

## Air pollution

### Structure of Atmosphere

The air consists of 78% nitrogen, 21% oxygen and about 1% inert gases (He , Ne , Ar , Kr ....etc ) while the amount of carbon dioxide (CO<sub>2</sub>) reaches 0.33% and also contains water vapor and gases that change according to local conditions (NH<sub>3</sub> gas appears In places where organic waste is decomposing) there are also amounts of dust, hard particles, microorganisms, pollen..... etc.

The atmosphere is divided into the following layers:-

- 1- **Troposphere** ( about 10 miles , necessary for human life and includes about 75% of the air mass).
- 2- **Stratosphere** ( about 20 miles , which contains about 24% of the air mass)
- 3- **Mesosphere** ( about 20 miles )
- 4- **Thermosphere** (about 350 miles )
- 5- **Exosphere** ( about 39.600 miles)

### Major pollutants of air: -

- 1- **Particulate matter**: (liquid aerosols and solid matter suspended in the atmosphere) which includes :-
  - a- The large particulate matter includes sand particles, ash and dust
  - b- The small particulate matter includes smoke , mist and aerosol. Its diameter ranges between 0.001 - 1000 microns. It is carried by wind to places far from its source while large particles fall in a region not far away.


## Sources: -

- I- **Natural resources** : that include dust and sand particles flying from deserts ... etc.
- II- **Industrial sources** : carbon particulate matter emitted from cars, fuel burning operations in industry, cement factories ... etc.

## The effect of particulate matter:

- I - Visibility decreases with the increase of particulate matter. In general, cities receive solar radiation less than villages by 15-20% because the particulate matter is more in the air of the city, which disperses and absorbs sunlight.
- II - It causes damage to the respiratory system as a result of inhaling it with the air, and it can lead to four major human disorders : (a- Chronic bronchitis b- Bronchial asthma c- Emphysema d - Lung cancer)
- III- Its effect on buildings by dirtying them
- IV - It causes damage to plants, especially vegetables, due to its heavy weight

## 2- Gases pollutants : Include -

\*  $\text{SO}_x$   ( $\text{SO}_2$ ,  $\text{SO}_3$ , ..... etc.)  $\text{SO}_2$  is the most important of the sulfur compounds (colorless gas, non-flammable) , 75% of the sulfur in the atmosphere is  $\text{SO}_2$ .

## Sources:

- I- **Natural sources:** - The decomposition of organic matter, as well as the activities of volcanoes, are the main source of hydrogen sulfide ( $\text{H}_2\text{S}$ ) gas, which turns into sulfur oxide gases ( $\text{SO}_x$ ) by oxidation.
- II- **Coal combustion:** Sulfur is found in coal by 0.2 - 7% , and it was found that about 87% of  $\text{SO}_x$  gases emitted to the atmosphere are due to coal combustion.

III- *various industrial processes:* such as extracting minerals, sulfuric acid industry and oil refining operations contribute to these gases emissions.

*The effect of SO<sub>x</sub> gases: -*

I- *Acidic rain:* the sulfur dioxide gas in the upper atmosphere combines with oxygen in the presence of sunlight, forming sulfur trioxide that combines with water vapor, forming sulfuric acid according to the following equations:



When the weather becomes ready for rain, this acid will dissolve in rain water and fall to the ground in the form of acid rain, which affects the properties of soil and water and thus affects marine, plant and animal organisms, as well as damage building materials and lead to the destruction of forests and historical cities.

II- *Increasing respiratory diseases:* sulfur dioxide gas causes irritation of the mucous membranes, causing cough, chest pain, bronchitis, and shortness of breath and leads to increased rates of asthma and pulmonary infections.

III- *The effect on the plant:* the sulfur dioxide gas removes the green color and the rate of photosynthesis is greatly reduced, which may reach stopping.