An Overview of Halo Chemicals

Halochemicals are compounds that contain halogens, one of the group of elements that includes fluorine, chlorine, bromine, iodine, astatine, and the as-yet undiscovered ununseptium (the existence of the latter element has been shown, but it has not yet been synthesized).

Chemical and Physical Properties of Halogens and Halochemicals

All of the elements in the halogen group are characterized by their extremely high state of reactivity. All halogen atoms have an outer shell that contains seven electrons, and therefore is one electron short of being a full shell. This means that halogen atoms can gain the electron by reacting with other elements, which in turn makes halogens extremely reactive.

This high reactivity means that it is extremely rare to find halogens in their pure elemental form outside the laboratory. In nature, halogens are typically found as halide salts, and all "pure" halogens commonly exist as diatomic molecules, meaning that two atoms of a given halogen are bonded together.

Fluorine, for example, is so highly reactive that it can form compounds with several of the heavier noble gases, which are well-known for being largely inert. The only elements that fluorine cannot react with are the highly inert light noble gases helium, neon, and argon. Fluorine can also attack other types of inert material, such as glass.

All halogens can form compounds with hydrogen, each forming a strong acid called a hydrogen halide. Halogens can also react with each other, forming compounds called interhalogens.

Halogens are also used to create halocarbons. These are substances with one or more carbon atoms that are linked with one or more halogen atoms. The chemical reaction between carbon and halogen atoms produces strong chemical bonds called covalent bonds, which are not easily broken once formed.

Past and Present Uses of Halochemicals

Halochemicals have an extremely wide range of uses, and fluorochemicals alone are used in a variety of different ways.

Halocarbons have been used as solvents, adhesives, sealants, pesticides, herbicides, fungicides, and refrigerants, and have been used to create plastics and plasticizers (meaning they are added to substances to increase certain desirable physical properties).

Some halochemicals that were once widely utilized are no longer in use, due to concerns over toxicity, or environmental issues. Examples include chlorofluorocarbons (CFCs) such as Freon, many types of fluorocarbons (which were once commonly used industrial solvents, but now have a much more limited range of uses), and solvents such as carbon tetrachloride and trichloroethane, which were once available for public use but are now tightly regulated.

Two particularly well-used halogens are chlorine and fluorine, both of which are added to drinking water in many countries-chlorine as an antibacterial and antifungal agent, and fluorine (in the form of fluoride) to strengthen tooth enamel and help prevent tooth decay.

Many substances-including pharmaceuticals, and agricultural substances such as pesticides and herbicides-also benefit in terms of factors such as stability and potency from the addition of one or more halogen atoms. The addition of a halogen is carried out in a process called halogenation (this process can actually be done in several different ways, each involving a series of specific chemical steps). In many cases, the halogen added is fluorine.

In fact, fluorine is a component of a surprisingly large percentage of modern pharmaceuticals. The addition of fluorine atoms increases the stability and potency of many drugs, and fluorine is currently added to a wide variety of pharmaceuticals, including anesthetics, antacids, antifungal and antibiotic medicines, antidepressants, steroids, cholesterol lowering agents, and anticancer chemotherapeutic drugs.

Source: http://www.articlecircle.com

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