ABSTRACT

Biomimetic Synthesis of TB Epitopes and oligofuranosides
via propane-1,3-diylphosphate sugars

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The preparation of oligofuranosides using the propane-1,3-diyl phosphate leaving group is described. A linear trisaccharide containing 1→5-linked arabinofuranosidic residues was prepared in a stepwise synthesis using 2,3-di-*O*-benzyl-D-arabinose as the acceptor.

The acceptor was subjected to NMR investigations in two solvents: $CDCl_3$ and DMSO-d_6. The 2,3-di-*O*-benzyl derivatives of D-ribose and D-xylose were also prepared and analysed. These partially protected derivatives were found to exist as mixtures of pyranose and furanose forms whose equilibrium compositions in both solvents were determined. Changes in conformation of the pyranoses were related to their ability to form intramolecular bonds in the absence of solvent interactions. 2,3-Di-*O*-benzyl-D-arabinose was found to contain 45% furanose at equilibrium in $CDCl_3$ and 63% in DMSO-d_6 with the equilibrium in favour of the α-furanose form.

Protected di- and trisaccharide motifs D and E of *Mycobacterium tuberculosis* were also prepared using the propane-1,3-diyl phosphate protocol. Preparation of these using benzyl-protected building blocks led to poor stereo- and regioselectivity. In the case of the galactofuranosidic linkages a remarkable preference for the more sterically demanding *cis*-1→5 glycosidic linkage was observed. Thus the syntheses of the desired oligosaccharides were accomplished using benzoyl-protected building blocks.

This dissertation also describes the preparation of a new class of carbohydrate-based ionic liquids. These consist of benzyl-protected monosaccharides with an *N*-linkage at the anomeric centre to 1-methylimidazole. A number of these ionic liquids were prepared including those derived from arabinose, ribose, xylose and glucose in the furanoid form, as well as an ionic liquid derived from mannose in the pyranoid form. All of the prepared ionic liquids were viscous oils at room temperature and were found to be stable up to 180^{o}C. Asymmetric induction was not realized in the reaction of methyl magnesium bromide with benzaldehyde, however, the ionic liquid could be regenerated. Selective removal of the primary benzyl group of 1-(2′,3′,5′-tri-*O*-benzyl-D-arabinofuranosyl)-3-methylimidazole was accomplished using palladium hydroxide in cyclohexene.

KEYWORDS: Glycosylation, propane-1,3-diylphosphate, arabinofuranosides, 2,3-di-*O*-benzyl, galactofuranosides, *Mycobacterium tuberculosis*, Motif D, Motif E, carbohydrate ionic liquids.