

Production of Sulfuric Acid

INTRODUCTION:-

The production of sulfuric acid has come to be accepted throughout the world as a reliable barometer of industrial activity. Its universal use has made it indispensable, in the widest sense of the world, in chemical and process industries.

Sulfuric acid is a strong acid i.e. is in aqueous solution it's largely changed to hydrogen ions and sulfate ions. Each molecule gives 2 hydrogen ions and thus sulfuric acid is dibasic acid.

Sulfuric acid is a multipurpose product and finds its application as a dehydrating agent, catalyst, active reagent in chemical processes, solvent and absorbent etc. It is used in process industries from very dilute concentrations, for pH control of saline solutions to strong fuming acids used in the dye, explosives and pharmaceutical industries, in grades of less exacting specifications for use in steel, heavy chemical and super phosphate industries. Sulfuric acid is not a one use product like a returnable steel drum, after initial use in some phases of explosives, petroleum and dye industries, the sulfuric acid is recovered in a form often unsuitable for use in the same process but, of strength and grades entirely suitable for use in other process industries.

HISTORICAL DEVELOPMENTS:-

The origin of the first sulfuric acid is unknown but it was mentioned as far back as the tenth century. The preparation by burning sulfur with saltpeter was first described by Valentinus in the fifteenth century. Later its preparation by distilling niter with green vitriol was mentioned by Persian alchemist Abu-Bekr-Ahhas, who died in 940. The weathering of iron pyrites was usually the source of green vitriol.

Sulfuric acid has been an important item of commerce for at least 250 years and has been known and used since the Middle Ages. In the eighteenth and nineteenth centuries, it was essentially and entirely produced by chamber process, in which oxides of nitrogen (as nitrosyl compounds) were used as homogeneous catalysts for the oxidation of sulfur dioxide. The product made by this process were of rather low concentration (typically 60° Baume or 77 to 78% H₂SO₄) not high enough for many commercial uses.

In 1746, Roebuck of Birmingham, England produced successfully on commercial scale by burning sulfur and potassium nitrate in ladle suspended in a large glass partially filled with water.

The contact process was first discovered in 1831 by Phillips, an Englishman whose patent included the essential features of the modern contact process namely the passing of the

mixture SO_2 over a catalyst followed by absorption of SO_3 in 98-99% H_2SO_4 . Later it was demonstrated that excess of oxygen in the gaseous mixture for contact process was advantageous. The contact process has been improved in all details and at the current scenario is one of the low cost industries and is almost wholly automatic continuous process for the manufacture of sulfuric acid.

During the first part of the twentieth century, the contact process gradually replaced the chamber process and today the former is considered to be obsolete. However there has been one recent installation of a modified chamber plant to process very dilute SO_2 gases generated by molybdenum ore roasting.

Primary impetus for the development of the contact process came from a need for high strength acid and oleum to make synthetic dyes and organic chemicals. The contact process employing platinum catalysts began to be used on large scale for this purpose late in the nineteenth century. Its development accelerated during the World War I to provide the concentrated mixtures of sulfuric and nitric acid for the production of explosives.

In 1915, an effective vanadium catalyst for the contact process was developed and used by Badische in Germany. This type of catalyst was employed in the United States starting in 1926 and gradually replaced the platinum catalyst over the next few decades. Vanadium catalysts have the advantages of superior resistance to poisoning and of being relatively abundant and inexpensive compared to platinum.

Another significant change in the contact process occurred in 1963, when Bayer AG announced the first large scale use of Double Contact Double Absorption process and granted several patents. In this process, the SO_2 gas that has been partially converted to SO_3 by catalysis is cooled, passed through sulfuric acid to remove SO_3 , reheated and then passed through another one or two catalysts bed. By this means the overall conversions can be increased from 98 up to 99.5-99.8% thereby reduced emissions of unconverted SO_2 to the atmosphere. Because of worldwide pressure to reduced SO_2 emissions, most new plants now utilize Double Contact Double Absorption and many existing plants have been modified to use it.