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NEW DEVELOPMENTS IN CYANIDE MANAGEMENT: COST EFFECTIVE DETOXIFICATION OF CYANIDE, CYANATE AND THIOCYANATE BY USING NEWLY DISCOVERED ENZYMES

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ABSTRACT

Biotechnological Cyanide-degradation is known for the use of either living cells or crude lysates of those microorganisms. Unfortunately, so far this kind of technology results only in moderate success.

Cambrex IEP GmbH discovered various enzymes that can be used outside a living cell and are therefore easy to use ingredients for the detoxification of cyanide. Those enzymes can be used for the detoxification of excess NaCN after cyanation reactions or in aqueous waste waters. Also, those enzymes provide a new tool for the decontamination of Cyanide after accident-caused release in the Environment.

The Nitrilase enzyme IEPNit23 converts free cyanide (CN) according to $CN + H_2O \rightarrow NH_4^+ + HCOOH$. NaCN, KCN and complex forms of CN like Na[Au(CN)2, Na[Zn(CN)4], Cu(I)CN, K[Au(CN)2, ZnCN2 , K2Ni(CN)4 x H2O can be converted. The Cyanase enzyme IEPCy4 degrades OCN according to $OCN + H_2O \rightarrow H_2NCOO^- \rightarrow CO_2 + NH_3$. The Thiocyanase enzyme IEPSP76 degrades SCN according to $SCN + H_2O \rightarrow COS + NH_3$. The enzymatic reactions can be completed within 2-8 hours. Reaction temperature is between 15°C and 50°C, pH 4.5 to 8.0. Slurry at 40-50% w/w is acceptable.

All enzymes can be manufactured at industrial scale (up to 100 tons p.a.) as spray dried powder. They can be shipped and stored for 6 months at 4-8 °C. Below 0° C the enzymes can be stored for 2 years.

The high efficiency of those enzymes will be demonstrated by case studies from the chemical Industry, wastewater management and CN complex detoxification. Reaction parameters and cost estimations will be presented.

Keywords: Cyanide management, Gold mining, Enzyme, Cyanide degradation, Cyanide detoxification, Environment, New technology, Waste Water management, NaCN, KCN, CN complexes, Nitrilase, Cyanase, Thiocyanse, Cyanide, Cyanate, Thiocyanate