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

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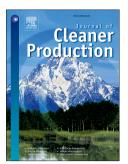
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3 4	Cleaner Chlorine Production Using Oxygen Depolarized Cathodes? A Life Cycle Assessment
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9	
10 11	Abstract
12	Chlorine and caustic soda are two indispensable chemical commodities co-produced in the so-called chlor-alkali
13	electrolysis. Chlor-alkali electrolysis is today a target for cleaner production because of its large electricity
14	demand causing considerable environmental impacts. The electricity demand of chlor-alkali electrolysis can be
15	reduced by 30 % using oxygen depolarized cathodes (ODCs) instead of the standard cathodes (STCs) used
16	today. However, ODCs require additional resources and do not produce hydrogen in contrast to existing chlor-
17	alkali plants. This work investigates if the reduction in electricity demand also contributes to cleaner production.
18	For this purpose, environmental impacts from chlor-alkali electrolysis using ODCs are compared to the impacts
19	from best available existing chlor-alkali plants using STCs. The life cycle assessment includes manufacturing,
20	operation and disposal of the plants. To account for utilization of hydrogen from existing chlor-alkali plants, two
21	alternative utilization scenarios are studied: energy recovery by combustion of hydrogen and use of hydrogen as
22	chemical commodity. Seven environmental impact categories are studied in detail using the ReCiPe method.
23	Chlor-alkali electrolysis using ODCs yields lower environmental impacts in up to six environmental impact
24	categories. Plant operation contributes most in six out of seven impact categories. Chlor-alkali electrolysis using
25	ODCs has thus potential to contribute to cleaner production in the chlor-alkali industry.
26	Highlights
27	• Life cycle assessment (LCA) of chlor-alkali electrolysis using oxygen depolarized cathodes
28	• Global warming impact reduction by 8 % to 12 % compared to existing plants in Germany
29	Reductions in up to five more environmental impact categories
30	• World-wide potential for reduction of environmental impacts identified
31 32 33 34	Keywords: chlor-alkali electrolysis, oxygen depolarized cathodes, electricity demand reduction, life cycle assessment, environmental impacts

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