

SELECTED PROBLEMS OF PLASTIC WASTE PYROLYSIS: PURIFICATION OF PYROLYTIC OIL FROM CHLORINE (ORGANOCHLORINE COMPOUNDS)

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Background

Present methods of liquid mixture purification from organochlorine compounds are useless for the industry because are either dangerous, insufficient or produce inorganic waste. Investigated method is based on chemisorbing properties of certain metals (Pt, Ag) [1,2,3,4]. The hypothesis originated from the poisoning activity of chlorine for heterogeneous catalysts based upon these metals [5,6].

Initial experiments have shown slightly better efficiency of silver-based adsorbents (Fig.1.)

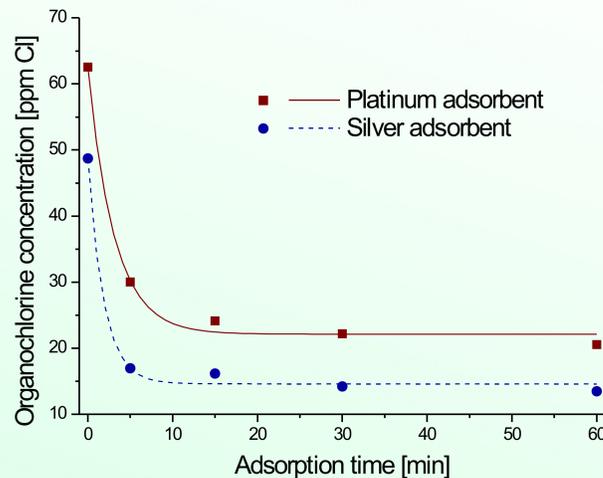


Fig.1. The comparison of activity of silver and platinum in adsorption of 1,2-dichlorobenzene at 150 °C.

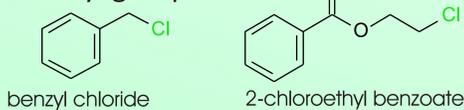
Materials and methods

Organochlorine particles selected for test procedure included aromats with chlorine bonded:

A) directly to aromatic ring



B) via alkyl group



The adsorption from aromatic mixtures were carried in batch reactor and pulse microreactor. Organochlorine concentration was determined using gas chromatography.

Initial results

Carried experiments (Table 1) confirmed [2,3,4], that the adsorption on silver of compounds with chlorine bonded directly to aromatic ring is significantly slower and requires use of greater portions of adsorbent.

The effect is related with chlorine polarisation.

In most organochlorine compounds, there is a partial negative charge located on the chlorine atom due to its significant electronegativity. While bonded With an aromatic ring however a resonance effect (Fig.2.) occurs, which causes chlorine to be positively charged.

As a result, creation of a surface $Ag_{metal}^- - Cl_{org}^+$ complex is more difficult.

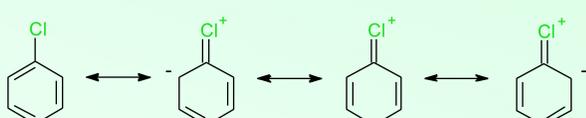


Fig. 2. The resonance effect in chlorobenzene



Best results

Adsorption on silver is more effective when used in purification from organochlorine compounds with chlorine bonded with alkyl group. Purification of alkylnaphthalene oil from 2-chloroethyl benzoate is possible at ambient temperature up to 150 ppm Cl and silver coverage of 20% in 15 days.

Raising the temperature to 220°C and use of a 2-step process allowed further purification up to ca. 15 ppm Cl (Fig. 3.).

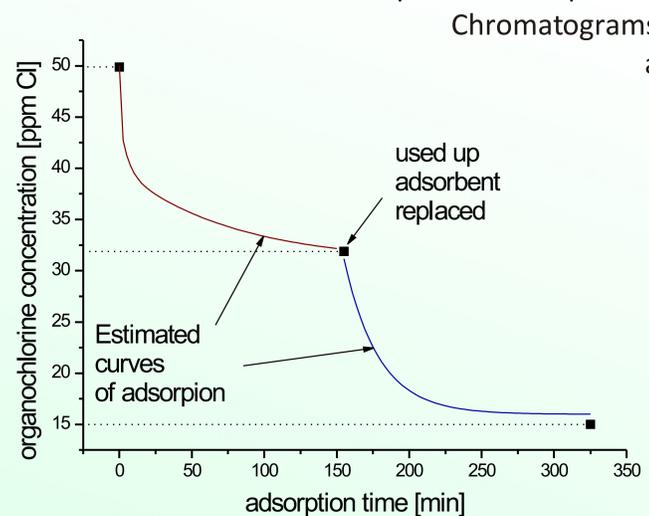


Fig. 3. Chlorine concentration during 2-step batch adsorption of 2-chloroethyl benzoate from oil in 220°C

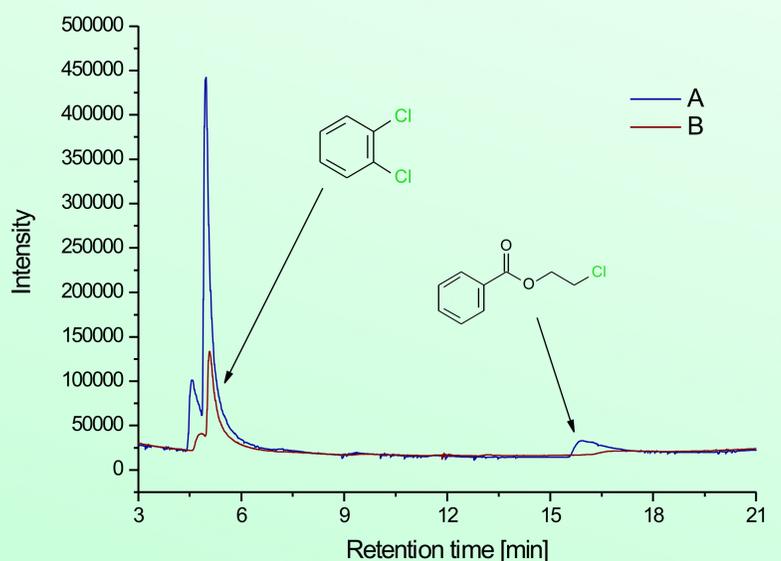


Fig. 4. Cumulated chromatograms of polluted T110 oil before (A) and after (B) two step adsorption at 220°C

Adsorbent regeneration

Experiments with hydrogen [3,4] have proven, that silver can be easily regenerated at temperature 300-400°C.

It is also possible, that regeneration of silver surface can be achieved by aldehyde treatment [7] under same conditions.

Literature

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