

## 7.2: COMMON USES OF ALKYL HALIDES

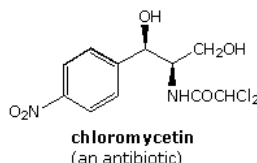
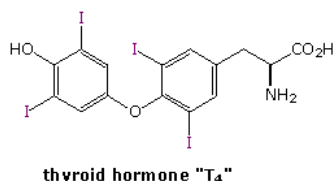
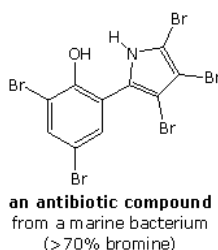
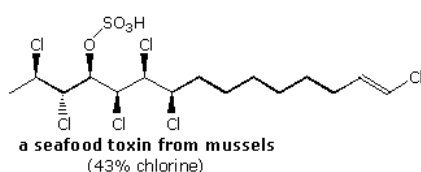
### Learning Objective

- Discuss the common uses of alkyl halides

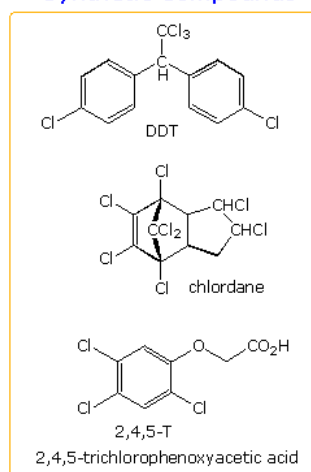
Halogen containing organic compounds are relatively rare in terrestrial plants and animals. The thyroid hormones  $T_3$  and  $T_4$  are exceptions; as is fluoroacetate, the toxic agent in the South African shrub *Dichapetalum cymosum*, known as "gifblaar". However, the halogen rich environment of the ocean has produced many interesting natural products incorporating large amounts of halogen. Some examples are shown below.

The ocean is the largest known source for atmospheric methyl bromide and methyl iodide. Furthermore, the ocean is also estimated to supply 10-20% of atmospheric methyl chloride, with other significant contributions coming from biomass burning, salt marshes and wood-rotting fungi. Many subsequent chemical and biological processes produce poly-halogenated methanes.

#### Naturally Occurring Compounds



#### Synthetic Compounds



Synthetic organic halogen compounds are readily available by direct halogenation of hydrocarbons and by addition reactions to alkenes and alkynes. Many of these have proven useful as intermediates in traditional synthetic processes. Some halogen compounds, shown in the box, have been used as pesticides, but their persistence in the environment, once applied, has led to restrictions, including banning, of their use in developed countries. Because DDT is a cheap and effective mosquito control agent, underdeveloped countries in Africa and Latin America have experienced a dramatic increase in malaria deaths following its removal, and arguments are made for returning it to limited use. 2,4,5-T and 2,4-D are common herbicides that are sold by most garden stores. Other organic halogen compounds that have been implicated in environmental damage include the polychloro- and polybromo-biphenyls (PCBs and PBBs), used as heat transfer fluids and fire retardants; and freons (e.g.  $CCl_2F_2$  and other chlorofluorocarbons) used as refrigeration gases and fire extinguishing agents.

Alkyl halides provide nice examples for learning about two very important organic reaction mechanism types: nucleophilic substitution and beta-elimination. In learning about these mechanisms in the context of alkyl halide reactivity, we will also learn some very fundamental ideas about three main players in many organic reactions: nucleophiles, electrophiles, and leaving groups. We'll start with an overview of the substitution and elimination reactions which alkyl halides undergo.

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