

Accepted Manuscript

Cleaner Chlorine Production Using Oxygen Depolarized Cathodes? A Life Cycle Assessment

Johannes Jung , Sarah Postels , André Bardow



PII: S0959-6526(14)00565-4

DOI: [10.1016/j.jclepro.2014.05.086](https://doi.org/10.1016/j.jclepro.2014.05.086)

Reference: JCLP 4380

To appear in: *Journal of Cleaner Production*

Received Date: 13 November 2013

Revised Date: 20 May 2014

Accepted Date: 26 May 2014

Please cite this article as: Jung J, Postels S, Bardow A, Cleaner Chlorine Production Using Oxygen Depolarized Cathodes? A Life Cycle Assessment, *Journal of Cleaner Production* (2014), doi: 10.1016/j.jclepro.2014.05.086.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Cleaner Chlorine Production Using Oxygen Depolarized Cathodes? A Life Cycle Assessment

Johannes Jung^a, Sarah Postels^a, André Bardow^a

^a*Institute of Technical Thermodynamics, RWTH Aachen University, Schinkelstraße 8, 52062 Aachen, Germany*
Contact: andre.bardow@ltt.rwth-aachen.de, Tel.: +49-241-80-95381, Fax: +49-241-80-92255

Abstract

Chlorine and caustic soda are two indispensable chemical commodities co-produced in the so-called chlor-alkali electrolysis. Chlor-alkali electrolysis is today a target for cleaner production because of its large electricity demand causing considerable environmental impacts. The electricity demand of chlor-alkali electrolysis can be reduced by 30 % using oxygen depolarized cathodes (ODCs) instead of the standard cathodes (STCs) used today. However, ODCs require additional resources and do not produce hydrogen in contrast to existing chlor-alkali plants. This work investigates if the reduction in electricity demand also contributes to cleaner production. For this purpose, environmental impacts from chlor-alkali electrolysis using ODCs are compared to the impacts from best available existing chlor-alkali plants using STCs. The life cycle assessment includes manufacturing, operation and disposal of the plants. To account for utilization of hydrogen from existing chlor-alkali plants, two alternative utilization scenarios are studied: energy recovery by combustion of hydrogen and use of hydrogen as chemical commodity. Seven environmental impact categories are studied in detail using the ReCiPe method. Chlor-alkali electrolysis using ODCs yields lower environmental impacts in up to six environmental impact categories. Plant operation contributes most in six out of seven impact categories. Chlor-alkali electrolysis using ODCs has thus potential to contribute to cleaner production in the chlor-alkali industry.

Highlights

- Life cycle assessment (LCA) of chlor-alkali electrolysis using oxygen depolarized cathodes
- Global warming impact reduction by 8 % to 12 % compared to existing plants in Germany
- Reductions in up to five more environmental impact categories
- World-wide potential for reduction of environmental impacts identified

Keywords: chlor-alkali electrolysis, oxygen depolarized cathodes, electricity demand reduction, life cycle assessment, environmental impacts

Download English Version:

<https://daneshyari.com/en/article/8105897>

Download Persian Version:

<https://daneshyari.com/article/8105897>

[Daneshyari.com](https://daneshyari.com)