souri, USA]; Personal communication); in addition, of 10 toxic metal ions, only the elution of zinc was detectable when the plastic was autoclaved with water at 121 °C for 1 h, even this being at a very low concentration.

Filling of the organ-baths may be accomplished by passing the 'physiological' solution through a warming coil, using gravity feed; this arrangement is, perhaps, not as convenient as that of the glass organ-bath used in conjunction with a warming column. Similarly, the baths may be emptied by the use of a suction-line.

This paper is not intended to exhaust all the possible examples of form or usage of the apparatus, but rather to outline the principles behind the construction and use of a simple system of multiple organ-baths. Readers are urged to exploit the versatility of the apparatus, adapting it to their own requirements.

1 Acknowledgment. G.E.R. was in receipt of the Ruggles Gates Research Award.

2 M.T. Rosseel and M.G. Bogaert: J. Pharm. Pharmac. *28*, 942 (1976).

Use of arrow-root powder in starch gel electrophoresis

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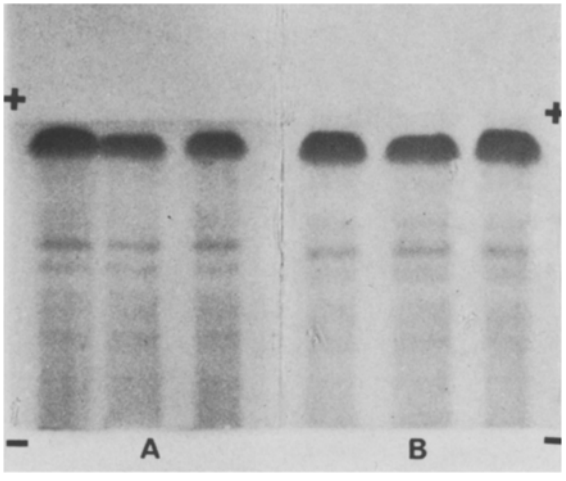
Summary. The arrow-root powder is used in electrophoresis as an alternative to potato starch. Its use is quite economical and this starch can be easily hydrolysed in any laboratory.

Since the discovery of Smithies[2] method for the hydrolysis of starch, potato starch is used frequently in various laboratories for electrophoretic separation of different substances. The introduction of any new gel medium for electrophoresis, must have some justification in view of the general use and satisfactory resolutions of the materials to be separated by this method. The present study presents considerable reasons for the use of arrowroot powder in place of potato starch.

In the present study, as the arrow-root powder is used for the first time, the properties of the gel made of this starch are tested by comparing it several times with the hydrolyzed potato starch supplied by BDH (England) by running human and frog serum[3] samples simultaneously in the 2 gels using same strength of buffers and current.

Materials and method. The commercially available arrow-root powder (Weikfields Ltd) was obtained from the local market and hydrolyzed in the laboratory by a modification of Smithies[2] method as follows.



Electrophoretic pattern of human serum in 2 starch media. *A* Arrow-root starch, *B* potato starch, after starch gel electrophoresis, in Tris (0.076 M) citric acid (0.005 M) buffer pH 8.7 for gel and boric acid (0.3 M) pH 8.6 for electrode vessel using the method of Gordon[4].

The arrow-root powder (200 g) was treated with 400 ml acetone - HCl (100:2) mixture and kept in an incubator at 37 °C for 2 h. The reaction was stopped by taking out the above mixture and adding 100 ml M sodium acetate. The starch was then filtered thoroughly with glass distilled water and finally dehydrated, in a cylinder, with acetone. 3 washings with acetone were found sufficient for complete dehydration. Lastly it was dried in an oven at 55 °C; this took about 48 h. The chemicals used were of analytical grade obtained from BDH.

Results. This starch was found suitable for the preparations of gels of the concentrations ranging from 10 to 20 g/100 ml of any desirable length. A concentration of 11% was found most suitable. It could be easily handled, sliced and stained with suitable dye. As shown in the figure to compare the properties of 2 gels, the human sera was separated into different fractions by running 3 samples in each gel kept parallel to each other using the same quantity of serum and keeping exactly similar strength of buffers and gels in the same tank. The results obtained were fairly comparable to each other. No difference could be observed in the pattern of electrophoretic separation. The experiments were repeated several times with different concentrations of gel; the results obtained were always identical.

Discussion. The new starch used for the separation of various protein fractions gives reasonably accurate results. These results are in good agreement with those obtained by Smithies hydrolyzed potato starch. In some cases the resolutions are better in arrow-root starch than in potato starch. Furthermore this arrow-root starch can be easily handled, and in some respects it is superior in certain properties to potato starch. This can be easily hydrolyzed in any laboratory.

The arrow-root starch can easily be adapted as an alternative to potato starch, and its use would cut down the cost several times.

1 The author is indebted to Dr M.M. Goil, Prof. & Head of the Department and Dr R.K. Sharma, Professor of Zoology, for their invaluable suggestions and help in various ways.

2 O. Smithies, Biochem. J. *61*, 629 (1955).
3 K. Singh, Zool. Anz. *197*, 39 (1976).
4 A.H. Gordon, Electrophoresis of proteins in polyacrylamide and starch gels. North-Holland Publ. Co., Amsterdam 1969.