# NOTIZEN

## Epoxide Assisted Displacement of Triflyl Group by Fluoride Ion. An Efficient Approach to Fluorodeoxy Sugars

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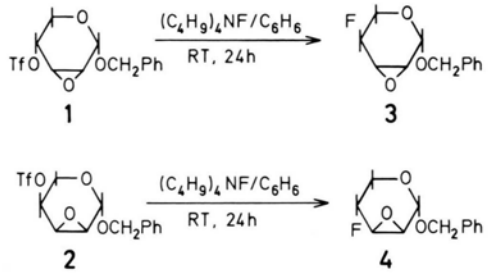
Z. Naturforsch. **40b,** 317–318 (1985); received August 20, 1984

Fluorodeoxy Sugars, Triflate Displacement, Tetrabutylammonium Fluoride

Displacement of triflyl group by fluoride ion in benzyl 2,3-anhydro sugars leads with stereochemical inversion to fluorodeoxy sugars, providing a general method for the introduction of fluorine in the neighbourhood of oxirane ring in anhydro sugars. This procedure is mild, convenient, and does not experience difficulties which sometime are encountered in nucleophilic fluoride displacements in carbohydrate systems.

Fluorodeoxy sugars have recently gained importance due to possible useful applications in the insecticide and herbicide areas besides acting as inhibitors of certain enzymes [1]. Specifically fluorinated carbohydrates have been found useful for the study of various dependencies of $^{19}F$ NMR parameters [2–4].

One of the methods commonly employed, amongst others, for the synthesis of fluoro sugars involve nucleophilic fluoride displacements of various sulphonyloxy groups [5]. The principal obstacle to the synthesis of these potential compounds rests in the fundamentally weak nucleophilicity and 'hard base' character of fluoride ion. The displacement reactions generally have to be carried out under forcing conditions of temperature and concentration and require strict control on the acidity of reaction to prevent elimination. A reaction which overcomes these limiting factors is the $S_N2$ displacement of the triflyl group with the fluorine atom in the neighbourhood of oxirane ring in anhydro sugars. This has been demonstrated by us in preliminary form using benzyl 2,3-anhydro-4-triflyl-$\alpha$-D-ribopyranoside (**1**) and its $\beta$-L-isomer (**2**) [6] respectively as model substances. Each of these was reacted with tetrabutylammonium fluoride at room temperature in benzene for 24 h to provide benzyl 2,3-anhydro-4-fluoro-4-deoxy-$\beta$-L-lyxopyranoside (**3**) and its $\alpha$-D-analogue (**4**).




The effectiveness of this reaction can be attributed to the unusual ease of displacement of triflyl group, the enhanced nucleophilicity of the fluoride ion in the form of its tetrabutylammonium salt and the anchimeric assistance of the adjacent epoxide ring. The carbon atoms of the latter show $sp^2$ character owing to ring strain (**7**) and tend to stabilize the transition state formed at C-4. The substitution at C-4 is also favoured by the molecular geometry which shows a dipole moment in direction to the C–O bond and not parallel to the newly forming C–F bond with the attacking nucleophile [7].

The structure of fluoro sugars (**3**) and (**4**) were determined by $^{19}F$ and $^{13}C$ NMR as well as field desorption mass spectroscopy. The evidence for stereochemical inversion at C-4, and $^oH_5$ conformations was provided by H–H and H–F coupling constants in 400 MHz NMR spectra.

### Experimental

The melting points were recorded in glass capillary and are uncorrected. $^1H$ and $^{13}C$ NMR: Instruments WH 400 and HFX 90, Bruker-Physik AG. FDMS: Instrument MAT 711, Varian. Optical rotations: Instrument Digitalpolarimeter OLD 5, Zeiss. Elemental analyses: Carlo Erba Elemental Analyser Mod. 1104.

*Benzyl-2,3-anhydro-4-fluoro-4-deoxy-$\beta$-L-lyxopyranoside* (**3**)

Column chromatography of the reaction product over silica gel (solvent system: ethyl acetate/ether/petrol ether 1:15:15) and crystallization from ethyl acetate-hexane provided 100 mg (60%) of **3** as colourless needles; m.p. 42 °C, $[\alpha]_{546}^{20} = 106.75$ (c = 0.1, chloroform).

$C_{12}H_{13}FO_3$ (224)

| | | | |
|---|---|---|---|
| Found | C 64.8 | H 5.91 | F 8.02, |
| Calcd | C 64.28 | H 5.80 | F 8.40. |

$R_F = 0.53$ (Silica gel-ethyl acetate/ether/petrol ether 1:15:15); FDMS (*m/e*): 224 ($M^+$, 100%).

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0340–5087/85/0200–0317/$ 01.00/0

*Benzyl-2,3-anhydro-4-fluoro-4-deoxy-α-D-lyxopyranoside* (**4**)

Isolation and crystallization as **3** afforded 90 mg (55%) of **4** as colourless needles; m.p. 91–92 °C, $[\alpha]_{546}^{20} = 79.05$ (0.1, chloroform).

$C_{12}H_{13}FO_3$ (224)

Found C 64.5 H 5.79 F 8.28,
Calcd C 64.28 H 5.80 F 8.40.

$R_F = 0.34$ (Silica gel-ethyl acetate/ether/petrol ether 1:15:15); FDMS (*m/e*): 224 ($M^+$, 100%).

We are thankful to DAAD and Ministerium für Wissenschaft und Kunst, Baden-Württemberg, for scholarships to F.L. and A.M. Thanks are also due to Prof. A. Nesmélyi of Central Research Institute for Chemistry of the Hungarian Academy of Sciences for his help in spectral assignments.

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