

(100 ml) and extracted repeatedly with chloroform. The combined extracts were dried over MgSO_4 , then reduced to dryness by rotatory evaporation followed by dessication to obtain 3.72 gm of mixed product.

By means of column chromatography (Baker analyzed silica gel, 60-200 mesh, 350 gm, I.D. 50 mm x 70 cm; -1.00 w/w ratio, column prepared and eulated with chloroform) two major components were separated while employing 200 ml aliquots for collection. The aliquots were monitored by TLC (S.G.F. 254 plates, CHCl_3 -acetone, 9:1, short UV detection). The first major component (total dry weight, 2.025 g was found in aliquots 7-12 together with some minor component having smaller R_f . Aliquot 10 was selected as a rich source of the major component (277 mg) for preparative TLC (plate thickness 0.5 mm, CHCl_3 -acetone 9:1). After plate development, the upper band (R_f 0.58) was scraped and eluted with CH_2Cl_2 . P.m.r. analysis of the dried oil obtained from this solution showed the substance to be 3,4-dimethoxybenzaldehyde by comparison with reference spectra (3), ($\delta\text{CDCl}_3/\text{intn. TMS}$: 3.93, s, 3H, m-MeO; 3.97, s, 3H, p-MeO; 6.9-7.1, 3H, ABC pattern for Ar-H; 9.87, s, 1H, CHO). Based on the total dry weight (2.025 g) of fractions 7-12, the percentage yield for IIa from Ia is 80%.

The second major component was found in aliquots 13-17. Fractions 14 and 15 were free of contamination by minor components of the reaction product, and from these fractions 665 mg of dry solid, m. $104-106^\circ\text{C}$, were obtained. P.m.r. spectra ($\delta\text{CDCl}_3/\text{intn. TMS}$: 1.53, s, 6H, CH_3 , at C-5, and 3.30, s, 6H, N- CH_3) revealed the solid to be 1,3,5,5-tetramethylbarbituric acid (III) identical to that obtained by treating a methanolic solution of 1,5,5-trimethylbarbituric acid (Ic) with ethereal diazomethane using a modified procedure by Bush and Butler (4). No depression on mixed melting was observed, and infrared spectra were identical to those from authentic III. Based on the total dry weight (1.274 g) of fractions 13-17, the percentage yield of III from Ia is 45%.

Oxidative methylation of a suspension of 5-benzylidenebarbituric acid (Ib) (1.50 g, 0.0069 mole) in DMF (100 ml) with methyl iodide (3.45 ml, 0.055 mole) and silver oxide (8.57 g, 0.037 mole) occurred during heating at 90° (1 hr) and continued stirring at room temperature (3 hr). Following removal of silver residues, the filtrate was concentrated by rotatory evaporation, then the concentrate was subjected to column chromatography as described above. Tetramethylbarbituric acid (III) together with some DMF was found by p.m.r. spectrometry in the third aliquot (195 ml reduced to 1.053 g), and from the composition ratio of III/DMF in an accurately weighed sample, the percentage yield of III from Ib was estimated to be 65%. Estimation of the yield of benzaldehyde was unsatisfactory in this reaction.

The facile oxidative methylation shown by both 5-vanillylidene- and 5-benzylidenebarbituric acid with MeI and $\text{Ag}_2\text{O}/\text{DMF}$ is most likely promoted by interaction of silver ion with the olefinic double bond. Such loose silver "addition" compounds were first recognized by Winstein and Lucas (5); various workers have measured argentation constants for such complexes (6,7,8) and Fueno et al. (9) have shown that the presence of electron-releasing substituents on the ring of styrenes facilitates silver-complex formation. Although Ag^+ assisted methanolysis of halogenocarbene adducts is known (10) and oxidative cleavage (demethylation) of hydroquinone methyl ethers by silver oxide in acid media was recently reported (11), the present work appears to be the first instance of oxidative cleavage with methylation. It is also probable that the solvent, DMF, plays a role as well as Ag_2O particularly in view of evidence obtained from variable temperature p.m.r. studies (12) indicating small amounts of a Ag^+ complex involving silver coordination to the nitrogen of N,N-dimethylacetamide (DMA).

As noted by a referee, yield data together with complete product identification is important for distinguishing between mechanisms for cleavage. One possible mechanism could involve initial formation of a radical

cation of the aromatic ring in which case the activated ring (of Ia) would be expected to form a radical cation much faster than the unsubstituted ring. A much lower yield of products from Ib would be consistent with the formation of a radical cation or initial attack on the double bond. Because the yield of tetramethylbarbituric acid (III) from Ib is as great as the yield from Ia, it would appear that the reaction mechanism favours attack on the double bond.

Acknowledgement: We are grateful to Mr. H.W. Avdovich for recording p.m.r. spectra and providing a sample of tetramethylbarbituric acid (III) which he had prepared from earlier work.

References

1. (a) G.A. Neville and H.W. Avdovich, *Can. J. Chem.* 50, 880 (1972);
(b) G.A. Neville, *Anal. Chem.* 42, 347 (1970);
(c) G.A. Neville, H.W. Avdovich and A.W. By, *Can. J. Chem.* 48, 2274 (1970);
(d) H.W. Avdovich and G.A. Neville, *Can. J. Pharm. Sci.* 4, 51 (1969).
2. R. Kuhn, H. Trischmann and I. Low, *Angew. Chem.* 67, 32 (1955);
R. Kuhn and H. Baer, *Ber.* 88, 1537 (1955); 89, 504 (1956).
3. G.A. Neville, *Org. Magn. Res.* (in press).
4. T. Bush and T. Butler, *J. Pharmacol. & Exper. Therap.* 61, 139 (1937).
5. S. Winstein and H.J. Lucas, *J. Am. Chem. Soc.* 60, 836 (1938).
6. C.F. Wilcox, Jr., and W. Gaal, *J. Am. Chem. Soc.* 93, 2453 (1971).
7. I. Rothberg, W.J. Krieg and W.R. Sisco, *J. Org. Chem.* 36, 4076 (1971).
8. M.A. Muhs and F.T. Weiss, *J. Am. Chem. Soc.* 84, 4697 (1962).
9. T. Fueno, T. Okuyama, T. Deguchi and J. Furukawa, *J. Am. Chem. Soc.* 87, 170 (1965).
10. M.S. Baird and C.B. Reese, *Tetrahedron Letters*, 4637 (1971).
11. C.D. Snyder and H. Rapoport, *J. Am. Chem. Soc.* 94, 227 (1972).
12. P.A. Temussi, T. Tancredi and F. Quadrifoglio, *J. Phys. Chem.* 73, 4227 (1969).