



Oxone™ monopersulfate compound can rapidly and efficiently detoxify hazardous cyanide ion in industrial waste streams.

Cyanides ($\text{-C}\equiv\text{N}$) are beneficial compounds that have widespread uses industrially. However, in order to avoid the environmental release of highly toxic cyanide species into the environment, it is necessary to use effective techniques to remediate cyanide-containing waste water.

Oxone™ monopersulfate compound – the powerful non-chlorine oxidizer – rapidly oxidizes cyanide ions in industrial waste streams. The excellent environmental and safety profile and ease of use of Oxone™ chemistry makes the powder product an attractive choice for a wide variety of cyanide detoxification applications. Oxone™ monopersulfate compound ($2\text{KHSO}_5 \cdot \text{KHSO}_4 \cdot \text{K}_2\text{SO}_4$) is the first neutralization salt of Caro's acid (H_2SO_5), meaning that it is a stable, powder version of the powerful chemistry and does not require on-site generation.

Industrial uses of cyanides

Carbon black production	Precious metal mining
Coal gasification	Printed circuit board manufacture
Electroplating	Steel production
Pesticide production	Synthetic fabrics manufacture
Petrochemical industry	Various other chemical processes
Pharmaceutical synthesis	
Plastics, coatings & foam production	

Benefits of Oxone™ chemistry for cyanide detoxification

Oxone™ monopersulfate compound reacts rapidly with waste streams with complex mineralogy. Cyanides, thiocyanates and weak acid dissociable (WAD) metal complexes are degraded at ambient temperature within minutes. The process is selective, efficient and operationally simple, requiring low capital investment. The Oxone™ product has an excellent safety profile for storage, handling and transport, and results in more environmentally favorable end products.

Advantages of the Oxone™ process

Strong oxidizer ($E^\circ = 1.85 \text{ V}$)	Process simplicity with low capital investment
Fast-acting at ambient temperature	Stable powder & solution peroxygen chemistry
Selective, efficient, non-chlorine oxidizer	Safe to store and handle
	Excellent environmental profile

Alternative oxidation methods have several disadvantages as compared with Oxone™ chemistry. Alkaline chlorination has environmental disadvantages due to the formation of toxic chlorinated by-products, meaning that additional dechlorination processes may be required. The hydrogen peroxide process can consume high quantities of copper sulfate and has slow reaction kinetics. Ozone treatment can have high operational costs, is limited by poor solubility and is a toxic gas, which has to be generated in situ. The sulfur dioxide and air processes are operationally complex.

Oxone™ cyanide oxidation chemistry

Cyanide ion oxidation: $\text{HSO}_5^- + \text{CN}^- \rightarrow \text{OCN}^- + \text{HSO}_4^-$

Thiocyanate ion oxidation:
 $4\text{HSO}_5^- + \text{SCN}^- + \text{H}_2\text{O} \rightarrow \text{OCN}^- + 5\text{HSO}_4^- + \text{H}^+$

During processing the pH should be maintained above 9 to avoid toxic HCN gas formation. Cyanate can be further oxidized to nitrogen and carbonate by using Oxone™ monopersulfate compound in excess.

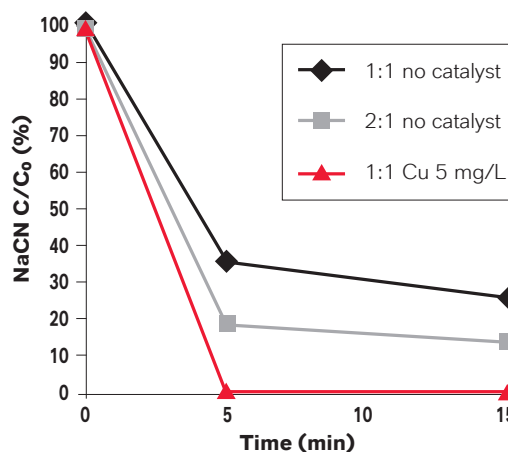
Proven chemistry

The following laboratory trial illustrates one example of the oxidation efficiency of Oxone™ monopersulfate compound for cyanide remediation. Plant pulp, with an initial sodium cyanide concentration of 42 mg/ml, was treated with Oxone™ powder in an amount sufficient to provide molar ratios of 1:1 or 2:1 $\text{KHSO}_5 : \text{CN}^-$ (equivalent to 13 and 26 g Oxone™ powder per gram of cyanide). As shown in Figure 1, at least a 60 % reduction occurred within 5 minutes, while addition of 5 mg/l Cu^{2+} catalyst further enhanced oxidation to achieve >99 % cyanide destruction within 5 minutes.

Oxone™ monopersulfate compound is a fast, effective, sustainable and convenient product for cyanide remediation.

As with any product, use of Oxone™ product in a given application must be tested (including field testing, etc.) by the user in advance to determine suitability.

Figure 1: Destruction of cyanide over time with Oxone™ monopersulfate compound, with and without copper sulfate catalyst*.



* These items are provided as general information only. They are approximate values and are not considered part of the product specifications.

Registration / Approval / Recommendation

The use of Oxone™ monopersulfate compound is subject to the relevant national legislation. Up-to-date information on the registration of our products can be obtained from:

LANXESS Deutschland GmbH
 Business Unit Material Protection
 Regulatory Affairs
 50569 Cologne / Germany
 E-Mail: Regulatory-Support-Biocides@lanxess.com

LANXESS
 Energizing Chemistry

LANXESS Deutschland GmbH
 Business Unit Material Protection Products
 50569 Cologne/Germany

www.protectedbylanxess.com

This information and our technical advice – whether verbal, in writing or by way of trials – are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information currently provided – especially that contained in our safety data and technical information sheets – and to test our products as to their suitability for the intended processes and uses. The application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold and our advisory service is given in accordance with the current version of our General Conditions of Sale and Delivery.

©2019 LANXESS. Oxone™ and any associated logos are trademarks or copyrights of LANXESS Corporation. LANXESS™ and the LANXESS Logo are trademarks of LANXESS Deutschland GmbH. All trademarks are registered in many countries worldwide.

Note: The information contained in this publication is current as of September, 2019. Please contact LANXESS Deutschland GmbH to determine if this publication has been revised.

Oxone™ Cyanide Detoxification/17.09.2019