from these data that gluconate is oxidized by the translucent spores. There are two known ways by which glucose is oxidized to gluconic acid. One is the Warburg-Dickens-Lipmann-Horecker pathway (*5*) and the other is the Stokes-Campbell route (*5*). The former requires the presence of phosphoric acid, but the latter does not. We found that glucose and gluconate oxidation proceeded in veronal buffer, which is phosphate-free, as efficiently as in phophate buffer. This would eliminate the Warburg-Dickens-Lipmann-Horecker pathway.

It is interesting to note that vegetative forms of this species have the cytochrome system and other oxidative enzymes (*6*), whereas the germinating spores can oxidize glucose or gluconate only in a phosphate-free buffer.

From this fact it may be assumed that the glucose oxidative enzyme system of *B. subtilis* (PCI 219) may develop in a stepwise manner as germination proceeds and as the cells change into the vegetative form.

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Rapid Ion-Exchange Method for Determining Total Fluoride in Impure KF · HF

As a result of the continuing need for large numbers of control analyses on electrolyte for fluorine generation cells at this plant, it became necessary to develop a rapid method of analyzing potassium acid fluoride (KF · HF) for total fluoride content (*1*). Accuracy comparable to that of the photofluorimetric method (2), which has been in use, was required. Consequently, an ion-exchange technique was investigated, and a procedure was developed, modifying the general methods described by Honda (*3*) and Roper et al. (*4*), in which the cations are removed from the solution, and the fluoride-containing eluant is titrated with NaOH.

A sulfonated hydrocarbon cation exchange resin (Rohm and Haas Amberlite IR-120) supported on 100-mesh nickel screen is used in the simple apparatus shown in Fig. 1. The resin is first activated by washing with 1 lit of 2-percent H_2SO_4 at 30ml/min., the acid that remains in the tube being washed out with distilled water. The weighed electrolyte sample (impure KF · HF) is dissolved in distilled water, and an aliquot of about 10 ml is passed through the ion-exchange column into a 400-ml polyethylene beaker. The column is then washed with distilled water until there is about 275 ml of eluate. This solution is then titrated to a phenolphthalein endpoint with NaOH solution prepared from CO_2-free NaOH and standardized at approximately 0.1*N* with NaF.

Samples of known amounts of reagent-grade NaF which were dried at 110°C for 24 hours were used to check the method prior to applying it to samples of KF · HF electrolyte. Good results, which are shown in Table 1, were obtained by using the procedure outlined here. As a further check, this ion-exchange procedure was directly compared against the photofluorimetric technique previously used by analyzing parts of the same electrolyte sample (impure KF · HF) by both methods. The portion for photofluorimetric analysis was steam-distilled and titrated with thorium nitrate in a modified Klett fluorimeter, using morin as the indicator; the portion for ion-exchange analysis was handled as described in preceding paragraphs. Results, in terms of percentage of fluoride found, are shown in Table 2.

The values obtained, together with data subsequently obtained in routine use of this procedure, show that it yields results of accuracy comparable to that obtained by the photofluorimetric method in about one-fourth of the previously required time. In general, the titration is correct to 1 or 2 drops with phenolphthalein as the indicator. Simple checks showed that accuracy was not affected by varying the rate of flow of sample and wash water in the column between 5 and 30 ml per minute or by varying the depth of resin in the column from 6 in. to 12 in. It was found, however, that the higher rates of flow with a 6-in. resin bed gave slightly erratic results. A single 12-in. bed has been used intermittently for 3 weeks (approximately 50 determinations) without regeneration. Since regeneration is easily accomplished with 2-percent H_2SO_4, the resin may be used indefinitely.

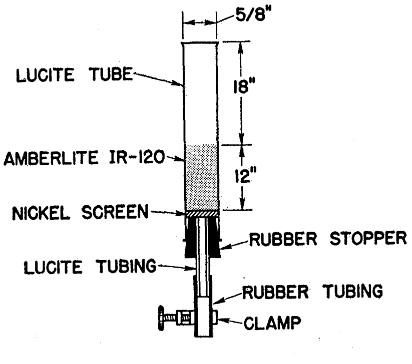

Fig. 1. Ion-exchange column.

Table 1. Results of analyses of samples of known fluoride content.

Sample	Fluoride present (mg)	Fluoride found (mg)
1	63.34	63.67
2	55.87	55.87
3	57.23	57.43
4	58.54	58.53
5	55.69	55.61
6	50.80	50.80
7	47.55	47.54
8	47.14	47.08
Avg.	54.52	54.57

Table 2. Comparison of percentage of fluoride found by ion-exchange and photofluorimetric methods in impure KF · HF samples.

Sample	Photo-fluorimetric method	Ion-exchange method
1	58.81	58.73
2	58.85	58.72
3	58.80	58.77
4	58.86	58.80
Avg.	58.83	58.76

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1. This work was performed under contract AT-(33-2)-1 with the U.S. Atomic Energy Commission.

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Ratio of Ionium to Uranium in Coral Limestone

Samples of coral limestone cuttings taken over the first 200 feet in drilling on Elugelab Island during the summer of 1952 (*1*) have been analyzed for uranium by the sodium fluoride fluorometric method and for ionium by a radiochemical procedure which involves carrier-free separation of the total thorium in the