Ran Vijay Smarak Mahavidyalaya, Sector – 12/D, Bokaro

SEMESTR-VI

CHEMISTRY (DSE - IV)

INDUSTRIAL CHEMICALS & ENVIROMENT-

1. **INDUSTRIAL GASES & INORGANIC CHEMICALS**

   INTRODUCTION:-

Industrial gases are the gaseous materials that are manufactured for use in industry. The principal gases provided are nitrogen, oxygen, carbon dioxide, argon, hydrogen, helium and acetylene, although many other gases and mixtures are also available in gas cylinders. The industry producing these gases is also known as **industrial gas**, which is seen as also encompassing the supply of equipment and technology to produce and use the gases. Their production is a part of the wider chemical Industry (where industrial gases are often seen as "specialty chemicals").

Industrial gases are used in a wide range of industries, which include oil and gas, petrochemicals, chemicals, power, mining, steelmaking, metals, environmental protection, medicine, pharmaceuticals, biotechnology, food, water, fertilizers, nuclear power, electronics and aerospace. Industrial gas is sold to other industrial enterprises; typically comprising large orders to corporate industrial clients, covering a size range from building a process facility or pipeline down to cylinder gas supply.

Industrial Gases:-

Nitrogen, Oxygen, Argon-

An **air separation** plant separates atmospheric air into its primary components, typically nitrogen and oxygen, and sometimes also argon and other rare inert gases.

The most common method for air separation is fractional distillation. Cryogenic air separation units (ASUs) are built to provide nitrogen or oxygen and often co-produce argon. Other methods such as membrane, pressure swing adsorption (PSA) and vacuum pressure swing adsorption (VPSA) are commercially used to separate a single component from ordinary air. High purity oxygen, nitrogen, and argon, used for semiconductor device fabrication, require cryogenic distillation.

Similarly, the only viable source of the rare gases neon, krypton, and xenon is the distillation of air using at least two distillation columns.

1. Cryogenic distillation process

Distillation column in a cryogenic air separation plant

Pure gases can be separated from air by first cooling it until it liquefies, then selectively distilling the components at their various boiling temperatures. The process can produce high purity gases but is energy-intensive. This process was pioneered by Carl von Linde in the early 20th century and is still used today to produce high purity gases. He developed it in the year 1895; the process remained purely academic for seven years before it was used in industrial applications for the first time (1902).

Non-cryogenic processes

This provides separation of oxygen or nitrogen from air without liquefaction. The process operates around ambient temperature; a zeolite (molecular sponge) is exposed to high pressure air, then the air is released and an adsorbed film of the desired gas is released. The size of compressor is much reduced over a liquefaction plant, and portable oxygen concentrators are made in this manner to provide oxygen-enriched air for medical purposes. Vacuum swing adsorption is a similar process; the product gas is evolved from the zeolite at sub-atmospheric pressure.

Applications

OXYGEN:- Oxygen is valued, above all, for its reactivity. Oxygen enrichment of air is used to increase the amount of oxygen available for combustion or biological activity. Biological activity enhancement includes medical applications and environmental applications such as industrial waste water and sanitary sewage treatment systems.

Oxygen enrichment of air in industrial processes increases reaction rates, which may permit greater throughput in existing equipment or the ability to reduce the physical size of equivalent capacity new equipment.

Another benefit of oxygen enrichment versus use of plain air is energy savings and due to a reduction in the amount of nitrogen and other gases passing through a furnace or through a chemical process. Reducing inert gases which would otherwise have to be compressed or heated, can reduce energy consumption due to a decrease in gas compression requirements or a reduction in the amount of fuel required to make a given amount of product. Reducing the amount of hot gases vented to the atmosphere from combustion processes may also decrease the size and cleanup costs associated with stack gas cleanup systems.

Oxygen's reactivity is commonly used in metals processing (steel, copper, lead, zinc), glass furnaces, cement kilns, chemical manufacture, sewage treatment, pulp and paper manufacture, welding and cutting of metals, and medical oxygen. In steelmaking oxygen is required for the basic oxygen steelmaking. Today, modern basic oxygen steelmaking uses almost two tons of oxygen per ton of steel.

NITROGEN & ARGON

(N2) and **Argon (Ar)** are commonly used in the gaseous form to shield potentially reactive materials from contact with oxygen. Nitrogen will react with oxygen at very high temperatures, as in furnaces, but it is inert under most other circumstances. Argon, helium, neon, krypton and xenon are "noble gases" that are extremely inert under all conditions.

Ammonia Nitrogen used in the Haber process to make ammonia

Coal gas

Large amounts of oxygen are required for coal gasification projects; cryogenic plants producing 3000 tons/day are found in some projects.

Inert gas

Inerting with nitrogen storage tanks of ships and tanks for petroleum products, or for protecting edible oil products from oxidation.