

# VITRIOL

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“Vitriol” is a historically important compound as it plays very important role in the history of chemistry and mineralogy. The substances referred to here as vitriol are recognized in modern science as hydrated sulfates of different metal or sulfuric acid. We are very much familiar with the terms like “Blue vitriol”, “Green vitriol”, “White vitriol” and “Oil of vitriol” from our school life. We also knew that “Blue vitriol” is cupric sulfate with five water molecules ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ); “Green vitriol” is ferrous sulfate with seven water molecules ( $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ); “White vitriol” is zinc sulfate with seven water molecules ( $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ ); and “Oil of vitriol” is concentrated sulfuric acid ( $\text{H}_2\text{SO}_4$ ). Although the study of vitriol began in ancient times, unfortunately, there is very little scope to get detail information about it in current literature. Here, I am trying to reminiscence it in details.

There is lot of debates about the origin of the word “Vitriol”. Basically, it is Middle English. Some people believe it came from Anglo-French word *vitriole*. Other group considers it came from Medieval Latin word *vitriolum*. Another faction thinks it is an alteration of Late Latin word *vitriolum*. The most ancient literary evidence confirms that “Vitriol” is from Sumerian-Assyrian dictionaries (around 600 BC) which also include some other chemical terms, e.g., common salt ( $\text{NaCl}$ ), gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) etc. Sumerians had classified vitriol according to their color. However, the earliest surviving discussions of vitriol in the literature of antiquity are the works of the Greek physician Dioscorides (first century AD) and the Roman naturalist Pliny the Elder (AD 23-79). The iron and copper varieties of vitriol were widely recognized and utilized in antiquity, and were commonly referred to respectively as green and blue vitriol. Metallurgical uses for vitriolic substances were recorded in the Hellenistic alchemical works. Islamic alchemists Jābir ibn Hayyān (721-815 AD), Razi (865-925 AD), and Jamal Din al-Watwat (1318) included vitriol in their mineral classification lists. Ibn Sina focused on its medical uses and different varieties of vitriol. Green Vitriol in its natural state is a powerful disinfectant, but the alchemists also made therapeutic use of the iron compounds produced when it was heated. As far back as 1500 BC, Egyptians smelted iron ore and knew its therapeutic value. They used powdered rust (iron oxide) to heal wounds and prepared a tonic from iron sulfate, a by-product of the distillation of Vitriol. The routine empirical use of these substances in such operations are recorded in the *Physica et mystica* of Bolos-

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Democritus<sup>15</sup> (300 BC), the third century AD writings of Zosimos<sup>16</sup>, and in the roughly contemporaneous<sup>[4]</sup> Leyden Papyrus X, all of which reflect vitriol involvement in the early development of alchemy in Hellenistic Egypt. The Graeco-Roman physician Galen (AD 129-200) discussed these vitriol substances in his book *"On Medical Simples"*.

Vitriol was the agent of transformation in most alchemical experiments. First commercial vitriol was obtained through lixiviation techniques that probably originated with similar processes for obtaining alum in ancient Mesopotamia. It was distilled from an oily, green substance that formed naturally from the weathering of sulfur-bearing gravel. After this Green Vitriol was collected, it was heated and broken down into iron compounds and sulfuric acid. The acid was separated out by distillation. The first distillation produced a brown liquid that stunk like rotten eggs, but further distillation yielded nearly odorless, yellow oil called simply Vitriol. The acid readily dissolves human tissue and is severely corrosive to most metals, although it has no effect on gold. It also shows a tremendous thirst for water. Vitriol and its related substances continued to be commonly used throughout antiquity.

### **Oil of Vitriol**

The most significant alchemical substance, 'Oil of Vitriol' was coined by the 8<sup>th</sup>-century Alchemist Jābir ibn Hayyān. It was formerly made by the refinement of 'green vitriol'. "Oil Of Vitriol" also known as sulphuric acid. In 17<sup>th</sup> century, the German-Dutch chemist Johann Glauber prepared sulfuric acid by burning sulfur together with saltpeter (potassium nitrate,  $\text{KNO}_3$ ), in the presence of steam. As saltpeter decomposes, it oxidizes the sulfur (S) to sulfur trioxide ( $\text{SO}_3$ ), which combines with water to produce sulfuric acid. In 1736, Joshua Ward, a London pharmacist, used this method to begin the first large-scale production of sulfuric acid. In 1746 in Birmingham, John Roebuck adapted this method to produce sulfuric acid in lead-lined chambers, which were stronger, less expensive, and could be made larger than the previously used glass containers. This process allowed the effective industrialization of sulfuric acid production. After several refinements, this method, called the lead chamber process or "chamber process", remained the standard for sulfuric acid production for almost two centuries. Sulfuric acid created by John Roebuck's process approached a 65% concentration. Later refinements to the lead chamber process by French chemist Joseph Louis Gay-Lussac and British chemist John Glover improved concentration to 78%. Throughout the 18<sup>th</sup> century, this could only be made by dry distilling minerals in a technique similar to the original alchemical processes. Pyrite, iron(II) disulfide ( $\text{FeS}_2$ ) was heated in air to yield iron(II) sulfate,  $\text{FeSO}_4$ , which was oxidized by further heating in air to form iron(III) sulfate,  $\text{Fe}_2(\text{SO}_4)_3$ , which, when heated to 480 °C, decomposed to iron(III) oxide and sulfur

trioxide, which could be passed through water to yield sulfuric acid in any concentration. In 1831, British vinegar merchant Peregrine Phillips patented the contact process, which was a far more economical process for producing sulfur trioxide and concentrated sulfuric acid. Today, nearly all of the world's sulfuric acid is produced using this method. In the middle Ages "Oil Of Vitriol" was used to make iron-gall nut ink. It is also used as a lawn conditioner, water purification, moss killer; it is also used in horticulture, and for medicinal and decorative purposes.

### Sweet oil of vitriol

The general formula of ether is  $(R)_2O$  (R=alkyl group, e.g. Methyl;  $-CH_3$ ). It is a colorless, highly volatile, flammable organic liquid. It is commonly used as a solvent and formerly it was used as a general anesthetic. It has narcotic properties which can cause temporary psychological addiction, sometimes referred to as etheromania. The compound possibly created by either Jābir ibn Hayyān in the 8th century or Raymundus Lullus in 1275. Valerius Cordus first synthesized this compound in 1540 and present it as "sweet oil of vitriol" (*oleum dulce vitrioli*). The name reveals the fact that it is obtained by distilling a mixture of ethanol and sulfuric acid. August Sigmund Frobenius give the name "ether" for this substance in 1729. The understanding of vitriols composition and chemical effects obtained by the pre-modern workers in the chemical fields constitutes an important chapter in the history of chemistry. All vitriols are poisons. This stuff is dangerous if badly handled. These can burn our skin, damage our clothes and can blind us if splashed in our eyes. So we should careful before their use.

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