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SYNTHESIS OF 2,3,4,6-TETRA-*O*-ACETYL-*β*-D-GLUCO(GALACTO)PYRANOSYLCAPROLACTAMS AND 2,3,4,6-TETRA-*O*-ACETYL-*β*-D-GLUCO(GALACTO) PYRANOSYLPYRROLIDONES

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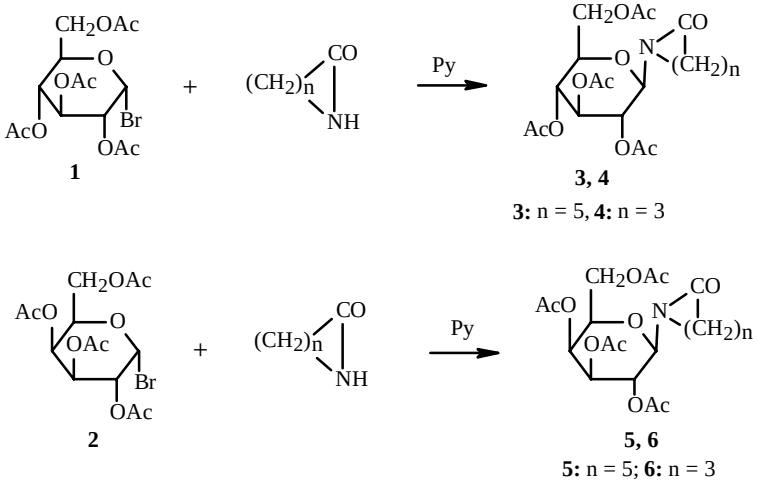
A new synthesis of certain lactam-containing N-*glycosides was developed. 2,3,4,6-Tetra*-O-*acetyl*-β-*D-gluco(galacto)pyranosylcaprolactams and 2,3,4,6-tetra*-O-*acetyl*-β-*D-gluco(galacto)pyranosylpyrrolidones were synthesized by condensation at room temperature of acetobromoglucose and acetobromogalactose with* ε-*caprolactams and* α-*pyrrolidone.*

Key words: *N*-glycosides, *ε*-caprolactam, *α*-pyrrolidone, acetobromoglucose, acetobromogalactose.

Lactams are valuable physiologically active compounds. Derivatives of lactams are mediators of central nervous system inhibition and are used in agriculture against parasites. Therefore, the preparation of lactam derivatives and the development of new methods for synthesizing them continue to be important goals [1].

The synthesis of *N*-glycosides containing lactam rings as aglycons had not been published until 1992. Anisimova and Baukov [2] developed a multistep method based on allylsilyllactam for preparing a nucleoside of 2,3,4,6-tetra-*O*-acetyl-*β*-D-glucopyranosylcaprolactam.

We developed a new method for synthesizing of *N*-glycosides containing lactams in order to simplify known methods and to prepare new compounds with improved yields of the target products and studied the reaction conditions. Condensation of 2,3,4,6-tetra-*O*-acetyl-*α*-D-glucopyranosylbromide (**1**) and 2,3,4,6-tetra-*O*-acetyl-*α*-D-galactopyranosylbromide (**2**) with *ε*-caprolactam and *α*-pyrrolidone at room temperature synthesized 2,3,4,6-tetra-*O*-acetyl-*β*-D-gluco-(galacto)pyranosylcaprolactams **3** and **5** and 2,3,4,6-tetra-*O*-acetyl-*β*-D-gluco(galacto)pyranosylpyrrolidones **4** and **6** according to the following scheme:



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This reaction occurs through S_N2 nucleophilic substitution. All reactions occur with inversion of configuration at C_1 for *O*-acylglycosylhalides with the *cis*-configuration at C_1–C_2. As a result, halide substitution forms the β-glycosides [3].

Compounds **3**, **5**, and **6** were synthesized for the first time. They are colorless crystalline compounds that are very soluble in alcohol (methanol, ethanol) and chloroform.

EXPERIMENTAL

Optical rotation was determined on a SU-3 universal saccharimeter. ^{13}C NMR spectra were recorded on a Bruker WM-250 spectrometer (62.89 MHz) in $CDCl_3$; IR spectra, on a UR-20 spectrometer in KBr disks; mass spectra, on a Varian MAT CH-6 instrument. The purity of the prepared compounds and the R_f values were determined on Silufol UV-254 using the solvent system benzene:dioxane (3:1).

2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosylcaprolactam (3). A mixture of ε-caprolactam (1.13 g, 0.01 mol), absolute pyridine (20 mL), and dry chloroform (10 mL) was treated dropwise with a solution of acetobromoglucose (4.11 g, 0.01 mol) in chloroform (15 mL) and stirred at room temperature for 30 h. Distilled water (8 mL) was added to isolate the precipitate ($C_5H_5N \cdot HBr$). The organic layer was treated with $NaHCO_3$ and water until neutral and left overnight over Na_2SO_4. The compound was precipitated from the filtrate with hexane. The resulting white crystals were recrystallized twice from absolute MeOH to afford **3** (3.2 g, 72%), R_f 0.54, mp 121-122°C, $[\alpha]_D^{18}$ +52° (*c* 1.5, $CHCl_3$), $C_{20}H_{29}NO_{10}$.

IR spectrum (ν_{max}, cm^{-1}): 1715 (acetate C=O), 1700 (lactam C=O), 1330 (C–N), 1020-1060 (C–O–C).

Mass spectrum (*m*/*z*): 384 $[M - 59]^+$, 383 $[M - 60]^+$, 331 $[M - 112]^+$, 324 $[M - 59 - 60]^+$, 298 $[M - 145]^+$. Ions with mass numbers 125 and 73 arose from rupture of the C_1–C_2 and C_5–C_6 bonds.

2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosylpyrrolidone (4). Analogously α-pyrrolidone (0.85 g, 0.01 mol) and acetobromoglucose (4.11 g, 0.01 mol) formed **4** (2.9 g, 70%), R_f 0.38, mp 112-113°C, $[\alpha]_D^{18}$ +38° (*c* 1.45, $CHCl_3$), $C_{18}H_{25}NO_{10}$. Lit. [2] mp 115-116°C (CCl_4), R_f 0.33, $[\alpha]_D^{25}$ +38° (*c* 2, $CHCl_3$).

IR spectrum (ν_{max}, cm^{-1}): 1715 (acetate C=O), 1685 (lactam C=O), 1295 (C–N), 1050-1140 (C–O–C).

^{13}C NMR spectrum (δ, ppm): 92.8 (C-1), 71.4 (C-2), 73.5 (C-3), 67.8 (C-4), 72.7 (C-5), 63.0 (C-6), 22.0-28.0 (4 CH_3), 173-177 (5 CO), 32.0-40 (3 CH_2).

Mass spectrum (*m*/*z*): 356 $[M - 59]^+$, 355 $[M - 60]^+$, 331 $[M - 80]^+$, 296 $[M - 59 - 60]^+$, 270 $[M - 145]^+$.

2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosylcaprolactam (5). Analogously to **3** ε-caprolactam (1.13 g, 0.01 mol) and acetobromogalactose (4.11 g, 0.01 mol) formed **5** (3.58 g, 81%), R_f 0.75, mp 144-145°C, $[\alpha]_D^{18}$ +38° (*c* 0.52, $CHCl_3$), $C_{20}H_{29}NO_{10}$.

IR spectrum (ν_{max}, cm^{-1}): 1740 (acetate C=O), 1680 (lactam C=O), 1310 (C–N), 1060-1120 (C–O–C).

^{13}C NMR spectrum (δ, ppm): 91.6 (C-1), 70.8 (C-2), 72.4 (C-3), 68.6 (C-4), 75.8 (C-5), 62.5 (C-6), 18.0-23.0 (4 CH_3), 169-172 (5 CO), 26.8-35.0 (5 CH_2).

2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosylpyrrolidone (6). Analogously to **3**, condensation of α-pyrrolidone (0.85 g, 0.01 mol) and acetobromogalactose (4.11 g, 0.01 mol) synthesized **6** (3.23 g, 78%), R_f 0.92, mp 134-135°C, $[\alpha]_D^{18}$ +60° (*c* 0.72, $CHCl_3$), $C_{18}H_{25}NO_{10}$.

IR spectrum (ν_{max}, cm^{-1}): 1725 (acetate C=O), 1695 (lactam C=O), 1260 (C–N), 1050-1140 (C–O–C).

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