

Destruction of chlorinated organic compounds with NaBH_4 and $\text{NaBH}(\text{OR})_3$ -promoted TEG/KOH media

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Abstract

General Electric pioneered the use of polyethylene glycol (PEG)/KOH for the dehalogenation of chlorinated aromatics such as PCBs. However, inconveniently high temperatures were required and the method is not effective with chlorinated olefinic and aliphatic compounds (herbicides, pesticides, solvents). Workers at the EPA Cincinnati Labs discovered that tetraethylene glycol (TEG)/KOH systems showed improved dechlorinating ability. Moreover, they dechlorinated a broader structural variety of compounds. We have found that TEG/KOH systems, when promoted by the strong hydride reducing agent, NaBH_4 , dechlorinate a wider range of organic structures at lower temperatures. Indeed, the total destruction of Mirex (a very stable aliphatic chlorinated pesticide, see below) occurs at $< 65^\circ\text{C}$). NaBH_4 is stable in water or alcohols in the presence of KOH. If it is reacted first with alcohols in the absence of KOH one can make solutions of $\text{NaBH}_x(\text{OR})_y$ ($x=3,2,1$; $y=1,2,3$). Alkoxyborohydrides are much stronger hydride reducing agents than NaBH_4 . When TEG/KOH is added to $\text{NaBH}_x(\text{OR})_y$, extremely reactive dehalogenating media are formed. The reduction of chlorinated organic compounds in these media are being studied both with and without added catalysts.

