

## CXLIV.—*Negative Adsorption of Alkali Haloids by Wood Charcoal.*

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ADSORPTION of salts from their aqueous solutions by means of charcoal is readily demonstrated, and it is also known that certain haloids are negatively adsorbed, that is, water, and not the solute, is removed by charcoal.

The haloids usually adsorbed negatively are those of the alkali metals. The amount of negative adsorption depends on temperature, the kind of charcoal used, and also on the state of division of that charcoal. Coarse charcoals scarcely show the phenomenon, whilst very fine powders do so to a remarkable degree. The charcoal used in the following experiments was birch charcoal in a very fine state of division. It had been prepared during the war for use in the newer types of gas masks and was therefore of a highly specialised nature.

*N/10*-Solutions of the haloids were used and 5 grams of charcoal added to each 250 c.c. The flasks containing the solutions were suspended in turn in a water-bath and frequently shaken, while the temperature was gradually raised. Precautions were taken against condensation of water in the flask. As the temperature of the mixture increased, and immediately after shaking, portions were filtered off through warmed funnels, and on cooling the concentration of the haloid in the filtrate was determined by the silver nitrate-chromate method, *N/10*- and *N/100*-solutions being used. For each salt, the same mixture, charcoal-haloid, furnished a series of readings; in other words, the same carbon was in contact with the same solution throughout the experiments. The temperature of the solution and the charcoal was not raised too rapidly, a series of readings from room temperature to 100° being taken during about half an hour. The charcoal was therefore in contact with the solution for about six minutes between each reading.

The concentrations given below are expressed as the number of c.c. of *N/10*-silver nitrate required by 10 c.c. of filtrate at room temperature.

### *Ammonium Bromide.*

Temperature .....	10°	26°	46°	64°	83°	100°
Concentration ....	10·67	10·24	10·26	10·43	10·7	11

### *Ammonium Chloride.*

Temperature .....	10°	28°	47°	72°	100°
Concentration ...	10·2	10·1	10·2	10·4	10·9

### *Lithium Chloride.*

Temperature .....	10°	42°	62°	80°	100°
Concentration ....	10·05	10·0	9·9	9·75	9·73

*Potassium Bromide.*

Temperature .....	10°	33°	42°	69°	100°
Concentration ...	10·3	10·1	10·35	10·60	11·2

*Potassium Chloride.*

Temperature .....	10°	29°	43°	60°	80°	100°
Concentration ...	10·1	10·04	10·1	10·2	10·25	10·3

*Potassium Iodide.*

Temperature .....	10°	23°	36°	46°	71°	82°	100°
Concentration ...	10·4	10·2	10·25	10·5	10·7	11·2	11

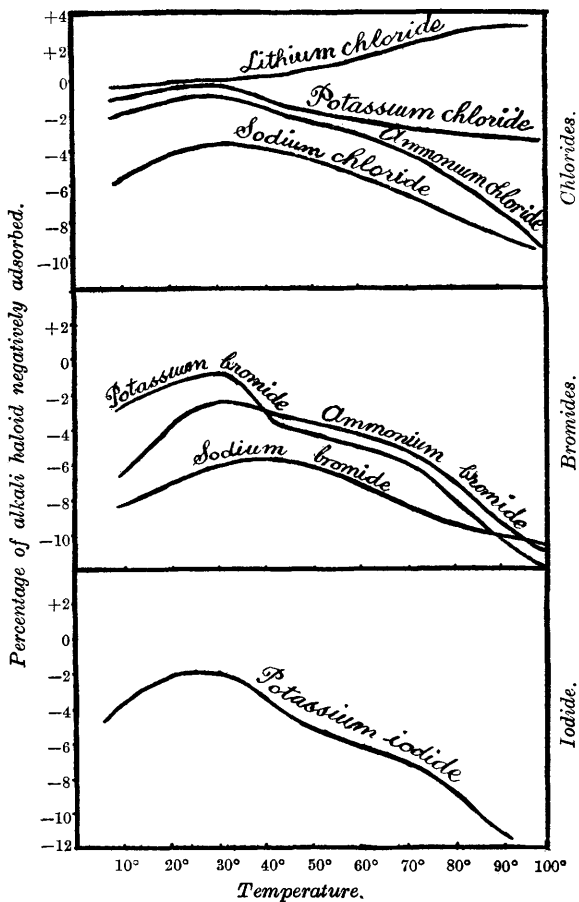
*Sodium Bromide.*

Temperature .....	12°	25°	40°	80°	100°
Concentration ...	10·82	10·7	10·58	10·88	10·97

*Sodium Chloride.*

Temperature .....	12°	25°	49°	66°	100°
Concentration ...	10·6	10·4	10·45	10·6	10·9

The results are expressed graphically in the accompanying diagram.



The decrease at the beginning is probably due to diminishing surface effect owing to the lowering of the surface tension between the liquid and the charcoal surface. As the temperature rises, however, the solvent opens up the complex interior of the charcoal by dissolving the oxidation products blocking the ends of the capillaries of the charcoal. More surface then becomes available and solute adsorption again occurs. This penetration effect with wood charcoals is often very great, as can readily be seen if experiments are made with the charcoals prepared for use in gas masks.

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