research interest into finding transition metal catalysed system which will absorb dinitrogen and produce ammonia for fertilisers cheaply without the necessity of high temperature or pressure. The first dinitrogen complex, the pentaammine dinitrogen ruthenium cation was made in 1969 by reducing ruthenium trichloride with hydrazine.

The formation of this stable complex led to studies with other metals. Complexes with titanium are the most promising.

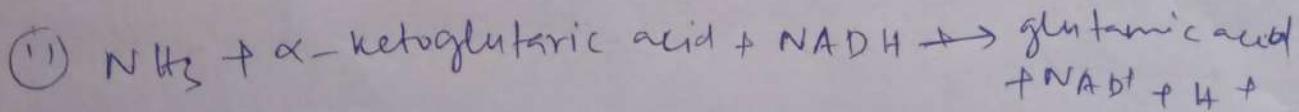


Biochemical process of  $\text{N}_2$  fixation:

Reaction: i) Nitrogen is reduced into ammonia by nitrogenase.  $\text{NADPH}_2$ ,  $\text{FMNH}_2$  and ATP are required here, it also requires a receptor compound for the ammonia.



Ammonia is never released as it exerts high toxicity even at very low level. the nitrogen fixing microbes survive by synthesizing various amino acids with ammonia.



The symbiotic N<sub>2</sub> fixing microbes supply the fixed nitrogen to the host in exchange of food and shelter. free living microbes never ~~can~~ transfer N<sub>2</sub> to the soil. The N<sub>2</sub> present within their body is released only after their death and enters into the N<sub>2</sub> cycle.

Denitrification: Under anaerobic conditions some micro-organisms use nitrate and other oxidised ions as the source of oxygen. In the process nitrates are reduced to gaseous nitrogen. Gaseous nitrogen escapes from the soil. Common bacteria causing denitrification are Pseudomonas denitrificans, Thiobacillus denitrificans, Micrococcus denitrificans

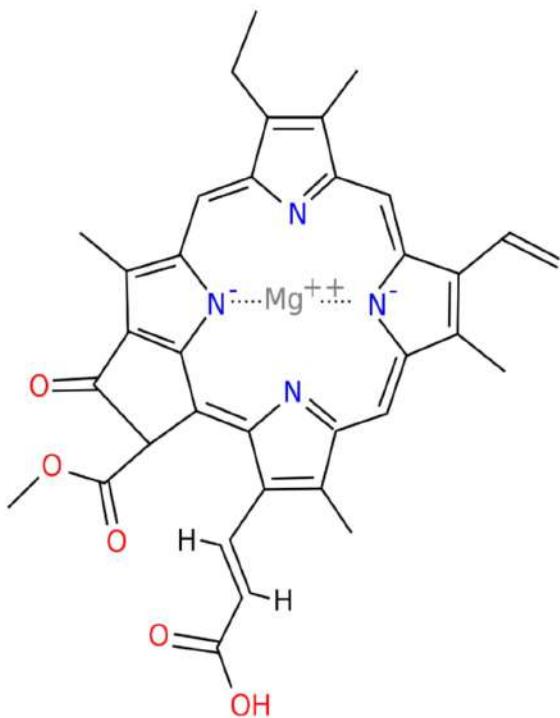


Importance: Nitrogen is essential for plants to grow and survive. without proteins some as structured units, others as enzymes. plants die. Nitrogen makes up a part of chlorophyll which plants need for photosynthesis. Nitrogen also forms a part of energy transfer compound such as ATP which lets cell conserve and use energy released via metabolism. plants also need nucleic acids such as DNA, RNA ~~to~~ to grow and reproduce.

Normal growth, cell replacement, tissue repair in animals require nitrogen. Various metabolic processes require protein in the form of enzymes. Nitrogen is continually recycled from amino acids, breaking amino acids not used for protein synthesis into components including nitrogen for energy. Nitrogen also makes up non-protein compounds such as heme in haemoglobin.

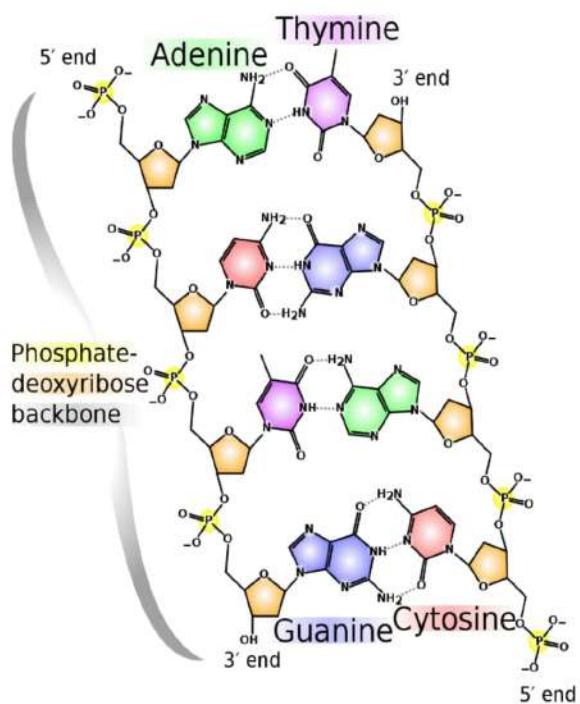
Free living microbes fixes 5 kg of N<sub>2</sub> per hectare soil per year. Thus the N<sub>2</sub> fixing micros like Anabaena sp. Azotobacter sp. are directly used as biofertilizer. Aulosira fertilisima a blue green algae is used as a N<sub>2</sub> fixing biofertilizer in the paddy fields of West Bengal.

## Structures of Chlorophyll, DNA, nucleobases (all contain nitrogen)



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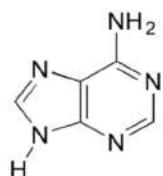
Structure of Chlorophyll



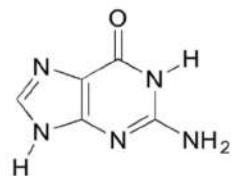
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Structure of deoxyribonucleic acid

### purine bases

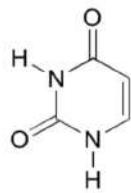


adenine (A)

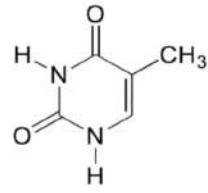


guanine (G)

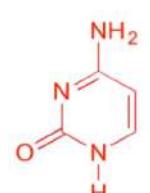
### pyrimidine bases



uracil (U)  
(RNA)



thymine (T)  
(DNA)



cytosine (C)

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Structure of nucleobases

RAMAKRISHNA MISSION RESIDENTIAL COLLEGE



NARENDRAPUR

ENVIRONMENTAL STUDIES

PROJECT TITLE:

AIR POLLUTION AND MEASURES  
TO CONTROL IT

NAME : PRADIPTA JANA  
COLLEGE ROLL NO : CHUG/096/19  
DEPARTMENT : CHEMISTRY  
YEAR : 2020  
SIGNATURE : Pradip Jana

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What is a Project?

Project:-

"A project is a problematic act carried to completion in its natural settings."

— Stevenson.

Project:- A project is a whole-hearted purposeful activity executed in a social environment.

— Kilpatrick.

Aims and Objects:-

The followings are the aims and objects of a project:-

1. A project develops deeper understanding of a particular topic.
2. A project develops imaginative faculty.
3. It develops practical knowledge through experience.
4. It develops communicative skills and power of organisation.

My Project and its objective:-

I have chose 'Air Pollution in Cities and Measures to control it' as my envs project.

The objective of the project is to know how the cities worldwide are getting polluted and the decreasing of air quality and its harmful effect on environment. It would also provide us to know the ways to get rid of this situation.

## Introduction :-

Air pollution is the introduction into the atmosphere of chemicals, particulates or biological materials that cause discomfort, disease or death to humans, animals and plant. Air pollution threatens the health of humans and other living beings in our planet. When due to human activities or some natural processes; the amount of solid wastes or concentration of gases other than oxygen, increases in the air more than normal percentage of different gases, the air is said to be polluted and this phenomena is regarded to as air pollution.

Most cities world-wide suffer from serious air-quality problems, which have received increasing attention in the past decade. Air pollution in cities is a serious environmental problem especially in the developing countries. To prevent air pollution in cities, some measures would be taken. In this industrial age, air pollution can not be eliminate completely but steps can be taken to reduce it.

## Definition of Air Pollution:-

Air pollution means the presence in the atmosphere or injection into it of substances that are not present naturally or present naturally but are in much lesser concentrations and that may be harm living organism directly. (Allaby 1995).

## Source of Air Pollution :-

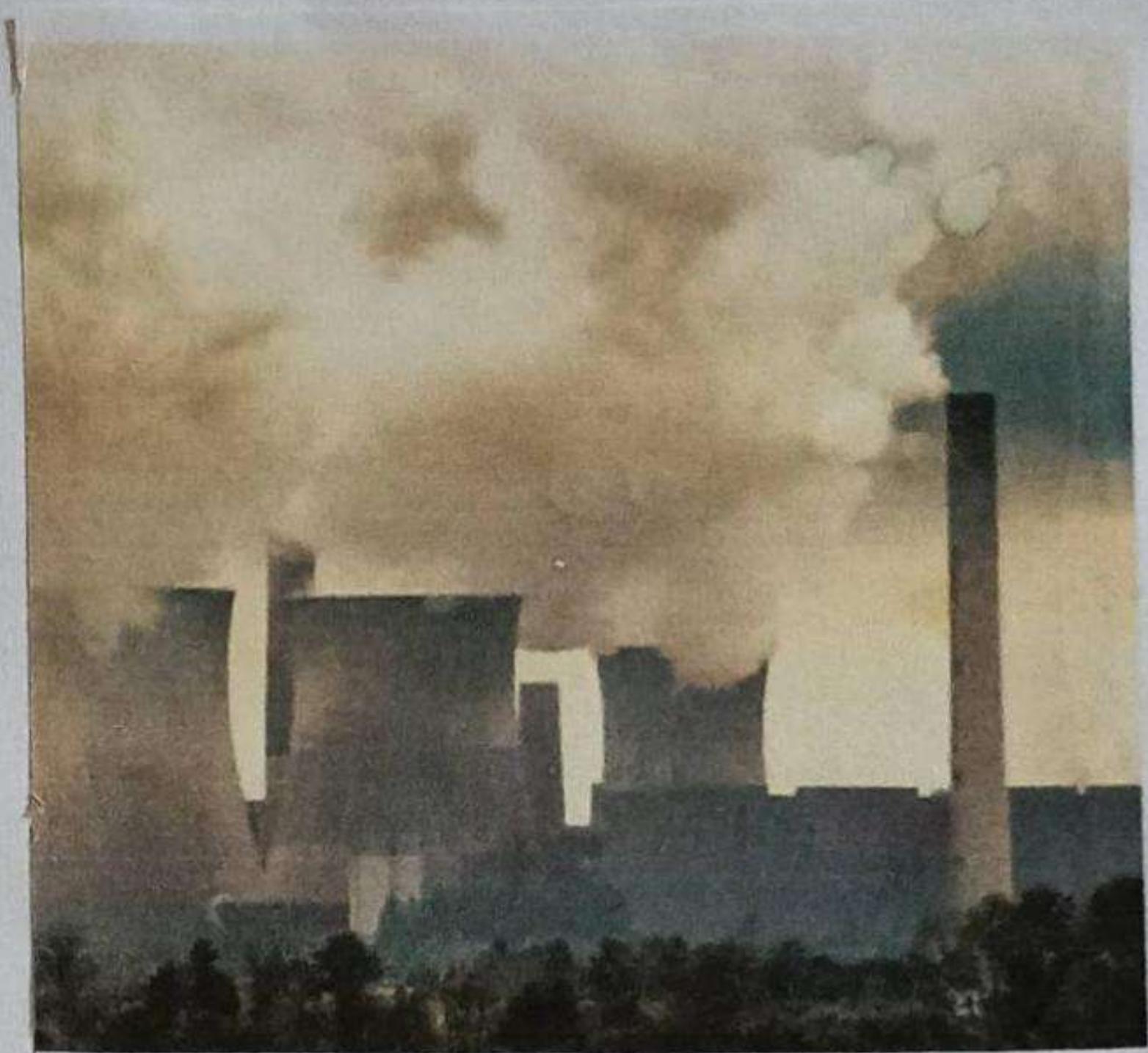
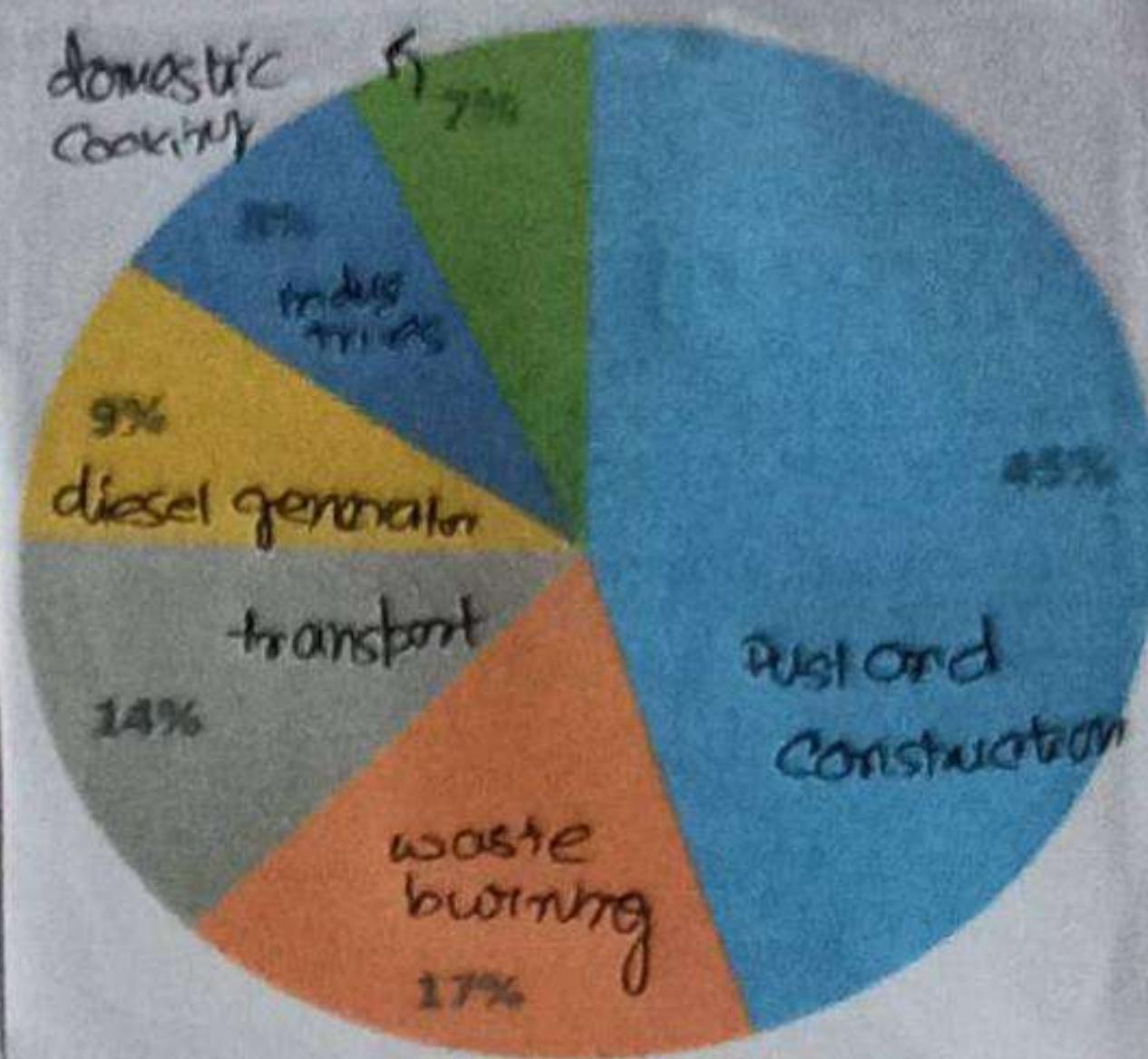
Air pollution can result from both the human and natural emissions. Natural events that pollute the air include forest fires, volcanic eruptions, wind erosion, pollen dispersal, evaporation of natural organic compounds and natural radioactivity. Sources of air pollution refer to the various locations, activities or factors which are responsible for the releasing of pollutants into the atmosphere.

## Man-made sources :-

The probable man made sources are given below:

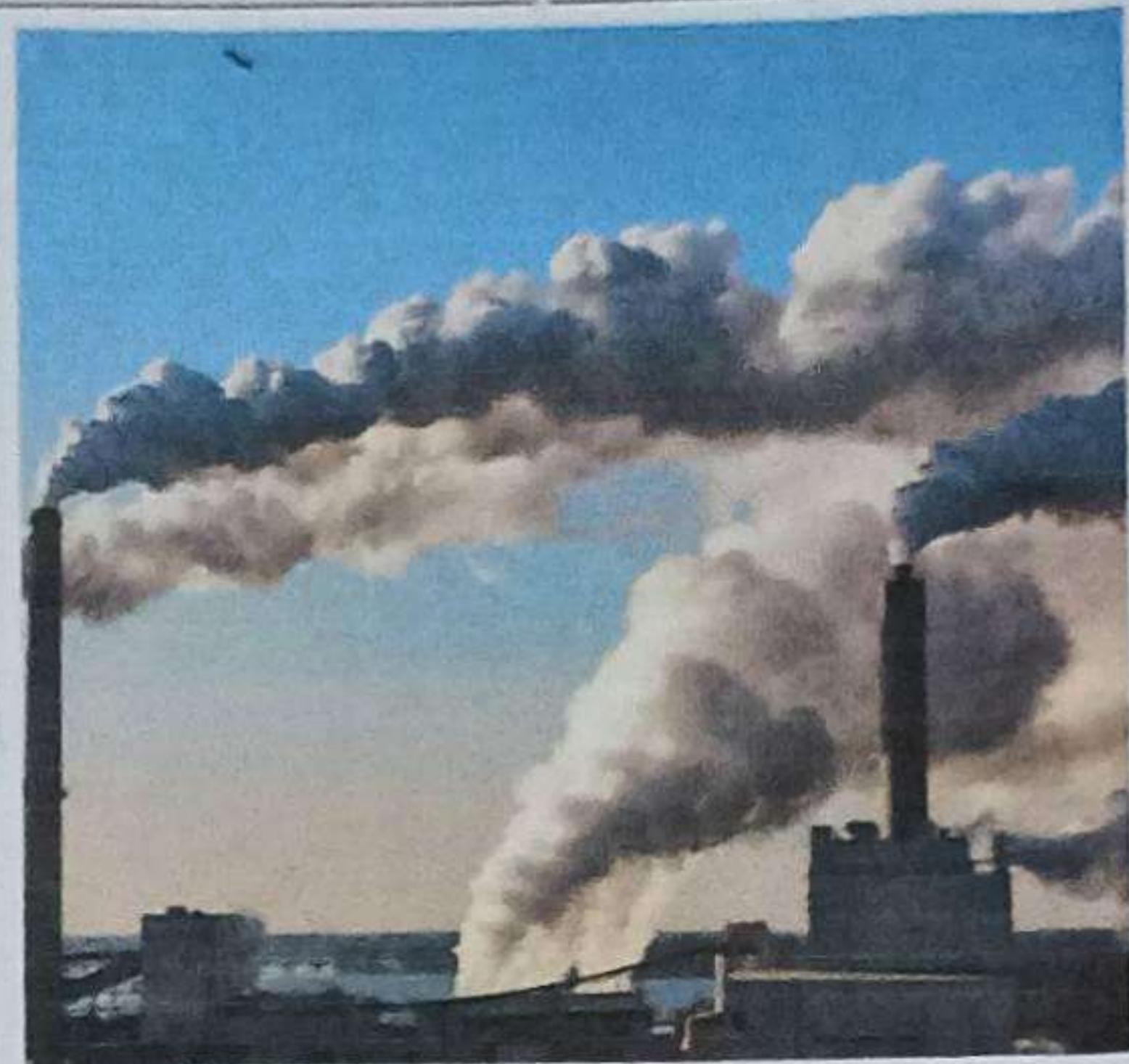
### 1) Emissions from Industrial Chimney :-

There are many industries which act as the major sources of air pollution. Of those petroleum refinery, cement factories, stone crushers, food processing, chemical fertilizer factories etc emit gases through the chimney of the factories. Among those, petroleum refinery are the major sources of  $\text{SO}_2$  and  $\text{NO}_x$ . Similarly, dusts releasing from cement factories cause health hazards. Stone crushers and hot ~~mix~~ food factories emit various poisonous gases. Acid rain is coming continuously from the chemical factories. Mathra based refinery has been accused to aggravate the pollution related decay of Tajmahal and as well as monuments of Fatehpur Sikri.



## 2. Thermal Power stations:-

Both normal and super thermal plants are present in or near the cities and coal are used as fuels in most of these plants. The fly ash,  $\text{SO}_2$  and other gases and hydrocarbons are regularly released in air and these make the air polluted and unhealthy.



## 3. Automobile Exhaust:-

Toxic exhaust of automobiles is a source of considerable air pollution in cities. Several construction toxic substances,  $\text{CO}_2$ ,  $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{CO}$  pollutes the air.



## 4. Construction and Demolition:-

With the rise of population in cities, construction and demolition is a part of ever going development phase of cities. Several construction sites and raw materials such as bricks and concrete cause haze and foul air which is hazardous for the people especially children and elderly people.



### 5. Use of chemical and synthetic process :-

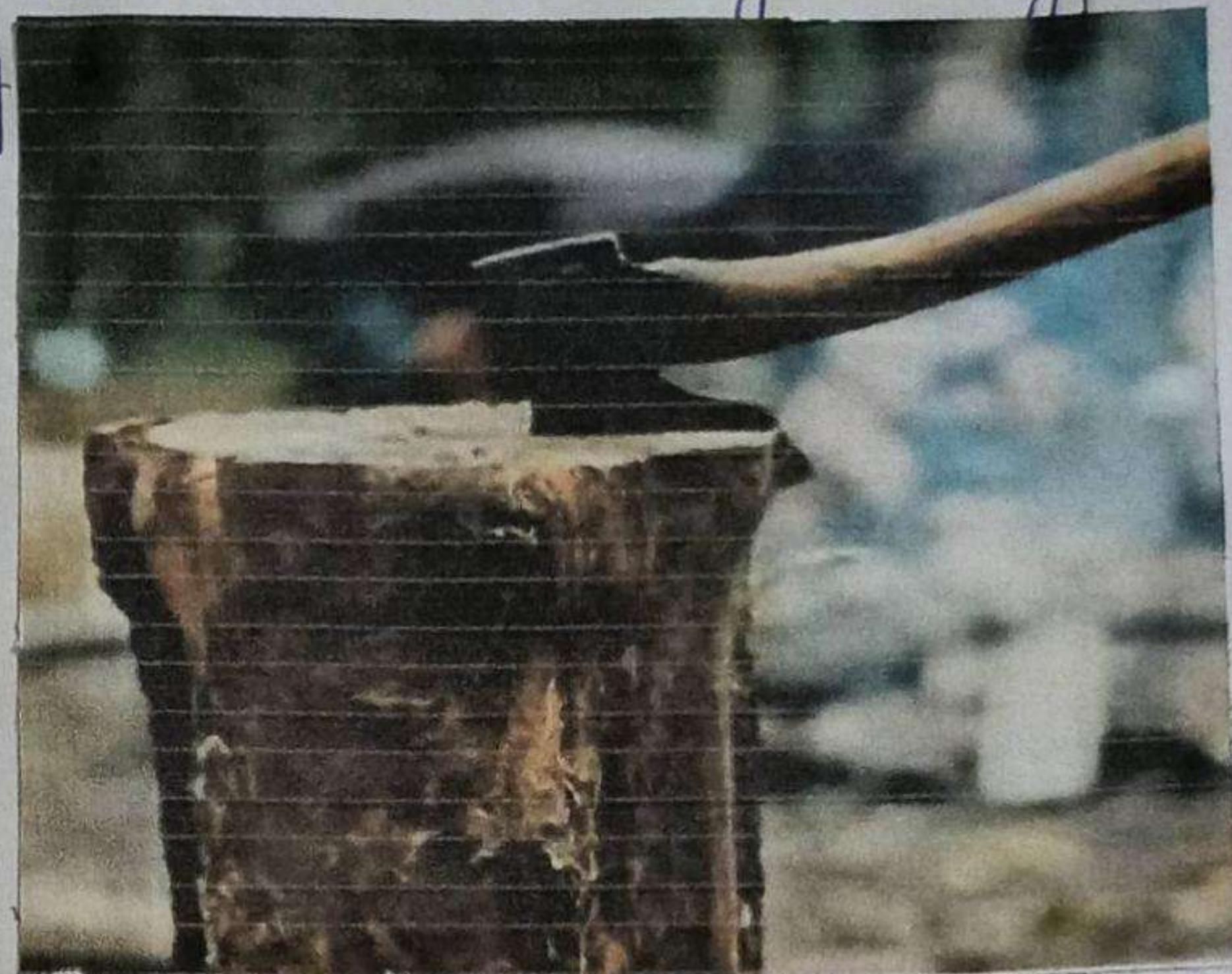
Taking about air pollution in cities, we always consider outdoor pollution dangerous for our lives but never talk about indoor air pollution. Household products cause indoor pollution which is 10 times more harmful than outdoor air pollution. Volatile organic compound (voc-s) found in paints, cleaners and personal care products such as perfume and deodorants are a reason for common health issues. Risk like asthma or other issues cause by inhaling poor house air quality.

### 6. Rapid Population Growth and cutting trees :-

A major probable reason for the air quality problems are population growth combined with change in land use due to increasing urban areas. The population is caused by drift to cities and excess of births over deaths. Also we can see hardly a green area in cities. Most of the trees are cut down for construction and road development.

### 7. Smoking :-

Smoking is the most dangerous and fatal to human health. A lot of air pollutants are exhausted during smoking. It effects the lungs and breathing system of primary consumers as well as non-consumers also.



## Major Air Pollutants and their effect :-

Major air pollutants are basically two types

1. Major Primary Pollutants.
2. Major Secondary Pollutants.

### Some Major Primary Pollutants :-

The primary major air pollutants of cities and their effects are given below -

#### 1. Carbon monoxide (CO) :-

##### Source :-

Smoke of automobile and burning of fuels in industries, smoking etc.

##### Effect :-

CO is highly toxic gas, it combines with haemoglobin of blood and blocks the transportation of oxygen. Thus it implies that it is a very harmful colourless, odourless, poisonous gas. It impairs respiration and it causes death due to asphyxiation when inhaled in large amount.

#### 2. Unburnt Hydrocarbons - (3,4 Benzo pyrene, Benzene) :-

##### Source :-

Automobile, burning of fossil fuel (Petrol, diesel)

##### Effect :-

Hydrocarbon causes lung's cancer.

### B. Nitrogen oxides (NO, NO<sub>2</sub>):→

Source :→ Especially nitrogen dioxide are expelled from high temperature combustion and are also produced naturally during thunderstorms by electric discharge. Burning of fossil fuel in automobiles, aromatic products etc are also the prominent source of nitrogen oxides.

Effect → In nitrogen oxide from photochemical smog in atmosphere and release ozone. These are also responsible for ozone acid rains and cause health problems like emphysema, bronchitis, swelling of lungs and lung cancer etc.

### 4. Sulphur oxide : (SO<sub>2</sub>, SO<sub>3</sub>):→

source :→ Main source of sulphur oxides are coal burning, smelters, oil refineries.

Effect :→ These causes chlorophyll destruction and also responsible for acid rains. These are global warming gases.

### 5. Carbon di-oxide :→

source → Industrial foul air, thermal plants, automobile exhaust, smoking.

Effect :→ It is the main cause of global warming. It also disturbs the respiratory actions of animal beings when highly present in amount.

### Volatile organic compounds:

VOC-s are an important outdoor air pollutant. In this field they are often divided into the separate categories of methane (CH<sub>4</sub>) and non-methane (NMVOC-s). Methane is an extremely effice greenhouse gas which contributes to enhance global warming. Within NMVOC-s the benzene, toluene and xylylene are suspected carcinogens.

### Some secondary Pollutants:-

(A) Smog:- [smog = smoke + fog]. It is two types

#### (a) Photo chemical smog:-

It was first observed in Los Angeles. In this process smog, fog, nitrogen oxide, hydrocarbons oxygen, UV light and high temperature are essential. These components react with each other and form reddish brown smog ( $PAN + O_3 + \text{nitrogen oxide}$ ) or brown haze.

#### (b) London smog or sulfuric smog:-

It is first observed in London. In these process coal, smog, fog, sulfur oxide and low temperature essential. These components react with each other and form vapour of  $H_2SO_4$  which is known as London smog.

#### Effect :-

1. Photochemical smog causes irritation in eyes and harms the lungs. Due to smog elastic substances (rubber/tyres) also effected.

2. In sulfur smog, due to inhalation of  $H_2SO_4$  vapour with fog people may die.

#### (B) Acid rain:-

$NO_2, SO_2$  released from different sources in the form of smoke dissolved in atmospheric water vapour to form acid ( $H_2SO_4 + HNO_3$ ). These acids come down on earth with rain is called as acid rain.

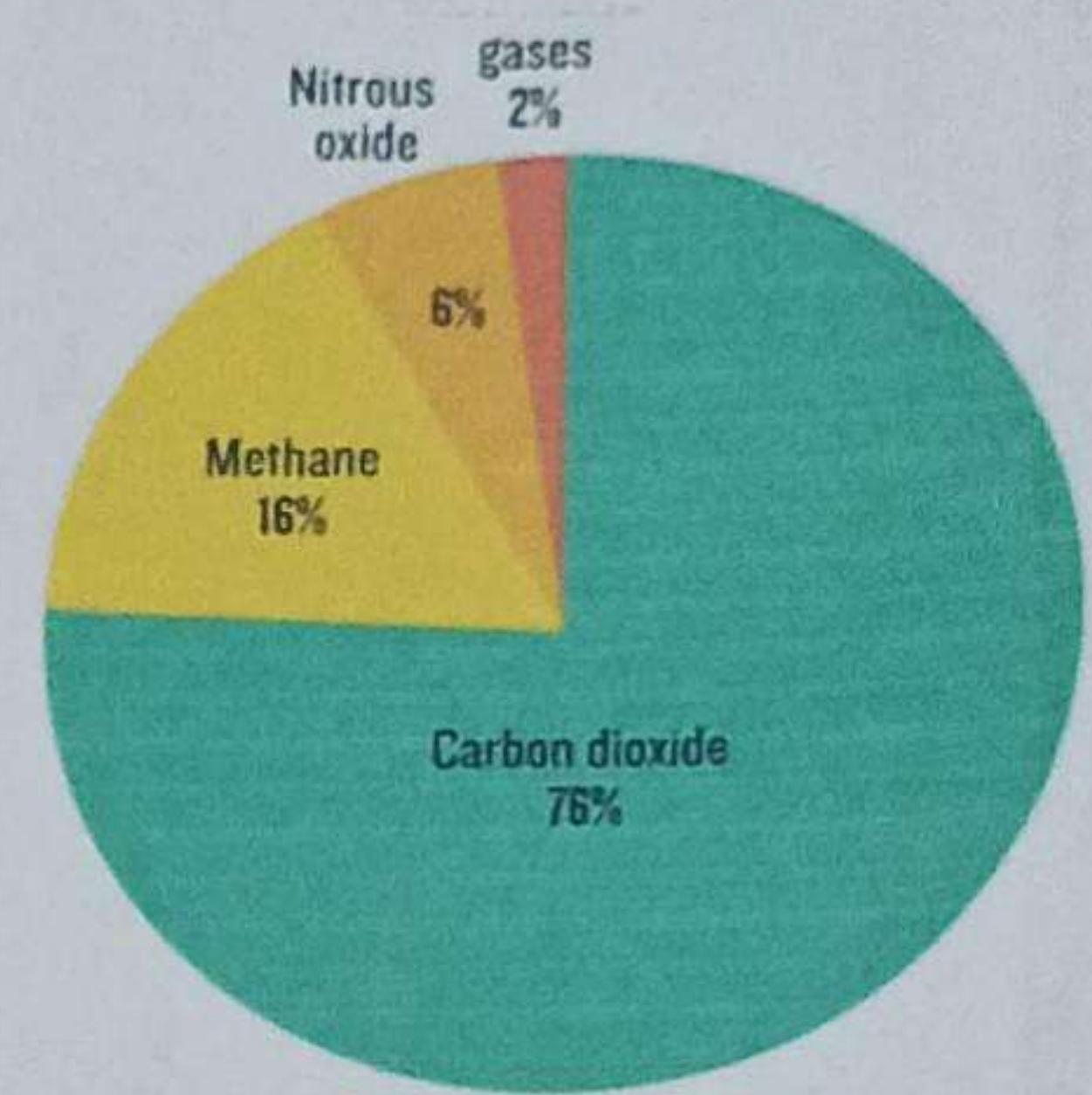
Effect:- 1. Due to acid rain acidity of soil and water increases. 2. Acid rain also causes damages historical monuments e.g. Taj Mahal, Red Fort.



One of the most harmful effects of Air pollution! →

Global warming: → The green house effect is a natural phenomenon and the basis of sustenance of life on Earth as it maintains a uniform temperature throughout but due to recent advancement of human civilization like industrialization, population explosions, modernisation, deforestation, pollution, the level of green house gases has increased alarmingly. The main green house gases and their contribution percentage given in the picture below.

Effects: → Due to global warming, climate changes are more evident. As the temperature increasing, the moisture carrying capacity of air is also increasing. Temperature raises cause thermal expansion of sea waters. The flora and fauna sensitive to the temp. will die out. Crop productivity is also affected.



Source: IPCC (2014)

Air Pollution in Cities: Case study: →

Case study of Delhi: →

Delhi ranks highest in numbers of vehicles in India. According to the record in 1990, the no of cars in Delhi are more than the total of WB and Gujarat. Due to this delhi become one of the most polluted cities in world. Residents of Delhi were suffering from burning eyes and respiratory problem. Using CNG in transport

Rank	PM2.5*
1. Kanpur	173
2. Faridabad	172
3. Varanasi	151
4. Gaya	149
5. Patna	144
6. Delhi	143
7. Lucknow	138
8. Agra	131
9. Muzaffarpur	120
10. Srinagar	113
11. Gurgaon	113
12. Jaipur	105
13. Patiala	101
14. Jodhpur	98
15. Ali Subah Al-Salem (Kuwait)	94

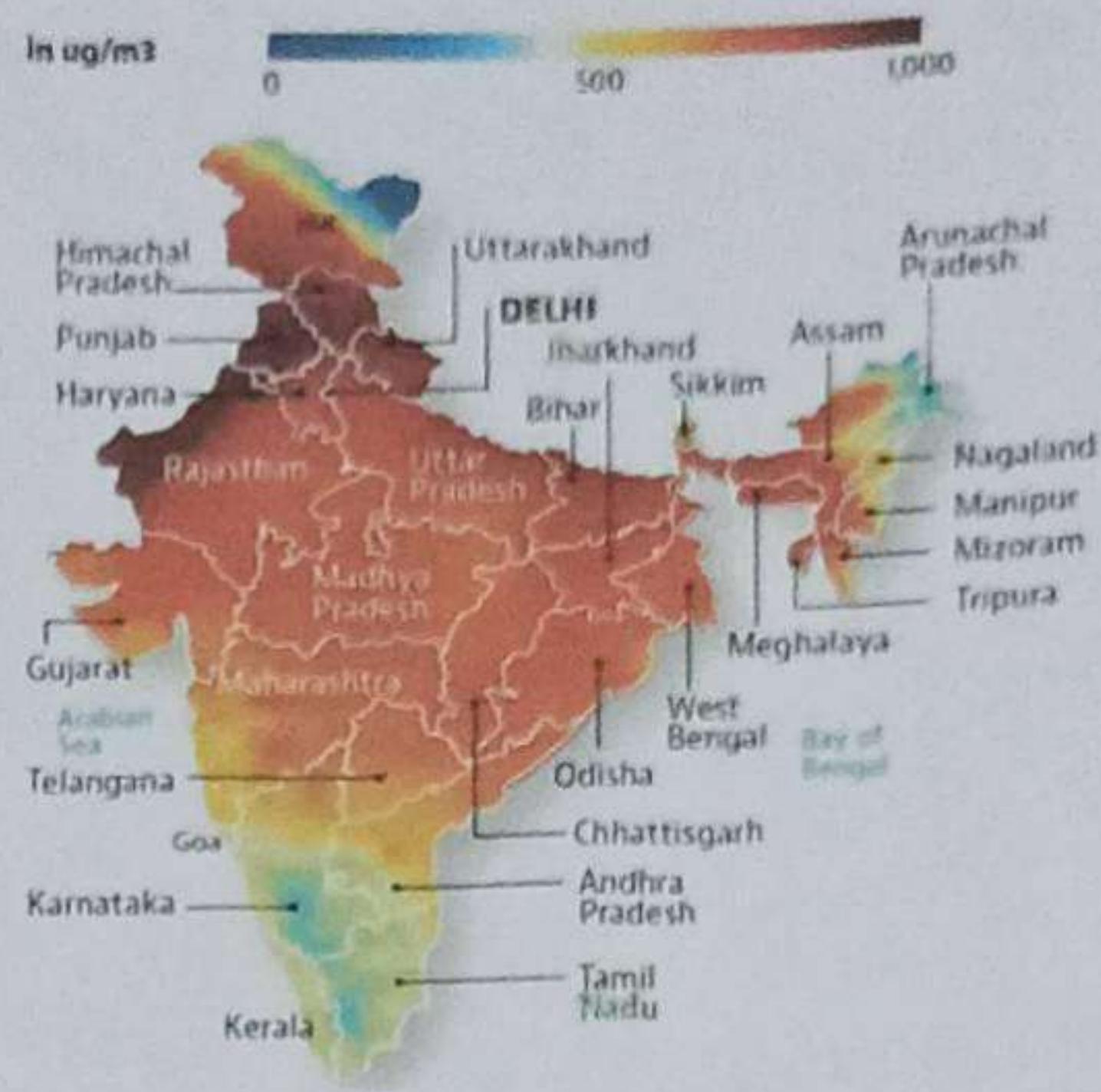
\* Annual average in 2016  
Source: WHO

replacing old vehicles, making emission check up are taken to prevent the air pollution. The Government used to imply norm to stipulate that sulphur be controlled at 350 ppm in diesel and 150 ppm in petrol. Aromatic hydrocarbons should be contained at max 42 percent of fuel and not more than that.

Every year in Delhi, low wind speed and low temp, inversion decrease the air quality low very poor and severe.

#### Air Pollution in Kolkata

Kolkata is the grip of rising air pollution and multi pollutant crisis. Official air quality monitoring has shown 61 percentage increase in particulate matter in just four years 2010 to 2013. NO<sub>x</sub> levels exceed close to two times. With growing vehicle numbers and resultant congestion and dieselisation air pollution is a growing concern in the city. Like Delhi, in Kolkata the air quality become very much poor in winter and this exacerbates public health risks. Some effective steps like banning of old vehicles, decreasing the use of diesel, petrol and increasing CNG using public transportation rather than private transportation like bike, car would be taken to prevent the falling of air quality.



## Measures to Control Air Pollution :-

Different kinds of air pollution can be controlled by modern technology. Emissions from factories and power plants can be made free from gaseous pollutants by three methods!

### 1. Combustion Technique:-

Only oxidisable pollutants can be removed by this method. Emissions are burnt at high temperature. This process is applied in petrochemical and plant industries.

### 2. Absorption Technique:-

Here scrubbers with packing materials are used to absorb gaseous pollutants. A fine spray of water is applied that dissolves  $\text{NH}_3$ ,  $\text{SO}_2$  etc. Sometimes, a bed of lime is also employed to absorb  $\text{SO}_2$ .

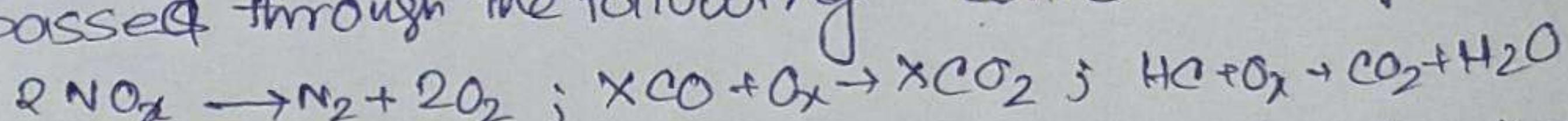
### 3. Adsorption Technique:-

Activated charcoal, a chief adsorption material is used in this technique. It can adsorb toxic vapours, gases and other harmful matters.

Following steps have to control pollution at source as well as after the release of pollutants in the atmosphere.

### 1. Prevention and control of Vehicular Pollution:-

i) Curbing the pollutant emission from vehicular exhaust by using various devices, such as positive crankcase, ventilation valve and catalytic converter. Catalytic converters consist of metals like palladium, platinum and rhodium as catalyst. The exhaust gases when passed through the following conversions happen.



ii) Control of evaporation from fuel tank and carburettor by several mechanical and chemical processes

iii) Filters can be used to capture and recycle the hydrocarbons from the engine.

- v) Leaded petrol should be avoided instead, unleaded petrol and low sulphur diesel should be used.
  - vi) Periodic checking of vehicles for pollution control.
  - vii) Increased use of CNG gas can lower the amount of pollutants.
2. Prevention and control of Industrial Pollution:- In different industries air pollution can be checked at 5 points of control process.
- i) Removal of particulate Matter:- It involves the use of following equipments.

Cyclone collector:-

This is used for centrifugation of waste gas containing particles. Cyclone collectors can remove upto 70% of the particles.

b) Electrostatic Precipitation (ESP-S):- To remove the suspended particles from gas stream, the electrical forces are applied within the chambers in precipitator. ESP-S work very efficiently in power plants, paper mills, carbon block plants, cement mills etc.

ii) Removal of gaseous pollutants:-

This uses the following three methods:

a) wet system:- These are used in washing towers in which alkali fluid circulate continuously. This reacts with  $\text{SO}_2$  to produce a precipitate.

b) Dry system:- Here the gas pollutants are allowed to react with an absorbant under a dry phase. Lime ( $\text{CaO}$ ), limestone ( $\text{CaCO}_3$ ) are placed in the way of following gas ( $\text{SO}_2, \text{SO}_3$ ). This process is very less expensive and effective.

c) Wet dry system:- Here water in absorbent react with acid components. The absorbant ( $\text{Ca(OH)}_2$ ) slurry is spread into hot stream in the form of small droplets.  $\text{Ca(OH)}_2$  reacts with  $\text{SO}_2$  and the hot gases cause the water to evaporate simultaneously. The end dry powder contains fly and ash.

3. Control Air pollution through law:- There have been several legislative measures to prevent and control different type of air pollution, Eg:- Bengal Smoke Nuisance act (1905), The Motor Vehicle act (1938), The Environment Act (1981).

4. Recycle and Buy recycled products: → Each stage of manufacture from raw material is accompanied by emission of polluting particles, chemicals and harmful gasses. Since recycled products have already been extracted and processed once, the manufacturing the same products the second time is much less energy intensive and polluting.

5. Tree plantation: → Trees help reduce the air pollutants significantly. Trees remove the particulate matter a large amount. Trees also decrease levels of carbon dioxide, benzene, dioxin etc. Trees planted along side road or on the boundaries of houses also slow down polluted air from being carried by wind.

6. Raise Awareness: →

Awareness raising can be the most effective step to increase the knowledge of people and start the change in their attitudes towards mitigating the problem of poor air quality in affected areas.

7. Use of Natural products and Non-toxic cleaners:

The majority of air fresheners, detergents, paints and cleaners in the market contain VOCs or volatile organic compounds. People should buy the cleanest and greenest products that contain no harmful polluting chemicals.

8. No smoking: → Cigarette smoke contains upto 70 carcinogenic substances and toxins. Active and passive exposure to the cigarette smoke face serious health problems. So, people should not smoke. Some legislative measure should be taken for this.

References: →

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2. <http://www.mdc.org.in/air/>
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