NOTES.

Some Derivatives of β-o-*Methoxyphenylpropaldehyde.* By A. Zaki and H. Fahim.

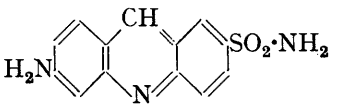
β-*o*-Methoxyphenylpropionyl chloride was obtained from β-*o*-methoxyphenylpropionic acid and thionyl chloride as a slightly yellow, fuming liquid with a penetrating odour, b. p. 165°/40 mm. It was identified by conversion into the amide, m. p. 110—111° (Buck, *J. Amer. Chem. Soc.*, 1932, **54**, 3663; Slotta and Heller, *Ber.*, 1930, **63**, 3037).

β-o-*Methoxyphenylpropaldehyde.*—A well-stirred boiling solution of the preceding chloride in dry xylene was hydrogenated in presence of palladium. The sodium bisulphite compound of β-*o*-methoxyphenylpropaldehyde, m. p. 163—164°, separated in white feathery crystals when a portion of the xylene solution was immediately shaken with sodium bisulphite solution and left over-night. β-o-*Methoxyphenylpropaldehyde-p-nitrophenylhydrazone*, obtained by treating another portion of the xylene solution with *p*-nitrophenylhydrazine, separated from dilute alcohol in yellow crystals, m. p. 126—127° (Found : C, 64·5; H, 5·7; N, 14·0. $C_{16}H_{17}O_3N_3$ requires C, 64·2; H, 5·7; N, 14·3%). β-*o*-Methoxyphenylpropaldehyde, liberated on treatment of the sodium bisulphite derivative with alkali, had b. p. 260° (micro).

Attempts to prepare benzpyrans from these compounds by digestion with hydriodic acid were unsuccessful. —The Egyptian University, Cairo. [*Received, November 1st*, 1941.]

2-Aminoacridine-7-sulphonamide. By ERIC AARONS and ADRIEN ALBERT.

IT is well known that benzenesulphonamide acquires chemotherapeutic value only when an amino-group is inserted in the *p*-position. The acridine nucleus displays its full antiseptic effect only when an amino-group is inserted in the 2- or the 5-position (Albert, Rubbo, and Goldacre, *Nature*, 1941, **147**, 332, 709). In response to a request from Dr. Malcolm Manifold of the Department of Biochemistry, Oxford University, we have combined these structural features in one molecule by effecting the synthesis of *2-aminoacridine-7-sulphonamide* (I).



(I.)

Preparation of 2-Nitroacridone-7-sulphonamide.—2-Nitroacridone-7-sulphonyl chloride (Matsumura, *J. Amer. Chem. Soc.*, 1938, **60**, 593) (45 g.) was finely powdered and suspended in acetone (1 l.), and dry ammonia passed in at the rate of 3 bubbles a second for an hour, with stirring and cooling. The precipitated sulphonamide was ground under acetone (250 ml.), collected, and dried at 120°. Yield, 31 g. of a yellow solid that was purified by dissolution in warm water (500 ml.) containing sodium hydroxide (10 g.), filtration, and precipitation with a slight excess of ammonium chloride.

Reduction to 2-Aminoacridine-7-sulphonamide (I).—A suspension of finely powdered 2-nitroacridone-7-sulphonamide (12 g.) in alcohol (600 ml.) was refluxed while sodium amalgam (430 g. of 2½%) was added during 2 hours. Refluxing was continued for 2 hours longer, a rapid stream of carbon dioxide as well as vigorous stirring being maintained throughout. After distillation of the alcohol from a water-bath, the residue was separated from the mercury and washed with warm water (2 portions of 500 ml.). The white solid that remained (2-aminodihydroacridine-7-sulphonamide) was boiled for 10 minutes with water (600 ml.), concentrated hydrochloric acid (10 ml.), and ferric chloride (20 g.). After cooling in ice, the hydrochloride of *2-aminoacridine-7-sulphonamide* crystallised in red needles; it was recrystallised from 50 parts of water, the corresponding aminoacridinesulphonic acid, formed during the reduction, remaining undissolved. The yield was 40%. The free base formed yellow-orange crystals from 3,500 parts of boiling water and was more soluble in acetone and alcohol. M. p. 253° (sealed tube, decomp.) (Found: C, 53·5; H, 4·5; N, 14·5; loss on drying at 120°, 6·0. $C_{13}H_{11}O_2N_3S,H_2O$ requires C, 53·6; H, 4·5; N, 14·4; H_2O, 6·2%). The substance dissolves in sodium hydroxide solution with a yellow colour and is precipitated by ammonium chloride. Its strength as an acid is similar to and its strength as a base is stronger than that of sulphanilamide.

To lessen hydrolysis during reduction, recourse was had to the aluminium amalgam method of Albert and Ritchie (*J. Soc. Chem. Ind.*, 1941, **60**, 102). Although successful from this point of view, the method presented the difficulty of eluting the product from the alumina on which it was tenaciously adsorbed.

2-Aminoacridine-7-sulphonic Acid.—The above aluminium amalgam method satisfactorily reduced 2-nitroacridone-7-sulphonic acid to 2-aminoacridine-7-sulphonic acid. No adsorption difficulties were encountered. Sodium 2-nitroacridone-7-sulphonate (30 g.) (Matsumura, *loc. cit.*) was dissolved in boiling water (1500 ml.) and aluminium foil (15 g.), amalgamated as required by dipping into alcoholic mercuric chloride solution (5%) and washing with alcohol, was added during ¾ hour; thereafter boiling was continued for ¼ hour. The alumina was separated and washed with four portions of boiling water (each of 250 ml. containing 50 ml. of concentrated aqueous ammonia). The united filtrates were made acid to Congo-paper with hydrochloric acid and treated, while boiling, with ferric chloride (about 3 g.) until a permanent blue spot test was given with potassium ferrocyanide. The suspension was made alkaline, and the liquid filtered from ferric hydroxide, concentrated to 50 ml., and made acid with hydrochloric acid. Yield, 75% of orange crystals with the properties described by Matsumura. The product did not combine with acids in aqueous solution.

An alternative synthesis of 2-aminoacridine-7-sulphonamide was attempted by acetylating the sodium salt of the above acid and converting it through the sulphonyl chloride into 2-acetamidoacridine-7-sulphonamide. However, on treatment of the latter with sodium hydroxide, sodium 2-acetamidoacridine-7-sulphonate was re-formed, and hydrolysis with boiling hydrochloric acid was slow and led to extensive resinification.—UNIVERSITY OF SYDNEY. [*Received, December 8th*, 1941.]

Periodic Acid as a Test for the Constitution of Polysaccharides. By VINCENT C. BARRY, THOMAS DILLON, and WINIFRED MCGETTRICK.

IN recent years it has been discovered that certain polysaccharides, on methylation and subsequent hydrolysis, yield 2 : 4 : 6-trimethyl hexoses, from which it is inferred that in these compounds, unlike starch and cellulose, the third carbon atom of each hexose unit is engaged in linking that unit with the first carbon atom of a neighbouring unit. In this group of compounds are included a polyglucose contained in the cell membrane of yeast (Zechmeister and Toth, *Biochem. Z.*, 1934, **270**, 309), a polygalactose contained in agar-agar (Percival and Somerville, J., 1937, 1615), and laminarin contained in laminariæ (Barry, *Sci. Proc. Roy. Dublin Soc.*, 1939, **22**, 56).

A simple confirmatory test for the constitution of these polysaccharides is afforded by periodic acid, a reagent introduced into polysaccharide chemistry by Jackson and Hudson (*J. Amer. Chem. Soc.*, 1937, **59**, 2049). Periodic acid reacts with the group $=C(OH)—C(OH)=$, splitting the carbon bond and oxidising each

C·OH to CHO (Clutterbuck and Reuter, J., 1935, 1467). In any polysaccharide in which the linkage of the units is 1 : 4, the necessary pair of adjacent C·OH groups is provided by carbon atoms 2 and 3; if, however, carbon atom 3 takes part in the linkage of the units, then no pair of adjacent C·OH groups is available and such a polysaccharide should not be attacked by periodic acid. This note gives an account of the application of this test to two of the three polysaccharides mentioned above, laminarin and agar-agar.

For the sake of comparison with the polysaccharides, the action of periodic acid on 3-methyl methylglucoside was examined. 3-Methyl glucose was prepared by the method of Freudenberg and Hixon (*Ber.*, 1923, **56**, 2125) and was converted into the methylglucoside by Fischer's method (Irvine and Scott, J., 1913, **103**, 573). The syrupy product had $[\alpha]_D$ +101° (c = 4·15) (Irvine and Scott's preparation had $[\alpha]_D$ +99·3°, c = 1·973). The syrup (0·793 g.) was treated with 0·269M-periodic acid (32 c.c.). Immediately after making up, the rotation of this solution was +3·91° (l = 2). It was unchanged after 24 hours. In the meantime a considerable quantity of iodine had separated, showing that periodic acid had been reduced. At the end of the experiment 0·673 g. of syrup was recovered from the solution. This syrup did not reduce Fehling's solution and had $[\alpha]_D$ +99·9°. The constancy of the rotatory power and the recovery of 85% of the syrup apparently unchanged would point to the conclusion that the periodic acid did not act on the 3-methyl methylglucoside; but that the appearance of iodine was due to the action of the reagent on some optically inactive impurities in the syrup. In the oxidation of starch and of cellulose no free iodine is produced, from which it would appear that in the oxidation of two neighbouring C·OH groups periodic acid is not reduced to hydriodic acid. When α-methylglucoside (1·24 g.) was left standing with the same solution of periodic acid (50 c.c.), the rotation fell from +7·55° to +5·25° in 1 hour and to +5·15° in 18 hours.

In the first experiments with laminarin, iodine was also produced. When, however, the laminarin was purified by repeated deposition from water (see Barry, *Sci. Proc. Roy. Dublin Soc.*, 1938, **21**, 615) no free iodine appeared, and the results referred to later were obtained.

During the course of these experiments it was found that the expensive periodic acid could be effectively replaced by sodium paraperiodate. This salt can be easily prepared by oxidising a hot solution of iodine in sodium hydroxide with chlorine (Partington, " Text-Book of Inorganic Chemistry," Macmillan and Co., 5th edn., p. 372). It dissolves readily in dilute sulphuric acid and, for our purposes at least, the presence of sodium and sulphate ions is not objectionable. The course of the reaction may be readily followed by titration of the free iodine formed by the addition of potassium iodide to the solution (Clutterbuck and Reuter, *loc. cit.*). The procedure was to add a standard solution of the paraperiodate in an equivalent quantity of dilute sulphuric acid to the solid polysaccharide and to withdraw 0·25 c.c. from time to time for titration. As a control, cellulose, in the form of absorbent cotton and of filter-paper, was treated in the same way. (The rate of oxidation of starch is much too rapid for this purpose.) A typical series of results is shown in the table :

Time, hours.	Absorbent cotton.†	Filter-paper.†	Agar.*	Lamin-arin.†	Time, hours.	Absorbent cotton.†	Filter-paper.†	Agar.*	Lamin-arin.†
24	4·08	4·08	8·02	4·08	168	3·50	3·44	7·96	3·94
48	3·90	3·90	7·88	4·04	240	3·46	3·38	8·00	3·92
72	3·74	3·80	7·86	4·00	312	3·38	3·30	8·00	3·88
120	3·58	3·60	7·96	3·98	648	3·20	3·13	—	3·73

* 1 G. of agar with 40 c.c. of 0·47M-periodic acid.
† 1 G. of polysaccharide with 40 c.c. of 0·235M-periodic acid.

The figures under each polysaccharide represent the number of c.c. of N/10-thiosulphate required to titrate the iodine liberated on addition of potassium iodide and sulphuric acid to 0·25 c.c. of the solution. Diminution in the figure thus represents oxidation of the polysaccharide.

The small diminution in the figures for laminarin during the first 240 hours is within the limit of experimental error. In other experiments with the same substance this diminution was not apparent. After 240 hours, however, a definite diminution begins to take place. This may be due to a slow action of the oxidising agent on terminal glucose units. At the end of the experiment the cellulose and the laminarin were hydrolysed and treated with phenylhydrazine acetate. No glucosazone was obtained from either the cotton or the filter-paper, whereas it was obtained in plenty from the laminarin.

No figure is available for the agar at 648 hours. At the end of 47 days, however, the titration had fallen to 7·68, showing that at the end of this long contact with the reagent some kind of oxidation was just beginning.

This remarkable stability of agar towards periodic acid is interesting from several points of view. From methylated agar, in addition to 2 : 4 : 6-trimethyl *d*-galactose, Forbes and Percival (J., 1939, 1844) have isolated 2 : 4-dimethyl 3 : 6-anhydro-*l*-galactose (by remethylation of the products of hydrolysis) and they believe that the anhydro-sugar pre-exists in the polysaccharide. The invulnerability of agar to periodic acid supports this view, since, if the 3 : 6-anhydrogalactose were an artefact produced from galactose units in which carbon atom 3 did not take part in the linkage, such galactose units would present =C(OH)—C(OH)= units for attack. According to the figures of Forbes and Percival, 13% of the galactose would then be vulnerable and an appreciable reduction of periodic acid would take place.

On the other hand, Pirie (*Biochem. J.*, 1936, **30**, 369) obtained hepta-acetyl *dl*-galactose by acetylation of

agar, from which he infers that agar contains open-chain galactose units. Such units would, however, present the necessary grouping for attack by periodic acid irrespective of the carbon atom taking part in the linkage of the units. The stability of agar displayed in the experiments above described thus proves that open-chain galactose units cannot exist in the molecule and therefore some other explanation must be found for the formation of hepta-acetyl galactose.—UNIVERSITY COLLEGE, GALWAY. [*Received, November 14th*, 1941.]

The Autoxidisability of the Alkyl Groups in Xylene. By ERNEST HAROLD FARMER and ERIC S. NARRACOTT.

IN the course of early experiments on the oxidation of rubber it was observed that its solutions in commercial xylene when exposed at 75° to a stream of oxygen, in presence of acetic anhydride (added to accelerate reaction) and a cobalt catalyst, gave *m*- and *p*-toluic acid, together with neutral liquids which were clearly not derived from the rubber. For instance, when a solution of 675 g. of rubber in 6075 g. of xylene was mixed with 844 c.c. of acetic anhydride and 42 g. of cobalt naphthenate, and the mixture (in 4 batches) treated at 75° for 2 days with a stream of oxygen, there were obtained, respectively, (1) by extraction of the xylene solution with 10% caustic alkali and (2) by subsequent distillation at *ca.* 1 mm. pressure of the volatile material from the residual xylene liquor, about 10 g. of crystalline acid and 80 g. of volatile neutral oxidation products. The acid was toluic acid (Found: C, 70·6; H, 6·1; equiv., 135. Calc. for $C_8H_8O_2$: C, 70·55; H, 5·95%; equiv. 136), from which samples of both the *m*- and the *p*-isomeride (m. p. 110° and 176°, respectively) were isolated by fractional crystallisation. The neutral products when fractionally distilled gave: (*a*) aldehydic material, b. p. 85—87°/15 mm. (21 g.); (*b*) aldehydic material, b. p. 87—105°/15 mm. (13 g.); (*c*) alcoholic material, b. p. 105—108°/15 mm. (41 g.); and (*d*) neutral material, b. p. >108°/15 mm. (5 g.). Fraction (*a*) was nearly pure tolualdehyde (Found: C, 61·3; H, 6·15. Calc. for C_8H_8O: C, 61·0; H, 6·25%) and gave at once a mixture of isomeric semicarbazones, m. p. 205°; also it gave on oxidation with excess of boiling alkaline permanganate an 80% yield of mixed phthalic acids (Found: C, 58·0; H; 3·55. Calc. for $C_8H_6O_4$: C, 57·8; H, 3·65%). From the methyl ester derived from the mixed acids, methyl terephthalate, m. p. 139°, and methyl *iso*phthalate, m. p. 65°, were easily separated. Fraction (*c*), doubtless consisting of impure tolyl alcohols (Found: C, 75·4; H, 7·7. Calc. for $C_8H_{10}O$: C, 78·65; H, 8·25%), gave on oxidation with boiling permanganate good yields of mixed phthalic acids, resolvable after esterification into the *m*- and the *p*-isomeride.

When xylene (200 c.c.) containing no dissolved rubber was similarly oxidised for 1 day at 75° in presence of cobalt naphthenate (1 g.) and acetic anhydride (25 c.c.) there was obtained a quite similar mixture (14·5 g.) of the liquid and the acid oxidation products.

This oxidation of xylene, which is facilitated by the cobalt catalysts employed, doubtless proceeds *via* the hydroperoxide, $CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}OOH$.—IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, S.W. 7. [*Received, October 18th*, 1941.]
