

ANOXKALDNES

# Tracer™ Cyanides

## Removal of cyanides 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. One example of such a group of compounds is cyanides. They can be present as free cyanide ( $\text{HCN}^+\text{CN}^-$ ), metal cyanides or derivatives in the form of cyanate ( $\text{OCN}^-$ ) and thiocyanate ( $\text{SCN}^-$ ).

### Biological removal of cyanides

Cyanide refers to the triple-bonded molecule of C and N as  $\text{C}\equiv\text{N}$ . Cyanides are found in nature as byproducts of bacteria, fungi, algae, plants and insects. Therefore, cyanide biodegradation and the biological treatment of cyanides is possible. Although cyanides can be treated physico-chemically, with reverse osmosis and/or oxidation with hydrogen peroxide, alkaline chlorination, electrolysis or UV, the biological degradation of cyanides is the preferred method since it is less expensive and does not generate secondary contaminated streams. The aerobic degradation of cyanides is more effective than anaerobic degradation and it commonly generates cyanates ( $\text{OCN}^-$ ) and ammonia as a hydrolysis product. The microorganisms able to degrade cyanides as well as cyanates by different pathways are easily enriched in biofilms attached to MBBR carriers.

### Why is cyanide of concern?

Although naturally present, cyanides can be toxic and affect all living organisms, including microorganisms in biological treatment processes. In general, for aquatic organisms, lethal cyanide levels are in the range of micrograms per litre (part per billion), whereas for birds and mammals lethal cyanide levels are in the milligram per litre range (part per million). Cyanide can be lethal to humans at a concentration of 60-90 mg/L in water or in 300 mg/m<sup>3</sup> in air.

Unfortunately, cyanide-containing wastes are produced by different industries worldwide in the range of millions of kg per year. Generally, cyanide-containing effluents cannot be discharged without previous treatment to reduce their cyanide contents to very low concentrations (<0.1-0.2 mg CN<sup>-</sup>/L).



## Water contaminated with cyanides

Cyanides play a key role in different industrial processes and products. Cyanide-containing wastes are typically generated from industries that manufacture paints, polymers, organic compounds and pharmaceuticals or steel and coal production. An important source of cyanide-contaminated effluents is the mining industry, as for example, gold, silver, zinc, copper mine effluents. In the mining industry, cyanides are used as leaching agents for metal recovery, especially in gold mining. Other typical examples of specific cyanide-contaminated effluents are electroplating industrial effluents, and scrubber water generated after wet-scrubbing of incinerator flue gas. Cyanides are also produced in refineries during the cracking processes.

## Industrial applications for Tracer™ Cyanides MBBRs



Power/Incineration



Chemicals and polymers



Mining and precious metal mining.



Oil and Gas



Pharmaceuticals

## Using AnoxKaldnes technologies to remove cyanide

AnoxKaldnes with other Veolia Water Technologies subsidiaries have demonstrated the technical feasibility of using Tracer™ Cyanides MBBRs for the treatment of cyanide-contaminated effluents. From bench- or pilot-scale testing, full-scale process solutions have been built for the efficient removal of cyanides, as in the mining industry in North America. Tracer™ Cyanides MBBRs have been designed as part of staged biological treatment processes that are complemented with nitrogen treatment through other well-established AnoxKaldnes™ MBBR technologies.

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

AnoxKaldnes • Veolia Water Technologies  
Klosterängsvägen 11A • 226 47 Lund • Sweden  
Office: +46 (0)46 18 21 50  
[www.anoxkaldnes.com](http://www.anoxkaldnes.com)

**ANOXKALDNES**

by  **VEOLIA**  
Water Technologies