Safer, sustainable water solution for cooling towers

This case study shows the advantages of using CO_2 over mineral acids in a data center cooling system, resulting in a more efficient and sustainable solution.

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As the world continues its migration from the physical and analogue to the digital economy, the place where our data is stored still demands a physical presence. Known as data centers, these giant processing and storage structures have sometimes been referred to as 'factories of the digital age'. Distributed across the globe, they keep the world's digital services running, but just like factories manufacturing physical goods, data centers are responsible for an ever-increasing carbon footprint.

While much climate action is directed to reducing emissions from the automotive, aviation and energy industries, reports say that data centers have gone to consuming "virtually nothing 10 years ago to consuming about 3 per cent of the global electricity supply and accounting for about 2 per cent of total greenhouse gas emissions", or the same carbon footprint as the airline industry.

The storing, processing, moving and analysis of vast amounts of data requires equally vast amounts of energy, as do the operating systems used to prevent the servers and buildings from overheating. Data centers house vast numbers of racks filled from floor to ceiling with servers throwing out significant amounts of heat.

Comprising of huge enclosed areas - some data centers can cover 90,000 m² or more - they require powerful and reliable cooling systems.

Data centers use water distributed via a dedicated looped circuit to undertake the job of cooling, with the water itself then cooled by the use of cooling towers. Although an effective cooling system, when the water absorbs heat from the servers, some of it will evaporate, changing its chemical composition and giving it a higher pH value, which can cause limescale deposits. Incorrect pH in cooling tower water could result in costly damage to, or contamination of, the system due to corrosion and scale formation.

As a result, strong acids, such as sulphuric acid, are typically added to the water to reduce the pH. Water pH is very important to the cooling tower system and is linked to the efficiency of disinfectants used to prevent biological contamination such as legionella. Replacing strong acids with carbon dioxide (CO_2), maintains an alkalinity balance that avoids calcium carbonate deposits or corrosion and the accumulation of sulphur in the water, making the water "cleaner" when discharged later on.

The customer challenge

For these reasons, when one of the world's leading multinational technology companies specialising in internet services and leading-edge tech products wanted to extend their 90 hectare data center, they looked to Air Products to come up with a more sustainable but equally efficient way to control the pH of its cooling system. Although the customer had already invested millions of euro in the installation of a solar panel park as part of their commitment to becoming a highly sustainable company, until this point, they had been using publicly accessible water from a near-by canal in their cooling towers and undertaking the dosing of necessary chemicals to regulate the pH. The construction of the new hall was an ideal opportunity to install a more environmentally friendly and safer system for cooling.

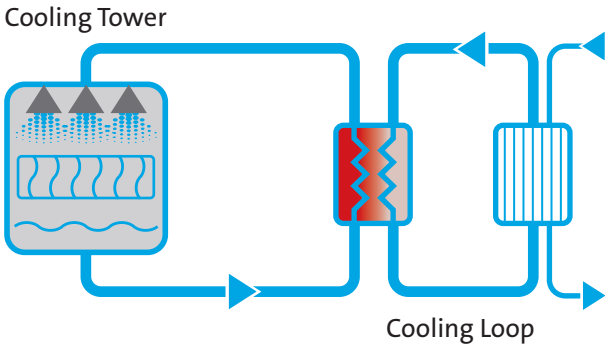
An effective and sustainable solution

Air Products recommended a more durable solution using CO_2 to replace the acidic chemicals being used. CO_2 offers many advantages over mineral acids, particularly in regards to safer handling and healthier conditions for users. Known for being a weak acid and not corrosive or toxic, it leaves no contaminating residue in the treated water. It is also more sustainable as the CO_2 bonds with the water. And as CO_2 forms a stable buffer solution, it is able to neutralise any basic constituents, so maintaining the stability of the pH for longer. Injection of the CO_2 is also straightforward and easy so control and overdosing of chemicals is no longer an issue. CO_2 captured from other processes plays a key role in sustainability by contributing to a circular economy.

A customer success story

Once the safety and environmental benefits became clear, the customer decided to roll out the new CO_2 based cooling system to all their data centers worldwide.

Economic evaluations of using CO_2 to control pH values of cooling tower water versus the more traditional method of adding chemicals show that costs are comparable.



Advantages of using CO_2 in cooling towers

Air Products' Halia® CO_2 neutralisation system helps control pH process water while providing an alternative to using mineral acids to lower the pH of alkaline water. CO_2 is less prone to overdosing than sulfuric acid and other mineral acids and is safer to handle.

Advantages of pH control using CO_2

- CO_2 is a weak acid and not corrosive or toxic
- CO_2 can be used to replace strong acids such as sulfuric acid
- CO_2 leaves no contaminating residue in the treated water
- CO_2 captured from other processes plays a key role in sustainability by contributing to a circular economy.
- CO_2 is also more sustainable, since in this particular application, CO_2 is bonded in the water
- As CO_2 forms a stable buffer solution, the reaction is very easy to control

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