MEDIATED PROCESS FOR HCl ELECTROLYSIS

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Investigation of a mediated process for HCl electrolysis in which cathodic reaction is based on a redox metal couple, e.g. Fe^{3+}/Fe^{2+}, and 3D cathode structures with no cathode catalyst are used to minimize cell voltages at current densities of 10 kA/m^2 or more. Figure 1 depicts an example flow schematic of an overall process for the anodic generation of chlorine from hydrochloric acid solution in a cation-exchange membrane cell, and for the cathodic reduction of metal ions,

e.g. $Fe^{3+} + e^- \leftrightarrow Fe^{2+}$,

where the reduced metal ion is re-oxidized in an external reactor using oxygen. Effects of metal ion composition and concentration, specific cathode area, etc. were studied.

A 3D-cathode structure having an estimated ratio of active surface area to projected area of 200 m^2/m^2 enabled cell operation to current densities of 32 kA/m^2 with no hydrogen evolution. Power consumptions were 650 kWh/ton Cl_2 (metric ton) at 4 kA/m^2 and 860 kWh/ton Cl_2 at 10 kA/m^2. Six weeks (~1000 hours) of continuous operation at 12 kA/m^2 demonstrated cell component and cell operating stability.

This mediated electrolytic process (patent pending[1]) is an energy efficient alternative to the route employing oxygen depolarized cathodes. Using an external reactor for re-oxidation of the mediator compound avoids complications of cell design, particularly with respect to the gas diffusion cathode, which requires expensive noble metal catalyst.

[1] US 20040074780 A1

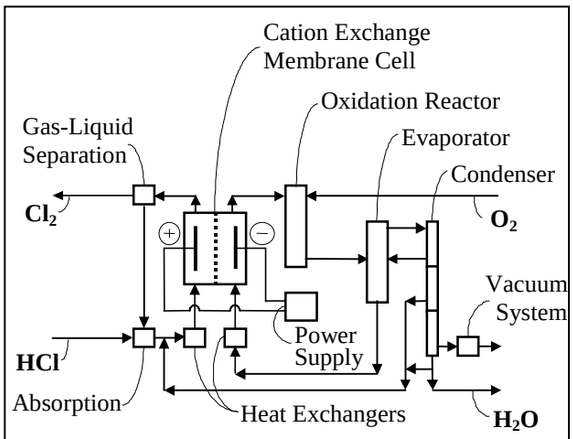

Figure 1 - Mediated HCl Electrolysis process flow schematic