limited to the determination of small amounts of fluoride. A detailed study has not been made of the application of this technique to larger amounts using a much higher concentration of ferric ion in the reagent. The preliminary titrations indicate that such an application could be made, but the range we have chosen to study should be satisfactory for most of the fluoride determinations necessary.

3. *Accuracy.*—Although, as pointed out above, the accuracy is very good for the small amounts of fluoride determined, it should also be mentioned that the method would not be satisfactory for the accurate determination of fluoride in a substance whose fluoride content is greater than 10%, because in that case a 1% error would be appreciable, whereas for very small amounts of fluoride a 1% error is not important.

4. *Liquid junction.*—It is important to keep the total impurity molarity of the unknown fluoride solution below 0.01 *M*, else an appreciable liquid junction potential will cause fictitious results. In practice this is very easily done, by distilling the sample from impurities if in no other way. The distillate is much lower than 0.01 *M* in foreign ions.

It should be pointed out that the size of sample of an unknown should be adjusted so that the amount of fluoride in the final concentration cell is between 0.1 and 30 mg. per liter, preferably greater than 10 mg. per liter, since the percentage error is smaller for larger amounts of fluoride.

The procedure we have described corresponds to the "Standard Solution" method for chloride used by Furman and Low.[3] An attempt was made to apply the "small excess" method[3] to the determination of fluoride, but with no success. The e. m. f. of the cell, with fluoride in both sides, seemed to be dependent upon the difference in fluoride concentration between the two sides rather than the ratio of the two concentrations. Because this "small excess" method offered no promising results, we abandoned a further study of it in favor of the procedure we have given.

The material presented in this paper gives indication that the technique described should be applicable to the determination of a number of other substances, such as aluminum, phosphate, sulfate, citrate or tartrate, by slight modifications of the procedure. It is hoped that further study will confirm this prediction.

Summary

A technique has been described for the determination of fluoride rapidly and accurately by means of a simple concentration cell. Interference of other ions can be eliminated entirely, since the procedure is applicable to the determination of fluoride in the distillate obtained in separating fluoride from all impurities. The range over which the method has been applied is 0.2 to 60 mg. per liter in a 5-cc. sample which is taken for analysis. Results are given showing the method's applicability to water analysis and to the determination of fluoride in phosphate rock.

AMHERST, MASS. RECEIVED JUNE 13, 1939

NOTES

Dibenzyl Sebacate

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The new compound dibenzyl sebacate was synthesized recently in this Laboratory for use in another investigation.[1] Sebacic acid was esterified with benzyl alcohol, the crude ester then distilled at 0.5 mm. pressure, and the middle fraction recrystallized several times from its melt. The following are properties of the pure dibenzyl sebacate.

Temp., °C.	Refractive index n_D (Abbe)	Density d_4^t
30.0	1.5171	1.055(6)
35.0	1.5152	1.051(9)
40.0	1.5133	1.048(1)

Colorless plates, practically odorless; melting point (from cooling curve), 28.3°; boiling point (in Claisen flask), 257° (uncorr.) at 4 mm.

(1) Verhoek and Marshall, unpublished results.

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RECEIVED FEBRUARY 21, 1939