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LETTERS
TO THE EDITOR

Dedicated to the 90th Anniversary of Academician M.G. Voronkov

New Intracomplex Compounds of Pentacoordinate Germanium. Hypogermatranes, Ge-Substituted (N→Ge) 2-Oxa-5-aza-1-germacyclopentanes

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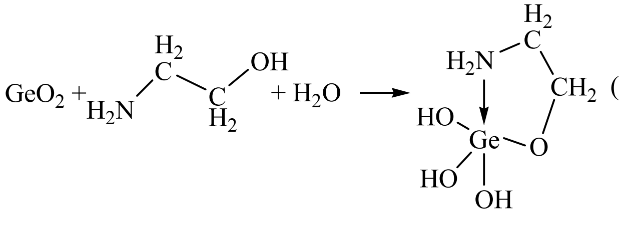
The chemistry of intracomplex compounds of pentacoordinate germanium, germatranes $XGe(OCH_2CH_2)_3N$, containing the transannular coordination bond N→Ge, has begun in 1968 and continues to actively develop [1–4]. In the present century, a great attention was attracted by their bicyclic analogs, quasigermatranes $X_2Ge(OCH_2CH_2)_2NH$ [5, 6].

In continuation of the investigations in this field, monocyclic hypogermatranes (N→Ge) $X_3Ge(OCH_2 \cdot CH_2)NH_2$, 2-oxa-5-aza-1-germacyclopentanes, also containing an intramolecular coordination bond N→Ge, were first synthesized. They can be classified as dragonoids [7].

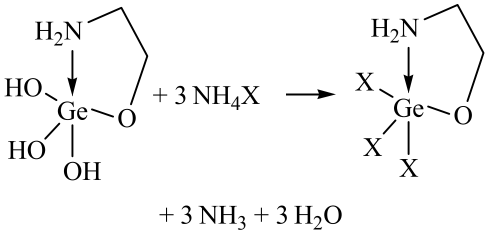
The first representative of these compounds, 1,1,1-trihydroxy-2-oxa-5-aza-1-germacyclopentane $(HO)_3Ge(OCH_2CH_2)NH_2$ (**I**) was synthesized by the reaction of germanium dioxide with 2-hydroxyethylamine in aqueous-alcoholic medium at 80°C in the absence of catalyst.


(1)

Reaction (1) is accomplished by complete dissolution of GeO_2, which requires no less than 1 h. The precipitate formed after removal of the solvent was filtered off and dried by heating in a vacuum. The yield of hypogermatranetriol was 93%. The product is a stable colorless powder with the temperature of decomposition ~300°C and the elemental analysis given below.

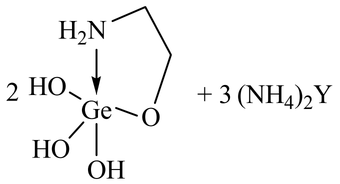
$C_2H_9GeNO_4$	C	H	Ge	N
Found, %	13.57	5.02	7.31	42.51
Calculated, %	13.08	4.94	7.62	39.52

Using the reaction we had earlier found between the germatranol and ammonium salts [8], the 1,1,1-substituted hypogermatranes were synthesized .


(2)

X = F (**II**, decomp. 300°C), Cl (**III**, decomp. 270°C), Br (**IV**, decomp. 280°C), I (**V**, decomp. 230°C), NO_3 (**VI**, subl. 240°C), ClO_4 (**VII**, decomp. 280°C), SCN (**VIII**, decomp. 290°C).

Compounds having anions CO_3^{2-} (**IX**) or SO_4^{2-} (**X**) and two germatrane cycles have been prepared similarly.



$$\longrightarrow [H_2N(CH_2CH_2O)Ge]_2(Y)_3 + 6\,NH_3 + 6\,H_2O \quad (3)$$

Y= CO_3 (**IX**, mp 300°C), SO_4 (**X**, mp 270°C).

Reactions (2) and (3) were carried out in boiling ethanol till the evolution of ammonia ceased. The composition and the structure of the obtained 1,1,1-trisubstituted hypogermatranes was confirmed by the data of elemental analysis, IR, ^1H and ^{13}C NMR spectroscopy. They all are colorless powders decomposed upon heating to 300°C.

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