



## Molten Salt Chemical Looping Process for Efficient Chlorine Production from HCl

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### BACKGROUND

Hydrogen chloride (HCl) is a waste product in several industrial processes at massive scale, such as in the preparation of isocyanates which are crucial to many industries. One way to repurpose HCl waste is to upcycle it into chlorine (Cl<sub>2</sub>), a valuable starting material used in industrial chemistry. Current methods of converting HCl to Cl<sub>2</sub> include the Deacon Process, an equilibrium reaction that consists of the aerobic oxidation of HCl to Cl<sub>2</sub> and water. A disadvantage to all single-stage Deacon Process concepts is the expensive workup (i.e. separation of Cl<sub>2</sub> from other products in the equilibrium mixture). More efficient continuous processes do exist. Both the two-stage process and the three-stage process involve molten salt-based chemical looping with three interconnected reactors containing reactive salts. However, these processes can be challenging, due to the requirement for circulation of the melt in all multiple reactors simultaneously.

### DESCRIPTION

Researchers at the University of California, Santa Barbara have realized continuous production of Cl<sub>2</sub> from HCl with a novel three-reactor molten salt chemical looping system. This three-stage process consists of (I) the oxidation of CuCl, (II) the chlorination of Cu<sub>2</sub>OCl<sub>2</sub>, and (III) thermal decomposition of CuCl<sub>2</sub>. The most essential component of this technology is the reactor system comprising three inter-connected bubble lift columns that are placed in a sand bath to provide uniform heating. The system's low KCl concentration allows for a high space-time yield, as well as relatively low temperature differences between the reactors. Additionally, this technology can be operated with notably low energy consumption. The Cl<sub>2</sub> produced can be used to manufacture other commercially valuable products and simultaneously curtail the emissions of waste HCl.

### ADVANTAGES

- ▶ Upcycles a common waste product
- ▶ More efficient Cl<sub>2</sub> workup compared to current HCl conversion technologies
- ▶ Low energy consumption

### APPLICATIONS

- ▶ Large-scale industrial chemistry

### PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO202174381A1	04/22/2021	2019-967

Additional Patent Pending

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### OTHER INFORMATION

#### KEYWORDS

Chlorine, Hydrogen, Molten salt, Deacon, chemical looping, upcycle, Cl<sub>2</sub>, HCl, industrial chemistry

#### CATEGORIZED AS

- ▶ **Materials & Chemicals**
- ▶ Chemicals
- ▶ Other

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