

## REMOVAL OF CYANIDE FROM CONTAMINATED WATER AND ITS USE IN BIOGAS PRODUCTION

### Fields of use

Anaerobic biological treatment of cyanide contaminated wastewater, and production of biogas from the cyanide

### Current state of technology

The solution has been demonstrated and tested in the laboratory

### Type of cooperation

License agreements with industry or research partners that carry out or require wastewater treatment, and / or biogas production facilities

### Intellectual property

Patent application has been filed.

### Contact

Jožef Stefan Institute,  
Jamova cesta 39,  
1000 Ljubljana,  
Slovenija  
Phone: + 386 1 47 73 224  
E-mail: [tehnologije@ijs.si](mailto:tehnologije@ijs.si)  
Web site: <http://tehnologije.ijs.si/>



### Summary

A procedure has been developed for anaerobic biological treatment of cyanide contaminated wastewater, and production of biogas from the cyanide. The procedure enables cyanide degradation by naturally present microorganisms, and the reactor conditions enable chemical detoxification of excess cyanide that allows for microbial biogas production.

### Description of the invention

Industrial effluents generally contain 100-500 times higher concentrations of cyanide compared to natural systems. Cyanide can be highly toxic to humans and wildlife, causing cytotoxic hypoxia, leading to respiratory arrest and death. The majority of wastewaters is treated by chemical and physical approaches which are predominantly aerobic and often expensive and complex to operate. The most commonly conducted method is chlorine oxidation, or microbiological treatment under aerobic conditions. The physiological and metabolic capabilities of anaerobic microbial consortia, which may be used for cyanide removal, have not been explored to the point of finding a satisfactory solution. At the same time, cyanide in various industrial wastewaters is resistant to anoxic microbial degradation due to the low content or low quality of anaerobically degradable carbon.

The invention solves this problem by introducing a procedure for anaerobic biological degradation of cyanide and production of biogas from cyanide using a mixture of cyanide contaminated industrial wastes, and organic-matter-rich industrial wastes as inflow for the treatment in typical anaerobic biogas production reactors. These two wastewater types normally originate from two different industrial sources. Cyanide degradation is achieved by carefully applying optimal environmental parameters for microbial growth.

The technology is useful wherever organic-matter-poor waters (e. g. mining or pharmaceutical industry wastewater) may be mixed with organic-matter-rich effluents (e. g. breweries, dairy production lines, paper mills) to result in detoxification of cyanide as well as production of biogas.

### Main Advantages

- anaerobic biological treatment eliminates the need for the aerobic phase
- organic matter-rich effluents increase the degradability of cyanide under anaerobic conditions
- microbial communities used are normally present in the reactors
- microbes hydrolyze cyanide using different enzymes, and form products that can be used further by other microbes

- process is environmentally friendly, faster, as well as less expensive compared to chemical treatments
- anaerobiosis allows for abiotic removal of excess cyanide that could otherwise be toxic to the microbes
- degradation is complete so no leakage of cyanide into soils / waters / air occurs
- operationally, the system of mixing different wastewaters may be set up in continuous or batch mode