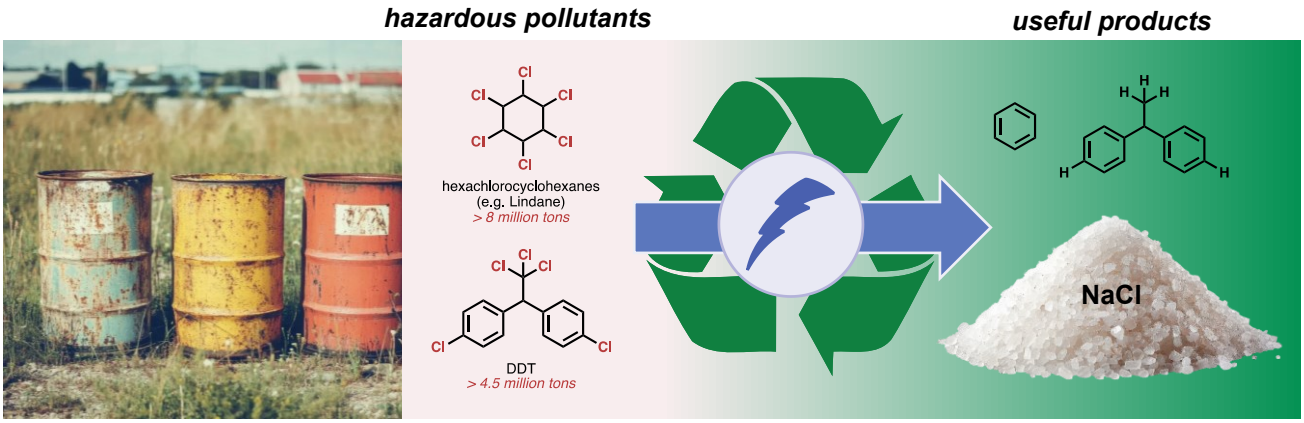
ETH zürich

Licensing Opportunity

Complete dechlorination and recycling of organochlorine pollutants such as lindane and DDT



Application

This electrochemical method completely dehalogenates organochlorine pollutants. The end products are harmless inorganic salts and recyclable commodity chemicals. This technology treats pure pollutant samples as well as both high or low-concentration mixtures consisting of contaminated soil, filtrate, or absorbers. Reactors are easily assembled on-site, circumventing the need to transport hazardous material.

Features & Benefits

- mild, environmentally friendly process
- low-cost and practical reactor components (graphite electrodes and undivided cells)
- designed for large-scale application

Publication

- Publication pending. For preliminary studies, see: *Science* **2021**, *371*, 507
- Patent pending

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Technology Readiness Level

1 2 3 4 **5** 6 7 8 9

Background

Persistent Organic Pollutants (POPs) are halogenated organic molecules produced on megaton scale during the 20th century as crop protection agents and flame retardants. POPs from abandoned disposal sites have leached into the environment and unveiled their toxicity upon entering the food chain. Due to their persistent nature (high stability, low chemical reactivity, low solubility in water), these compounds have been banned worldwide, but no clear solution for their disposal is in sight.

Invention

This invention electrochemically splits the carbon-halogen bond resulting in safe inorganic salts (e.g. NaCl) and useful hydrocarbons. The inexpensive and practical setup consists of an undivided vessel using: i) electricity, ii) graphite as electrode material, iii) organochlorine sample, and iv) solvent. DMSO acts as a solvent and a sacrificial reductant preventing undesirable oxidation in the undivided setup. The novel application of alternating current dissipates local pockets of acidity and basicity throughout the vessel, suppressing undesirable reaction pathways and electrode decomposition. The result is the complete conversion of organochlorine pollutants regardless of pollutant concentration, source of deposit, or scale of the reaction mixture.

A prototype was successfully built and tested on milligram to gram scale pollutants such as lindane (hexachloro-cyclohexane) and DDT (dichlorodiphenyltrichloroethane).