

Technical Papers

Oxidation of Disaccharide Alcohols by *Acetobacter suboxydans*¹

Dexter French, Robert J. Suhadolnik, and L. A. Underkofler

Department of Chemistry, Iowa State College, Ames

In connection with work on the constitution of planteose (1), we have been interested in various possibilities for the synthesis of oligosaccharides in which the reducing group is that of a ketose. Although the biological oxidation (2) of sugar alcohols by *Acetobacter* species has been used to prepare monosaccharide ketoses, we have been unable to find any record that this selective oxidation has ever been used to convert disaccharide sugar alcohols into the corresponding disaccharide ketoses.

We wish to report now some preliminary experiments on the behavior of disaccharide alcohols in *A. suboxydans* cultures. Typical 10-ml cultures contained 50 mg of yeast extract and 25 mg of sorbitol or mannitol (to ensure good growth of the organism) with or without 100 mg of the disaccharide alcohol. Samples were taken at intervals and analyzed for total reducing sugar and for the presence of reducing sugars (alkaline copper, heated, followed by phosphomolybdic acid) and ketoses (phloroglucinol-hydrochloric acid) on paper chromatograms.

Melibiose (3), obtained by sodium borohydride reduction (4) of melibiose, was completely unaffected by the organism. Even after 46 days there was no evidence for the formation of any reducing sugar other than sorbose (from the added sorbitol). Since glycosides in general are not oxidized, the only position in melibiose which would be configurationally suitable for oxidation would be position 5 of the sorbitol moiety. However, substitution of the galactosyl group on position 6 blocked oxidation.

Maltitol (3), similarly obtained from maltose and purified through the crystalline acetate, behaves in the same fashion. Here, substitution on position 4 of the sorbitol unit blocked oxidation at the otherwise available position 5.

Epimelibiitol (1-galactosyl mannitol) (1) was obtained in crude form by the acid-catalyzed condensation of galactose and mannitol. The preparation contained much mannitol, some mannitol anhydrides, and a mixture of the α and β galactosyl mannitols. On subjecting this mixture to the action of *A. suboxydans*, coincident with the formation of fructose there appeared a reducing disaccharide which had the same R_f value as planteobiose (1) and gave the characteristic color test for a ketose when sprayed with the phloroglucinol reagent. In this case, substitution of a glycosyl group at one end of the mannitol chain still

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leaves the other end unsubstituted and of the correct configuration for oxidation.

It is proposed, then, that this oxidation can be used for the preparation of keto disaccharides or higher oligosaccharides, provided that the corresponding sugar alcohols are available. We are now attempting to prepare workable quantities of planteobiose from purified epimelibiitol, and maltulose from turanose (through epimaltitol [5]).

References

1. FRENCH, D., *et al.* Paper presented at 122nd meeting Am. Chem. Soc., Atlantic City (Sept. 1952).
2. FULMER, E. I., and UNDERKOFER, L. A. *Iowa State Coll. J. Sci.*, **21**, 251 (1947).
3. WOLFROM, M. L., and GARDNER, T. S. *J. Am. Chem. Soc.*, **62**, 2553 (1940).
4. ABDEL-AKHER, M., HAMILTON, J. K., and SMITH, F. *Ibid.*, **73**, 4691 (1951).
5. HUDSON, C. S. *J. Org. Chem.*, **9**, 470 (1944).

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Rh and ABO Blood Group Distributions in Japanese and Ethiopians

George J. Stein, Kathlyn C. Hilton, Harry P. Gelsing, and Richard P. Mason

Department of Serology and Blood Bank Section,
406th Medical General Laboratory, APO 500,
c/o P.M., San Francisco, California

Soon after the outbreak of hostilities in Korea a large-scale blood bank was activated in Tokyo. It supplied whole blood to medical units supporting United Nations forces in Korea and Japan. Most of its donor procurement and all its blood-processing operations centered in Tokyo.

Among the diverse racial and national groups volunteering as donors were numerous Japanese of the metropolitan area. Since these donors represented a realistic cross section of the indigenous population, it seemed appropriate to report some observations pertinent to them.

This paper records the Rh and ABO blood group distributions in 4541 native Japanese. It compares present findings with those described previously in Japan and in countries where persons of Japanese ancestry constitute a population minority. Data concerning frequencies in Ethiopian troops are also presented.

To ensure the accuracy of Rh¹ determinations, each blood was typed both by slide and by tube-centrifugation techniques. Fifty per cent concentrations of cells in their own serum were deposited on slides, mixed

¹ Refers to the Rh antigen most significant clinically, Rh₀ (D). Its presence in erythrocytes of any phenotype combination is demonstrated by agglutination with anti-Rh₀ serum. Lack of agglutination denotes its absence. Accordingly, persons with reactive cells are regarded as clinically Rh-positive; those with nonreactive cells are considered clinically Rh-negative.