

Ernest Gaston Joseph **SOLVAY**

Born: 16<sup>th</sup> of April, 1838 (Rebecq-Rognon)

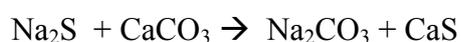
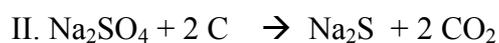
Died: 26<sup>th</sup> of May, 1922 (Elsene, near Brussels)

Ernest Solvay, the famous Belgian industrialist and chemist is the second of the five children of salt refiner. Due to an acute pleurisy, he cannot finish his secondary studies, let alone enroll at the university. This turns him into an autodidact developing a keen scientific mind through numerous chemical and electrical experiments. At the age of 21 (from 1859 on) he takes up a job at the gasworks of his uncle Florimond Semet in Sint-Joost-ten-Node. Later on Ernest and his brother Alfred are sent to Antwerp to train as accountants, but bookkeeping is not Ernest's forte. At uncle Semet's factory, he develops in 1861 a new process for manufacturing sodium carbonate (soda) starting from the ammonia-containing water of the gas plant, carbon dioxide and salt (sodium chloride).

### **Sodium carbonate**

At that time sodium carbonate is mainly applied in photography, cleaning, hygiene, pH-control of water, glass and enamel, food additive, as water softener, for treating of textiles, as volumetric reagent, etc. Before the industrial revolution soda is extracted from the ashes of wood imported from Russia and America. "Barilla" is the very pure soda extracted from the ashes of the barilla plant, which grows around the Mediterranean Sea. Another but less pure source of soda is provided by the ashes of kelp (seaweed) gathered from Scotland, Ireland and Brittany. The ashes are leached, the solution is evaporated until a usable material remains. But the supply of kelp has almost dried up, transport has become expensive and the industry increases its demand for the production of soap, glass, paper and textiles. The chemical industry is on the look-out for a new technique.

Nicolas Leblanc (1742-1806), a French surgeon by training who becomes a chemist already invents in 1787 the process which is named after him. First, sodium chloride is heated with concentrated sulphuric acid at 500°C, and sodium sulphate is reduced by carbon to sodium sulphide followed by a treatment of limestone.



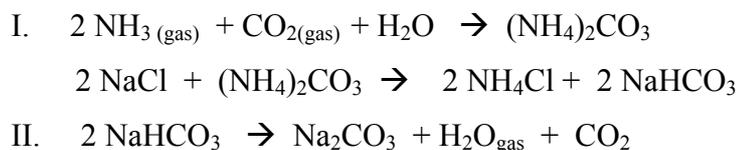
The final solution is leached at 30°- 40°C (maximum solubility of soda) and crystallized as its decahydrate, washing soda ( $\text{Na}_2\text{CO}_3 \cdot 10 \text{ H}_2\text{O}$ ).

The process has a number of disadvantages: expensive and noxious waste-products (HCl and CaS), expensive raw materials (during the French Revolution sulphur was mainly reserved for making gunpowder instead of the base material for sulphuric acid) and the high temperatures needed. The process of Leblanc is patented in 1791 and he establishes his first plant in Saint Denis in 1793. The patent however is claimed by the Convention without compensation. Leblanc will not receive the reward which the French Academy of Sciences had promised 16 years earlier. Unable to obtain legal redress from the government and reduced to utter poverty he commits suicide in 1806.

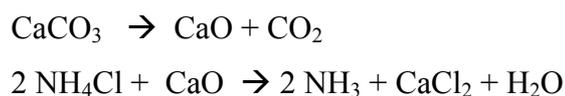
In England (Liverpool) James Muspratt (1793-1886), often regarded as the founder of the British chemical industry encounters serious difficulties to keep his factories going because of complaints by nearby irate landowners. In the end (1850) he has to move his production.

### **The Solvay process**

Ammonia and carbon dioxide under pressure are passed into brine (a saturated solution of sodium chloride). The less soluble sodium hydrogen carbonate (bicarbonate) precipitates and is heated above 300°C to turn it into sodium carbonate.



The yield depends upon the possibility of reusing ammonium chloride by treating it with quicklime (calcium oxide) obtained from heated limestone at 700°C



The only waste product is CaCl<sub>2</sub> which is used as a drying product, herbicide and salt for icy roads, etc.

The idea of the process is not entirely new. In 1811 the French physicist Augustin Fresnel (1788-1827) had already thought about the ammonia-soda technique. Ernest Solvay however is the first to develop the entire process. He is considered as the father of the actual process technology.

### **A World Concern**

Ernest Solvay is granted a patent and together with his brother Alfred, they start up a factory in 1865 at Couillet (near Charleroi): "Solvay & C<sup>ie</sup>". Their starting capital of 163.000 Belgian francs is hard to obtain. He purchases the ammonia from nearby gasworks; as a result of repeated technical setbacks designs the "tower" for a profitable reaction between carbon dioxide and

ammonia and invents the Semet-Solvay oven for purifying the distillate of the cokes ovens. We have to wait till 1870 to watch the company prosper. The branches expand globally (mainly in the USA and the European countries less familiar with the Leblanc process) and the company becomes a well quoted chemical concern on the stock exchange.

In England, the German chemist Ludwig Mond (1839-1900) and the Swiss banker John Brunner set up the Brunner-Mond Company manufacturing soda according to the Solvay process; the company merges in 1926 with three other firms (*Nobel Explosives, United Alkali Company, British Dyestuffs*) to become the I.C.I. (Imperial Chemical Industries)

### **Philanthropist**

As a socially engaged industrialist, Ernest Solvay rises above party politics and tries to bridge the gap between the liberals and the working class. As a senator for the liberal party between 1893 and 1900, he denounces the taxation system by which the offspring of plant owners inherit their fortune whose productivity, lacking the capacity or the interest to become involved in the business. He criticizes the socialist party and predicts that in the future its principles will stand in the way of the emancipation of the working class instead of realizing it. Solvay assumes that when there is unemployment, the society should provide jobs and the means of living, even if it means the retraining of the workers and if necessary put them to work far from their place of residence. Schooling must be provided according to the demand for adapted jobs.

With mild financial gifts Solvay contributes to scientific and social works.

Long before it becomes a law he organizes in his plants among other reforms: a social security system (1878), pensions for the workers (1878), the 8-hour workday (1897) and one week vacations with double wages (1913).

In 1906 together with Louis Empain, he subsidizes the foundation of the “Ibis” in Ostend: a school originally reserved for the orphans of the fisher population.

In 1911 he organizes in Brussels a conference for physicists (invitation only!) about “Radiation and Quanta” with Hendrik Lorentz (1853-1928) as chairman. The Metropole Hotel in Brussels still sells a postcard of the group photo of the participants, among others Albert Einstein, Marie Curie, Max Planck, Walter Nernst, Rutherford, Kamerlingh-Onnes. Two years later he does the same and the conference discusses the advances in theoretical chemistry with Sir William Ramsey as chairman. The fifth and most important conference of the International Institute for Physics and Chemistry takes place in 1927, leading to a confrontation and breakthrough of the quantum mechanics. On this occasion a lifelong friendship develops between Einstein and Queen Elizabeth of Belgium.

In 1914 he establishes the National Committee for Help and Food which will provide the necessary support (as the name says) for the Belgian population during World War I.

He is the founder of the “Solvay Institutes” consisting of a number of study centers attached to the ULB (Free University of Brussels): physiology, sociology, commerce, political and social sciences.

Ernest Solvay dies in Elsene (near Brussels) on the 26<sup>th</sup> of May 1922.

In spite of his frail health, Ernest Solvay is a keen mountain climber in Switzerland. He loves to take long walks between Brussels and his castle in La Hulpe.

His son Armand commissions the art-nouveau architects Victor Horta (1861-1947) to build a house, the Palais Solvay, at the Louizalaan 224 in Brussels.