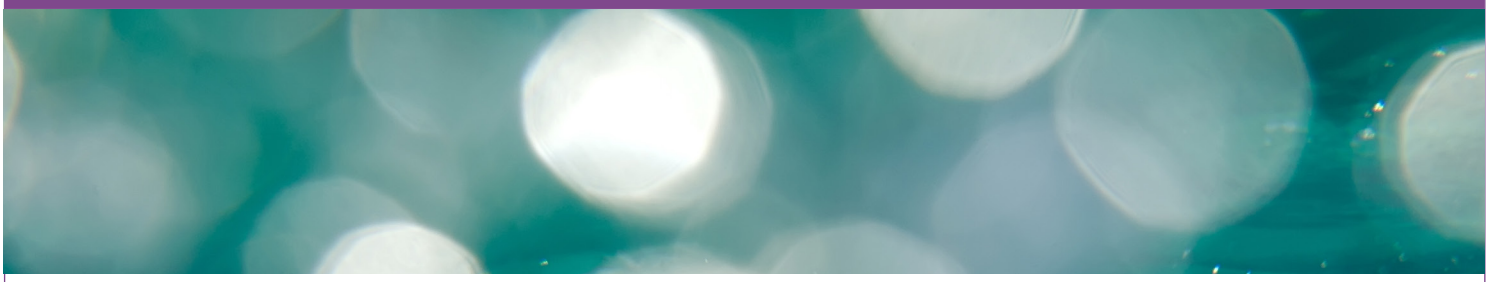
ANOXKALDNES

Tracer™ Selenium



Removal of selenium with AnoxKaldnes™ Moving Bed Biofilm Reactors (MBBRs)

Industrial effluents can often be loaded with special and complex compounds. Some of these compounds are difficult to remove and can also be harmful to the environment and living organisms if left untreated. A group of these special compounds is selenates (SeO_4^{2-}) and/or selenites (SeO_3^{-}) that contain selenium.

Biological treatment of selenium contaminated wastewaters

Selenium is challenging and costly to remove from wastewater alone with physico-chemical methods, such as filtration (sand, clay, titanium oxide), membrane filtration (reverse osmosis, nanofiltration), non-selective ion exchange resin adsorption, precipitation, cementation, coagulation and combinations thereof. Therefore, biological removal of selenium has also become a viable option. Bacteria can reduce selenate and selenite to elemental selenium under anaerobic conditions.

Why is selenium of concern?

Selenium is an essential nutrient for all living organisms; humans need approximately 15-60 µg daily.
Nevertheless, selenium compounds bioaccumulate in aquatic environments, and even at low concentrations (a couple of µg/L), they can compromise the health of living organisms.
Therefore, selenium discharge into the environment is becoming of increasing concern. The US Environmental Protection Agency (EPA) has identified selenium as a freshwater priority pollutant and proposed a discharge limit for release into freshwater systems of only 4.7 ppb. This discharge limit will often apply to mining industries that discharge into fresh water systems. For coal-based power plants, a discharge limit of 12 ppb as a monthly average and 23 ppb as a daily maximum will apply from 2023.

In Canada, a guideline for selenium in surface water is 1 ppb. In Europe, selenium discharge limits tend to be less strict, in the range of 50 to 100 ppb. In Japan, the industrial discharge limit for selenium is 100 ppb irrespective of source.

Water contaminated with selenium

Selenium contaminated wastewaters are generated by industries with activities in coal and mineral mining, coal-based power generation, oil extraction, and petrochemical refining, metallurgy, and agricultural irrigation. Effluents from the production of solar panels and lithium batteries also tend to be contaminated with selenium. In these wastewaters, selenium is mainly present in the form of selenate, with an oxidation state of 6+, but it can also be present as selenite, with an oxidation state of 4+. Both these forms of selenium are soluble in water, independently of pH values.

Industrial applications for Tracer™ Selenium MBBRs

Power and energy

Chemical

Mining

Oil and gas

Using AnoxKaldnes technologies to remove selenium

AnoxKaldnes, with other Veolia Water Technologies subsidiaries, have demonstrated the technical feasibility of using Tracer™ Selenium MBBRs for the treatment of selenium-contaminated effluents from different locations in the USA and Europe, both at bench- and pilot scales.
Efficient removal of selenium and nitrate has been achieved for many different types of wastewaters including effluents from copper and coal mines, a refinery and a copper anode factory. Efficient selenium removal was also achieved from Flue Gas Desulphurisation (FGD) effluents from several power plants

Feel free to contact us for more information about how AnoxKaldnes Tracer™ technology creates new possibilities in biologically removing harmful compounds in industrial wastewater.

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