



Ecotoxicity of degradation product from dye Reactive Black 5 by electrochemical degradation products using MFC as a source of electricity



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Introduction

The concept of microbial fuel cells, known since the beginning of the 18th century, has found its place in potential application among alternative energy sources. Using microorganisms, chemical energy is successfully converted into electricity. The resulting energy has the potential to be used to power small consumers, such as an electrode system for electrochemical color degradation.

The results

Ecotoxicological analysis using *Vibrio fischeri* showed that the highest toxicity is the RB5 dye (EC₂₀ 8.17%), while the resulting degradation product after 6 h of treatment with electricity obtained through the MFC system has the lowest toxicity to this bacterium (EC₂₀ 33.05%).

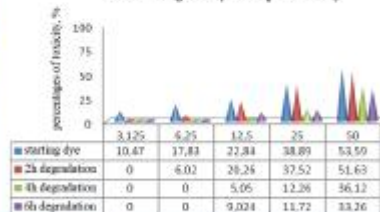
Results of ecotoxicity testing of dyes and degradation products after 2h, 4h and 6h.

	Dye RB5	2 h	4 h	6 h
EC ₂₀	8.17	18.43	32.44	33.05
Reliability interval	9.84-6.50	25.35-141.52	38.05-26.32	37.24-28.86

Methods

Aqueous dye solution (100 mL) RB5 of 25 mg/L and 1 mM H₂O₂ was electrochemically treated, using Pt and Fe electrodes. The MFC cell was used as a current source for degradation. The solution also contained 0.1M Na₂SO₄ for better electrical conductivity. A control consisting of only 25 ppm dye and 1 mM peroxide was also monitored. RB5 dye samples were taken after 2, 4 and 6 h from the beginning of degradation. A bacterial strain belonging to *Vibrio fischeri* NRRL B-11177 was used for toxicity testing, and toxicity testing was performed according to ISO 11348-3/2007 standard. Processing of results and validity criteria have already been described and are performed according to the same model. The EC₂₀ value was calculated using Microsoft Excel 2003.

Percentage of dye sample toxicity



Conclusion

Ecotoxicological analysis using the bacterium *Vibrio fischeri* showed that the highest toxicity is the RB5 dye coating (EC₂₀ 8.17%), while the resulting degradation product after 6 h of treatment with electricity obtained through the MFC system has the lowest toxicity to this bacterium (EC₂₀ 33.05%).

References

- M. Rahimnejad, A. Adlzami, S. Darvazi, A. Zarepour, S. Ota, *Chem. Eng. J.*, 5 (2015), 745-756. (<https://doi.org/10.1016/j.cej.2015.03.031>)
M.C. Potter, *Proc. Roy. Soc.*, 84 (1911), 260-276. (<https://doi.org/10.1098/rspb.1911.0073>)

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