Electrochemical recovery of sodium and sulfur species from spent caustic streams

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Problem

H$_2$S rich gas

<table>
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<th>Scrubber</th>
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<tbody>
<tr>
<td>Clean gas</td>
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<tr>
<td>NaOH</td>
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Spent Caustic
2-10 wt % NaOH
0.5 - 4 wt % H$_2$S

- Wet air oxidation
- Advanced oxidation
- Biological
- Electrochemical

- Costly
- No recovery
- Chemical usage
- Low efficiency

- Recovery of sodium and sulfur
- No chemical usage
Anode: IrOx coated Ti

Cathode: Stainless Steel

S\textsubscript{x}O\textsubscript{y}: S\textsuperscript{\circ}, polyS, SO\textsubscript{4}\textsuperscript{2-}, S\textsubscript{2}O\textsubscript{3}\textsuperscript{2-}, SO\textsubscript{3}\textsuperscript{-}

Cation Exchange Membrane

NaOH

DI H\textsubscript{2}O

Artificial Spent caustic: 4 wt% NaOH
1 wt% Na\textsubscript{2}S-S

Continuous reactor
Long term operation

- Operation of 2.5 months at 100 A/m² and loading rate of 50 g S L⁻¹ d⁻¹

- Steady cell potential (between 2.6 and 3 V)
  - No increased costs + steady state

- Sulfide removal efficiency: 69 ± 3%
  - 10 % Polysulfide
  - 20 % Sulfate
  - 40 % Thiosulfate

- Coulombic sodium hydroxide efficiency : 100 ± 5%
- Unaffected membrane/electrodes
Thank you for listening

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