

# Good for industry and the environment

**Sulfuric acid** is one of the most important industrially manufactured chemical compounds, and it is produced during the copper production process at Aurubis. When added to slurry, this versatile and valuable commodity can even help to solve environmental problems in agriculture



Sustainable farming: Sulfuric acid in slurry reduces nitrate residues in the soil by binding the ammonia and converting it into plant-friendly ammonium. This could also help farmers to cut down on synthetic fertilizers

Our world would look strange and empty if all the things that sulfuric acid is used to make were suddenly to disappear. It would also take on a gray sheen, because the chemical is indispensable to the production of many pigments. We would have no clothes made of synthetic fibers and we would have to do without many other synthetic products – perhaps even including this issue of CU, because sulfuric acid is also important in paper production. Gaps would even appear on the bread and beer shelves, because the substance helps with yeast production. At the same time, it reduces the damage caused to the environment by farming as a result of spreading slurry on the fields.

Sulfuric acid is thus one of the most versatile and important chemical compounds. It is hardly ever contained in end products, however, as it is generally used as an additive in manufacturing processes, which is why a nation's sulfuric acid production is a good indicator of its industrial strength. Approx. 275 million t of sulfuric acid are manufactured worldwide, making it the most produced chemical on the planet. The amount traded annually is only around 15 million t, however, as the manufacturers use most of what they produce. Aurubis manufactures around 2.5 million t annually but consumes only a minimal amount of this. This is also why the company is one of the world's leading traders in sulfuric acid.

#### Sulfuric acid production at Aurubis

Sulfuric acid consists of the elements sulfur (S), hydrogen (H) and oxygen (O) and is the result of various process steps. The chemical compound occurs as a by-product at Aurubis, i.e., automatically during copper production, because around a third of copper concentrate is sulfur. It is "oxidized out" by adding oxygen during the smelting of the copper

concentrate before being burnt in the furnaces to form the gas sulfur dioxide ( $S + O_2 = SO_2$ ). In the acid plant, this reacts with oxygen again in the presence of a catalyst to form the gas sulfur trioxide ( $SO_3$ ), which is then dissolved in sulfuric acid. Finally, it reacts here with water to form new sulfuric acid ( $SO_3 + H_2O = H_2SO_4$ ), a viscous, colorless, and odorless substance.

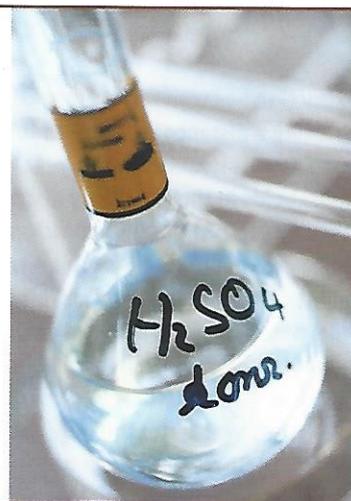
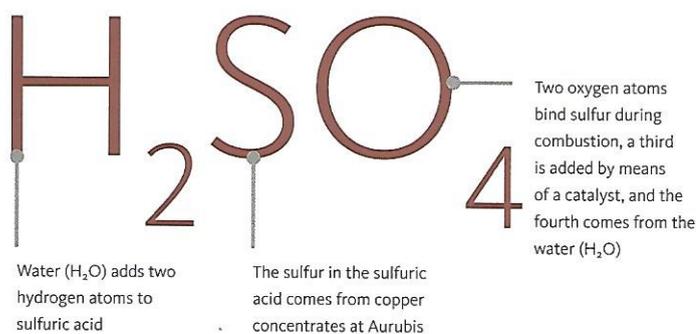
The sulfuric acid produced and marketed by Aurubis is some of the best in the global market. It undergoes several cleaning stages and continuous quality controls to ensure that its ultra-high purity grade exceeds all statutory requirements. It is produced at the sites in Hamburg (1.1 million t) and Pirdop (1.4 million t). The product made in Hamburg is supplied to customers by sea, inland waterway, rail, and truck. Aurubis uses three tanks, each with a capacity of 15,000 t, for interim storage on the premises of VOPAK-Terminal GmbH in the port of Hamburg.

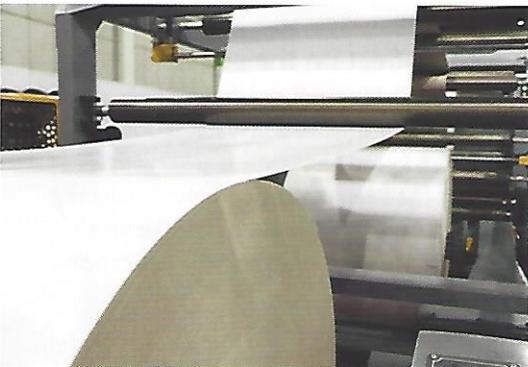
In turn, the product made in Pirdop is transported by rail to a storage depot with a total capacity of 50,000 t in the Black Sea port of Burgas (Bulgaria) and shipped out from there to customers in the Black Sea and Mediterranean region. While fertilizer producers account for the majority of worldwide sulfuric acid consumption, only 40 % of production at Aurubis goes to customers in this sector – another 40 % goes to the processing industry, and the remaining 20 % to metallurgy for ore leaching.

#### Positive effect on the environment

Heat is inevitably produced during the reaction between sulfur trioxide and water to form sulfuric acid, which has to be slightly diluted with water. This heat has been used at Aurubis in Hamburg since October 2018 to supply an entire district: this flagship project for industrial district heat

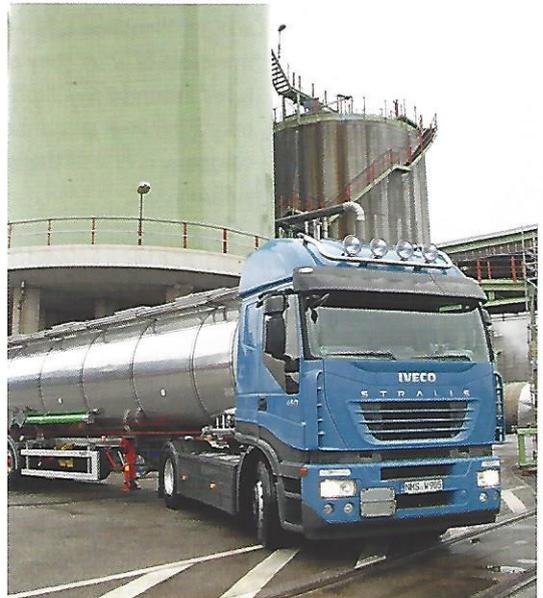
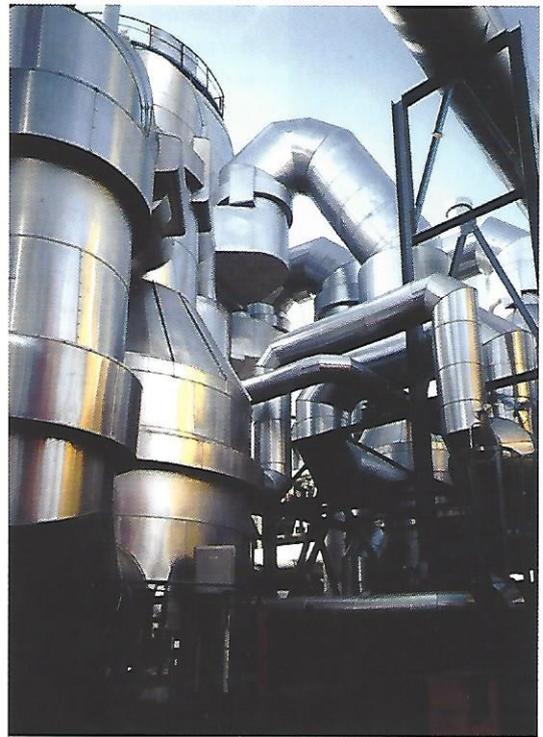
#### Chemistry of sulfuric acid





Sulfuric acid plays a role in the production of many things. It is a food additive (E513) and is used as an acidifier or to separate proteins and carbohydrates. In addition to this, it is used to promote the growth of yeast, which is needed in fermentation and baking processes. It also helps in manufacturing paper and pickling steel.

The sulfuric acid produced in the acid plant (top) in Hamburg is transported to customers by truck, rail, and ship



extraction has won several awards and uses a line covering a distance of 2.3 miles to supply 160 million kilowatt hours of heat a year to around 8,000 households in the HafenCity district of Hamburg – saving 20,000 t of CO<sub>2</sub> emissions a year in the process. What's more, Aurubis now needs around 12 million m<sup>3</sup> less water from the Elbe River for cooling. And, because the project has only used about a third of the theoretically available heat, there is still plenty of potential for it to grow.

District heat is not the only environmental benefit to be closely associated with sulfuric acid, however: agriculture can also gain from H<sub>2</sub>SO<sub>4</sub>

and become more sustainable. Industrial livestock farming produces more slurry than the crops on the land are able to consume. The fields become over-fertilized and compounds like ammonia leak into the air, where they bind to other substances. If you add sulfuric acid to slurry, however, a large portion of the ammonia is converted into ammonium, with two positive effects: it can be absorbed by crops as a nutrient and it is bound, which means that it cannot escape into the air. This "acidification" of the slurry by sulfuric acid not only reduces the need for synthetic fertilizers, but also the amount of harmful substances released.



The sulfuric acid is formed in the intermediate absorber (orange silo) of the acid plant. Aurubis extracts the CO<sub>2</sub>-free heat released during this process and has been using it to supply a new district of Hamburg since the fall of 2018. The picture shows TV presenter Andrea Thilo (l.), Christian Hein of Aurubis, and Dr. Martin Schüle of enercity at the opening of the multi-award-winning project

This still relatively young technique is being pioneered in Denmark, where the initial results give reason to hope that it may be possible to halve ammonia emissions. Other calculations even indicate a potential reduction of up to 64 %. This is also necessary because the EU has stipulated a reduction of 30 % for Germany by 2030. It is for this reason that a 7-point program for better nutrient management in the farming sector has just been drawn up in Germany. Among other things, the program contains a proposal to test the acidification of slurry with sulfuric acid "in order to achieve a reduction in ammonia emissions into the air and an increase in fertilizer efficiency during slurry output". It is estimated that between 400,000 and 500,000 t of sulfuric acid a year could be needed for this purpose in Germany.

### Stable market with high prices

Ore leaching is the third-biggest area of application for sulfuric acid after agriculture and the chemical industry. Leaching is an industrial process to extract metals from oxide ores. These are sprayed with sulfuric acid so that metals such as copper, nickel, and uranium are released from the ores.

Manufacturers of sulfuric acid such as Aurubis don't need to worry about future demand in the current environment. In fact, demand is more likely to increase from the new market created by the acidification of slurry – just like prices over the last two years. Having risen over a period of ten years, they have now stabilized at a high level. Stable and predictable conditions also prevail in the market, as 80 to 90 % of trading is done by term contracts rather than in the spot market.

Aurubis takes account of this trend by setting growth targets in line with the company's "Growth, Efficiency, and Responsibility" strategy. That is why a new office was opened in Tampa, Florida, in October 2018 (*as already reported by CU in issue 01-2019*). Managing Director Marcus Conrad intends to work from here to tap into new sales markets in South America. His job is not only to market the company's own sulfuric acid, but also to purchase and trade additional volumes in Asia. This versatile and omnipresent chemical thus turns an increasing number of cogs in the growth engine designed to propel Aurubis into a successful future.

Hartmut Krafczyk