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Synthesis methods of organoselenium compounds

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Abstract

Most of known methods of organoselenium compounds are labour-intensive and multi-stage. The manuscript provides the results of the development of available methods of producing these compounds with various functional groups, selection of catalysts and description of their practically useful properties.

Keywords: organoselenium compounds, 2-dibutylaminoethaneselenol-1 seleniimides, selenium betaines

1. Introduction

Chemistry of organoselenium compounds is an important and rapidly growing direction in organoelemental chemistry. In scientific literature there are large numbers of works on fundamental and applied studies of organoselenium compounds. The variety of important and useful properties of these compounds is a strong incentive for intense studies [1-4].

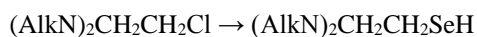
Systematic laboratory studies on the synthesis of organoselenium compounds over petrochemical feedstock led to the creation of a new direction developed from a synthesis method of a wide range of selenium- and oxygenated compounds, including new reactions and creation of new catalytic systems, as well as detection of possibilities of their application as biologically active, photoactive substances and modifiers of polymer materials [5-7].

Most of synthesis methods of Se compounds are labor intensive and multi stage. The question on the development of available methods of producing these compounds with different functional groups is more relevant.

2. Results and discussion

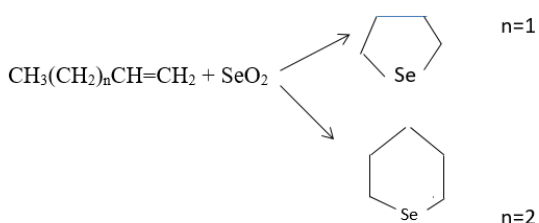
The results of our studies make a considerable stage in the development of chemistry of selenium- and oxygenated compounds, in particular, studies on production reaction of selenium hydride compounds of selenurea derivatives on the selection of effective catalytic systems to synthesize selenium heterocyclic compound *et al.*

A method based on previously unknown reactions of dialkylaminoethanehaloid with sodium hydroselenide (without heating) was developed in the chemistry of seleniumhydride compounds [8].



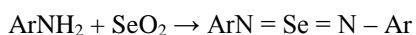
Catalysts of a phase transfer catalysis – triethyl benzene ammonium chloride $\text{C}_6\text{H}_5\text{CH}_2\text{CIN}(\text{C}_2\text{H}_5)_3$ quaternary ammonium salt and crown-ether (18-crown-6-ether) were used in the reaction. The last one which exhibits rather good catalytic activity was preferred. Among selenohydride compounds 2-dibutylaminoethaneselenol-1(selenol-1) which provides the growth of silkworm moth, was found to be more active. Its test as a biostimulator has allowed to increase efficiency of mulberry-fed caterpillar and to improve the quality of cocoon thread that can result in considerable economic effect.

Originality of a new catalytic system consisting of aluminum oxide and zeolite catalyst with rare earth elements (Ceokar - 2) is its universal character that is seen in heterocyclization process of hydrocarbons with selenium dioxide:



The use of this catalyst allows producing both 5-membered and 6-membered selenium compounds, while the catalysts described before our studies allowed producing only 5-membered heterocycles.

A new class of organic photoactive compounds of a number of selenium diimides which can be used both as independent converters of solar energy and sensitizer of organic photo conductors:



The obtained aryldiimides have higher values of photo bleaching, photo electromotive force, wide range of absorption in maximum of solar radiation, high extinction coefficient as compared to the best modern samples of phthalocyanides that allow using incident light effectively in thin-layer use of photosensitive elements.

The studies detected a number of new interesting influence laws of structural factors of synthesized new selenium compounds on their reactivity and functional properties which are of great importance for the theory of organic synthesis.

Study of antioxidizing properties of synthesized selenium compounds – bis (hydroxyethyl) selenide and its derivatives ($\text{R-OCH}_2\text{OCH}_2\text{CH}_2\text{SeCH}_2\text{OCH}_2\text{OR}$) clarified the contradictory statements in literature on the presence or lack of aforementioned properties. As a result both in model reactions and in living organism it was proved that these compounds exhibit effective antioxidant properties.

An original synthesis method of unsaturated organoselenium compounds by interaction of selenium dioxide amine (SeO_2Py) with unsaturated compounds has been proposed. The interaction goes as a conjugate addition of selenium oxide and pyrimidine groups by multiple bonds with the formation of selenious betaines. Sodium salts of relevant selenites with double or triple bonds in a chain were obtained by alkali hydrolysis of the last: $\text{AlkCH}=\text{ChSeO}_2\text{Na}$, $\text{ArC}=\text{CSeO}_2\text{Na}$.

Synthesized selenites exhibit bioactive properties. Polyfunctional compounds can be obtained on their basis by the reaction with haloalkyls.

A number of selenium compounds with effective properties of thermo- and light stabilisers of polyolefins have been found.

Di (propanol-2) selenide used as an insecticide and oil additives also exhibited high stabilizing properties for isotactic polypropylene. Selenium glycol introduced in low weight quantities than di (propanol-2) selenide into polypropylene increases strength properties of the last significantly.

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