Water enhancement

Carbon dioxide neutralises wastewater in the construction industry – ecologically and economically

Water reservoirs prior to neutralisation with carbon dioxide

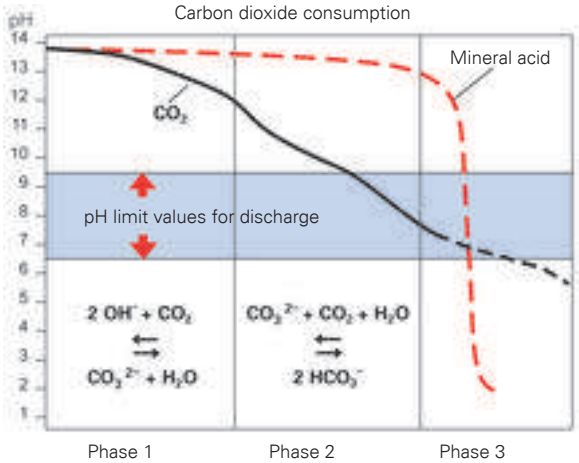
Successful neutralisation is indicated by the change in colour.

Efficiently countering high pH values in underground construction

Underground and waterway construction projects often encroach on layers that conduct groundwater. The water encountered in the process must either be diverted to receiving waters or allowed to seep away. However, contact with concrete changes the chemical properties of that water. The main problem is the increase in pH.

Acids – mineral acids, for example, which are especially frequently used – can neutralise the water, but they also increase salinity and result in high storage requirements.

The use of carbon dioxide (CO_2) represents a more efficient and at the same time totally natural approach: carbon dioxide is a component in the buffer system of the water. This is why the salinity does not increase and the pH can be adjusted more precisely. And that makes it possible to meet government-imposed water treatment regulations economically.



Neutralisation curves for sodium hydroxide when using carbon dioxide versus mineral acid

Three phases, one goal – neutralisation

From a chemical point of view, the neutralisation process actually occurs in three phases. In practical terms, however, it proceeds seamlessly: after chemical reactions in phases one and two, the pH is already below 8.3 in the third phase and gradually approaches its lower limit with additional CO_2 absorption. The actual limit depends on the CO_2 pressure, hydrogen carbonate concentration, temperature and other substances dissolved in the water.

This flatter neutralisation curve, which is typical of "weak acids" like CO_2, offers a clear advantage: by contrast with "strong" mineral acids, further addition of CO_2 in the immediate vicinity of the neutral point practically never leads to overacidification. That means there is no need for a sophisticated control system when neutralising with CO_2.

Lay new foundations in neutralisation

For neutralisation, the water is usually fed through long pipelines to the receiving waters – generally by means of a pumping station to increase the pressure. Messer makes use of the existing equipment and adds the carbon dioxide directly into the customer's own pipeline via dosing lances. A special design even makes it possible to clean these lances while the pump is running.

Monitoring of limit values through regular control measurements

Pre-neutralisation in the underwater concrete basin combined with an in-line neutralisation plant

The carbon dioxide is prepared in a suitable tank system and supplied via secured lines to the dosing panel. From there, the CO_2 is fed via hoses to the injection lances. The CO_2 addition is controlled by a pressure increase signal from the pump and a continuous pH measurement. When the pump turns on, the dosing is controlled by the pH value in two steps.

The special case of "underwater concrete"

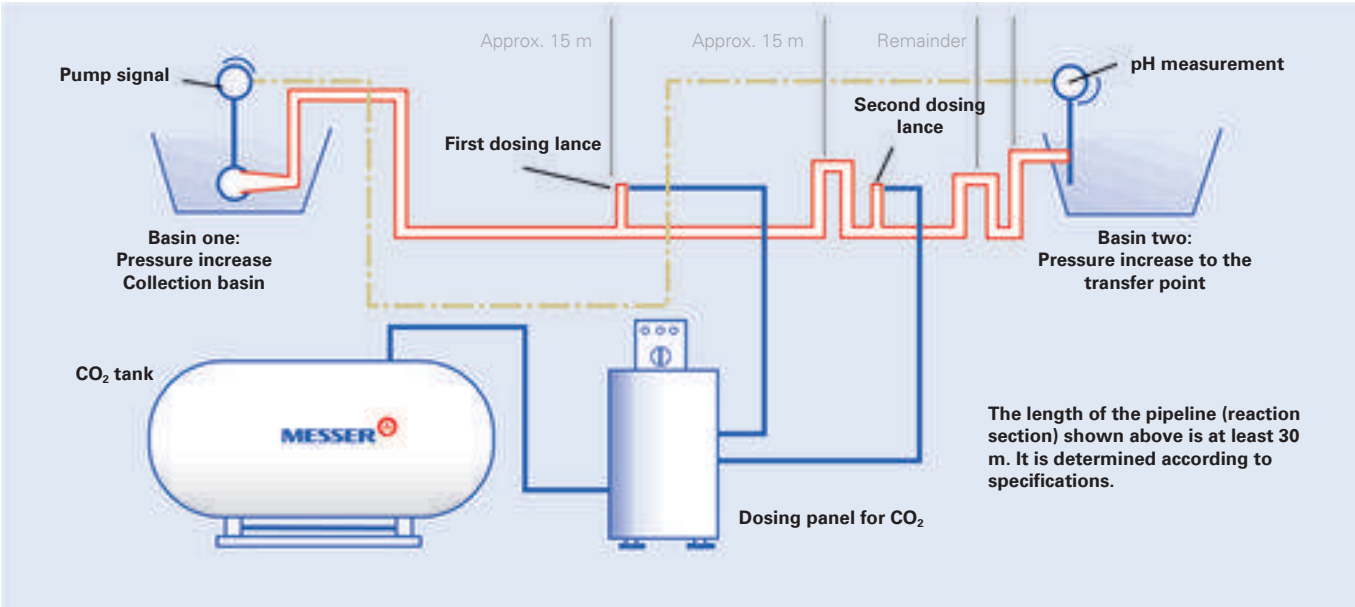
When underwater concrete is installed in a construction site, one thing counts above all else: the water in the pit must be pumped out as rapidly as possible after completion.

For this reason, high capacity pumps and large pipe cross-sections are used. But this also places high demands on the neutralisation system, as the high pH values in the construction pit system must be compensated with correspondingly large volumes of carbon dioxide. Precipitation of calcium carbonate also occurs, which in large quantities can cause problems in downstream pumps.

Pre-neutralisation provides the answer in such cases. In this process, carbon dioxide is injected as fine bubbles directly into the construction pit via special hoses. This approach lowers the pH of the water while still in the pit. The calcium carbonate precipitates out and can be drawn off with the residual sludge. High initial pH values lead to rapid and complete dissolution of the carbon dioxide in the water in the construction pit. As a result, it takes less CO_2 to carry out the same in-line neutralisation.

Advantages at a glance

- Eco-friendly treatment that prevents increased salinity
- No possibility of over-acidification under normal circumstances
- Extended service life of systems due to the absence of corrosion
- No handling of dangerous, aggressive acids
- No charges for elevated salt loading in wastewater
- No investment costs for acid storage facilities, acid dosing pump, safety showers
- No investment costs for possible acid neutralisation in case of over-acidification
- Low space and personnel requirements
- Low maintenance costs
- Low operating costs



Schematic diagram of the reaction section

In-line neutralisation at a construction site in Tyrol

CO_2 storage reservoir of a construction site neutralisation plant

Finding the best solution together
Take advantage of our experience. Our application engineers will be glad to advise you in the selection and integration of a carbon dioxide neutralisation system for your construction projects.

Please do not hesitate to contact us if you have any questions.

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