

vious to the addition of a mustard-spoonful of zinc. If with the zinc in use it is found that this amount of acid dissolves it too quickly, or not quickly enough, the proper amount of acid to be used is found by varying the quantity added by one or two-tenths cc. If, for instance, twenty-five cc. are found to dissolve the zinc too quickly, so that the color of the reduced solution is only wine colored instead of green, as it should be, then 24.9 cc. will usually be found the right quantity for use on every occasion. It should perhaps be pointed out to those who have never used the Emmerton process that in titrating the reduced solution, the end point of the titration does not for some reason manifest itself with such suddenness as in the reductor process, and care must therefore be taken to note that the pink coloration is a distinct and permanent one.

[CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF CINCINNATI.]

LI. THE USE OF ALUMINUM FOR CONDENSERS.

By T. H. NORTON.

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IN connection with the extended use of aluminum in this laboratory for various forms of apparatus, water-baths, air-baths, Bunsen burners, hot water filtering funnels, etc., it seemed desirable to study the availability of the metal for condensation processes.

For this purpose a condenser was constructed as follows: The outer jacket was of glass; the inner tube was of aluminum and possessed the following dimensions: length, 122 cm., external diameter, one cm., inner diameter, eight and one-half mm., weight per meter, twenty-nine grams. At a distance of fifteen cm. from the end, the tube was bent at right angles. This permitted of connection with a distilling flask, without allowing the condensing vapors to come in contact with any substance but aluminum. It might be mentioned here that in order to bend an aluminum tube of these dimensions satisfactorily, it is necessary to fill it with molten lead, and further, that several distillations with water are requisite in order to remove completely slight traces of lead adherent to the surface of the aluminum, after this operation.

The method of testing the condenser was to distil a measured

¹ Read before the American Chemical Society at the Springfield Meeting.

quantity of a liquid from the glass flask, used as a still, collect the distillate in glass, evaporate it from weighed platinum dishes and note the weight of the ignited residue, thus ascertaining whether there was any appreciable attack on the aluminum. Nothing was attempted beyond the ordinary precautions for preventing dust from contaminating the distillates.

The liquids first employed were organic. In each case 500 cc. were distilled, and the weights of the residue left on evaporating the distillate noted. The following results were obtained:

Liquid.	Residue from 500 cc.
Ethyl alcohol (specific gravity 0.809).....	0.001 gram.
Benzene	0.0016 "
Nitrobenzene.....	0.0004 "
Chloroform	0.0002 "
Ethyl ether	0.0000 "
Acetone	0.0001 "

In all these cases it was evident that very rapid distillation could be carried on with an exceedingly short tube, on account of the high conductive power of the aluminum. The residues obtained showed that there was practically no attack upon the aluminum.

The deportment of the metal towards steam was next studied, and here it was deemed wise to establish in all cases comparative experiments with glass and block tin. The glass condenser tube used for this purpose was eighty-four cm. long and had an inner diameter of sixteen mm. ; the tin condenser tube was 305 cm. long and had an inner diameter of twenty-one mm. With the exception of differences in the superficial surface for condensation, other conditions were essentially identical. Three series of distillations were carried on with the three following samples of water :

- A. Hydrant water (Ohio River water), containing much impurity.
- B. " " " " " " " " less "
- C. Distilled water.

In all cases 500 cc. were employed. The following residues were obtained :

	Aluminum.	Block tin.	Glass.
A.....	0.0112	0.006	0.0118 gram.
B.....	0.0032	0.0028	0.0091 "
C.....	0.0035	0.005	0.008 "

A check determination on the amount of dust collecting in the platinum dish during the time for evaporation, showed it to be 0.0002 gram after ignition.

These results would show that as far as purity of the product is concerned, aluminum possesses about the same advantages over glass as tin, in connection with the distillation of water. In lightness and conductivity it exhibits marked superiority to the tin.

For use with neutral organic liquids it is well adapted, more especially in the distillation of low boiling substances such as ether. Here also the high thermal conductivity, as well as the absence of brittleness, are factors in its favor as compared with glass.

Mr. R. W. Hochstetter rendered valuable assistance in the determination of the above data.

[CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF CINCINNATI.]

LII. ON THE VOLATILITY OF CERTAIN INORGANIC SALTS.

BY T. H. NORTON AND D. M. ROTH.

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IN connection with some experiments on the volatility of sodium borate and sodium fluoride, carried on in this laboratory, it was thought advisable to make use of the method employed for certain salts by Bunsen nearly thirty years ago, but, as far as we can find from the literature, not used since then. This method consists in noting the time required for the volatilization of 0.01 gram of the substance under examination, in the form of a bead in a loop at the end of a platinum wire, after introduction into the hottest part of the Bunsen flame.¹ The disappearance of color when the substance is completely volatilized is marked and sudden. Naturally, great care must be observed in assuring, for purposes of comparison, identical conditions of location in the flame, temperature of the flame, etc. The method is of course applicable to such compounds only as impart color to the flame. Following Bunsen's example, the time required for the volatilization of 0.01 gram of sodium chloride was taken as unity. In this connection the volatility of most of the

¹ *Ann. Chem.* (Liebig), 138, 263.