**LABORATORY REPORT**

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**TITLE: HALOGEN CHEMISTRY**

**OBJECTIVES**

To determine the halogen present in an unknown sample.

**INTRODUCTION**

Halogens like fluorine, chlorine, bromine and iodine are reactive non-metals. All halogens are highly reactive and toxic, the magnitude of reactivity and toxicity generally decreases from fluorine to iodine. Halogens form a very large number of compounds. In the elements state, they form the atomic molecules, X2.

Halogens react with most metals and non-metals to form many ionic and covalent compounds, halides, halogen oxides and oxoacids. Halogens have the same reactivity as alkali metals due to their electronic configuration in which there is one electron less than that of a noble gas. A halogen atom must gain one electron to fill its outer shell. This filling is accomplished by: Gain of an electron form a metal atom thus forming a negative ion and the Sharing an electron pair with a non-metal thus forming a covalent bond.

Halogens display the largest range in electronegativity and act as an oxidizing agent in majority of their reactions. Halogens form many oxides that are very strong oxidizing agents and acids in water. The halogen acids and oxoanions are produced from reactions of the halogens and their oxides with water.

Halogens act as oxidizing agents in the majority of their reactions, and the higher ones can oxidize halide ions lower down the group. They also undergo some important aqueous redox chemistry. Fluorine (F2), a highly toxic, colorless gas, is the most reactive element known so reactive that asbestos, water, and silicon burst into flame in its presence. It is so reactive it even forms compounds with Kr, Xe, and Rn, elements that were once thought to be inert. Fluorine is such a powerful oxidizing agent that it can coax other elements into unusually high oxidation numbers, as in AgF2, PtF6, and IF7.

Fluorine is so reactive that it is difficult to find a container in which it can be stored. F2 attacks both glass and quartz, for example, and causes most metals to burst into flame. Fluorine is handled in equipment built out of certain alloys of copper and nickel. It still reacts with these alloys, but it forms a layer of a fluoride on the surface that protects the metal from further reaction.

Fluorine is used in the manufacture of Teflon or poly (tetrafluoroethylene), (C2F4)n which is used for everything from linings for pots and pans to gaskets that are inert to chemical reactions. Large amounts of fluorine are also consumed each year to make the freons (such as CCl2F2) used in refrigerators.

Chlorine (Cl2) is a highly toxic gas with a pale yellow-green color. Chlorine is a very strong oxidizing agent, which is used commercially as a bleaching agent and as a disinfectant. It is strong enough to oxidize the dyes that give wood pulp its yellow or brown color, for example, thereby bleaching out this color, and strong enough to destroy bacteria and thereby act as a germicide. Large quantities of chlorine are used each year to make solvents such as carbon tetrachloride (CCl4), chloroform (CHCl3), dichloroethylene (C2H2Cl2), and trichloroethylene (C2HCl3).

Bromine (Br2) is a reddish-orange liquid with an unpleasant, choking odor. The name of the element, in fact, comes from the Greek stem bromos, "stench." Bromine is used to prepare flame retardants, fire-extinguishing agents, sedatives, antiknock agents for gasoline, and insecticides

Iodine (from the Iodes, meaning "violet"), is a chemical element in the periodic table that has the symbol I and atomic number 53. This is an insoluble element that is required as a trace element for living organisms chemically , iodine is the least reactive of the halogens, and the most electro positive metallic halogen .Iodine is primarily used in medicine, photography and in dyes. Iodine is a bluish-black, lustrous solid that sublimes at standard temperatures into a blue-violet gas that has an irritating odor. This halogen also forms compounds with many elements, but is less active than the other member of its series and has some metallic-like properties. Iodine dissolves easily in chloroform, carbon tetrachloride, or carbon disulfide to form purple solutions (It is only slightly soluble in water). The deep blue color with starch solution is characteristic of the free element. Iodine can be prepared in an ultrapure form through the reaction of potassium iodide with copper (II) sulfate. There are also several other methods of isolating this element

In this experiment, an unknown sample containing a halogen will be determined for the presence of that particular halogen present in that sample. AgCl is soluble in dilute aqueous ammonia, AgBr only in concentrated aqueous, and AgI in neither of them.

**CHEMICALS AND APPARATUS**

* Unknown sample
* Concentrated HCl
* Cold concentrated H2­SO4
* KI dissolved in H2SO4
* AgNO3 solution
* Aqueous ammonia
* Sulphur dioxide
* Test tubes
* Bunsen burner
* Fumehood

**PROCEDURE**

The reactions of solid Y was examined carefully in the following processes with

1. Concentrated HCl
2. Cold concentrated sulphuric acid and then heated

Also, the reactions of aqueous solution of Y were examined with the following reagents.

1. Potassium iodide dissolved in dilute sulphuric acid.
2. Silver nitrate solution, then aqueous ammonia, then sulphur dioxide solution added dropwise until no further change appears to take place.

**DISCUSSION**

Formation of a colourless solution shows the displacement of a halide from the compound by a stronger oxidizing agent, being the concentrated HCl, in comparisons to literature data. The addition of cold concentrated sulphric acid to the sample causing partial dissolution of salt forming light yellow solution and effervescence first and complete dissolution upon heating eliminates the possibility of the halide being a fluoride, F-. For the addition of silver nitrate to the sample, a pale colloidal suspension was formed. From literature data, the formation of a pale suspension indicates the presence of a Bromide ion being the precipitate or the ionic particles in the solution. The precipitates form in the equation

Ag(aq)+ + Br(aq)‑ AgBr

The confirmatory test was the addition of aqueous ammonia, which was dilute, causing the precipitate to be almost unchanged but dissolves in concentrated ammonia solution to give a colourless solution according to literature data. Thus the halide being a Bromide, Br- the unknown potassium salt, solid Y, can therefore be stated to be Potassium Bromide, KBr, according to our confirmatory test in comparison to literature.

**PRECAUTIONS**

All the reactions were performed in the fume hood to prevent any inhalation of any poisonous gas.

The heating was done in such a way that the gas produced is sent away from the nose.

Any gas to be smelled for identification was done in such a way that it was only blown to the nose.

All glass wares were handled with care.

**CONCLUSION**

The unknown potassium salt is Potassium Bromide, KBr.

**REFERENCES**

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