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ТЕЗИ

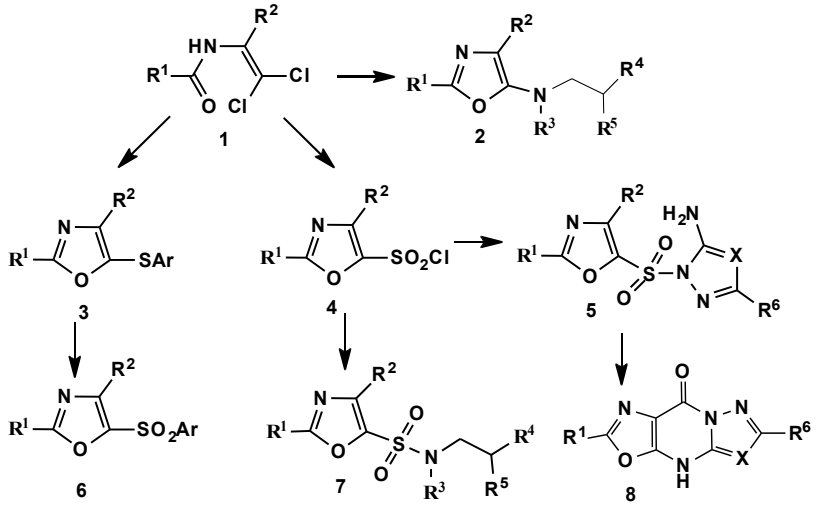
UDC 547.541.521+547.787

Synthesis and antitumor activity of new 4,5 difunctionalized 1,3-oxazole derivatives

M.V. Kachaeva, V.M. Prokopenko, A.M. Kornienko, S.G. Pilyo, V.S. Brovarets

Institute of Bioorganic Chemistry and Petrochemistry, NAS Ukraine,
Department of Chemistry of Bioactive Nitrogencontaining Heterocyclic Bases

A series of novel 2-cyano-1,3-oxazoles containing diamines and ethanoleamines moieties (**2**), 5 sulfanyl derivatives (**3**), 5 sulfonylchlorides (**4**), 5 sulfonyl derivatives (**6**) and 5-sulfonylamides (**5**, **7**) were synthesized from available dichloroenamides (**1**). Sulfonylamides (**5**) were converted into tricyclic fused compounds (**8**) with pyrazole or triazole moiety linking to oxazolopyrimidine compounds.



R^1 = Alk, Ar, Het; R^2 = CN, COOMe; R^3 = H, Me;
R^4 = OH, Ph, 4-MeC_6H_4, 4-MeOC_6H_4, 4-$Me_2NC_6H_4$, 2-MeOC_6H_4, 2-ClC_6H_4, фур-2-ил, тієн-2-іл;
R^5 = H, Me_2N, піролідин-1-іл, піперидин-1-іл, морфолін-1-іл; R^6 = H, Me, Ph, 4-MeC_6H_4;
Ar = Ph, 4-MeC_6H_4, 4-ClC_6H_4, 4-BrC_6H_4; X = CH, N

The newly synthesized compounds (**2**, **3**, **5**, **6** and **7**) were screened for their antitumor activity *in vitro*. 5-Sulfonyl derivatives (**6**) have shown the highest level of effective growth inhibition of tumor cells, cytotoxic and cytostatic action. The structure–activity relationship was determined.

УДК 54-185: 54.057: 544.169

Nanocomposites of electrically conductive polymers with metal oxides for ammonia and amines detection

S. Mikhaylov[1,2], A. Pud[1], N. Ogurtsov[1], J.-L. Wojkiewicz[2], N. Redon[2], P. Coddeville[2]

[1]*Institute of Bioorganic Chemistry and Petrochemistry, NAS of Ukraine,*
Chemistry of functional materials department
[2]*IMT Lille Douai, Sciences de l'Atmosphère et Génie de l'Environnement (SAGE)*

The study is concerned with the synthesis and investigation of properties of inorganic-organic conjugated polymers based hybrid materials with TiO_2 (rutile and anatase) and SnO_2 nanoparticles applicable for ammonia and amines detection. The direct polymer growth on the surface of nanoparticles allowed obtaining of nanocomposite materials with a "core-shell" structure which differed from simple mechanical mixture by a more uniform polymer distribution and stronger interaction between the source components.

The new approach to study of kinetics of aniline polymerization process by simultaneous RedOx and pH monitoring of reaction medium was proposed. For the first time, the influence of sulfonic acids and metal oxides on the aniline polymerization process and molecular characteristics of the obtained polymer was shown. For the first time, a linear correlation between the nanoparticles content and reciprocal duration of separate stages of polymerization was shown. The formed "core-shell" nanocomposites have a sensory sensitivity to ammonia and amines of about 2 times higher than the non-filled polymer. The new developed materials can be used in the manufacturing of chemiresistive sensors' active layers.

UDC 662.756.3+547.264+66.095.134

Transesterification of triglycerides by 1-butanol using alkaline catalyst

S.O. Zubenko, S.V. Konovalov, L.K. Patrylak, A.V. Yakovenko

Institute of Bioorganic Chemistry and Petrochemistry, NAS of Ukraine, Kyiv

Alkaline-catalyzed transesterification (TE) of triglycerides (TG) is additionally complicated by saponification, the rate of which escalates as the length of alcohol carbon chain increases. Intensive saponification during TE of TG by 1-butanol with the use of alcohol solutions of hydroxides and high temperatures results in low yields of fatty acids butyl esters (FABE). Saponification is caused by water contained in the reaction site. Even when absolute 1-butanol is used, water appears in the catalyst solution due to introduction of moisture-containing stock hydroxide and is formed as a result of chemical interaction of the latter with alcohol.

Saponification can be prevented by removal of water from the catalyst solution. This procedure was performed using distillation with subsequent separation of water from azeotropic mixture of 1-butanol and water in the Dean-Stark apparatus. This technique enabled us to obtain an alkaline catalyst concentrate containing potassium butoxide, on the basis of KOH and 1-butanol, with yields of alkoxide ranging between 80–85 %.

The resulting butoxide solution was used in TE of refined sunflower oil. We took such an amount of the concentrates, which contained 1.6 % of the alkaline catalyst (with reference to the initial KOH) relative to the oil mass. Temperature of the TE process was 15±1 °C, molar ratio 1-butanol : TG was 4,5 : 1, stirring time ranged between 1–120 minutes. The beginning of glycerol separation was fixed starting from the 3rd minute of stirring. After 1 day of settling of the reaction mixture, yields of FABE varied from 85 to 99 %, and separation into ester and glycerol layers occurred. Concentration of FABE in the former ranged between 77–88 %, whereas the latter contained no esters. The major part of alkaline catalyst migrated to the glycerol layer.

УДК 577.1+577.11+577.2+581.1

Study of growth regulating activity of [1,3]oxazolo[5,4-*d*]pyrimidine and N-sulfonyl substituted of 1,3-oxazole on cucumber plants

V. Kopich, V. Tsygankova, Y. Andrusevich, O. Shtompel

Institute of Bioorganic Chemistry and Petrochemistry, NAS of Ukraine,
Department for Chemistry of Bioactive Nitrogen-Containing Heterocyclic Compounds

Plant growth regulating activity of low molecular weight synthetic heterocyclic compounds – derivatives of [1,3]oxazolo[5,4-*d*]pyrimidine and N-sulfonyl substituted of 1,3-oxazole was studied. It was found that some tested compounds used at concentration 10^{-9}M/l of distilled water revealed high stimulating activity on growth of cucumber (*Cucumis sativus L.*) of cultivar Dzherelo during plant vegetation. The obtained biometric indexes of the 24st-day-old seedlings of cucumber grown on the water solution of heterocyclic compounds used at the concentration 10^{-9}M/l of distilled water were similar or higher of the biometric indexes of 24st-day-old seedlings of cucumber grown either on the distilled water (control) or on the water solution of auxin IAA used at the same concentration in average: at the 5–10 % – by number of germinated seeds, at the 14–23 % – by total length of seedlings, and at the 10–41 % – by total length of roots. It was shown also the positive effect of some most active synthetic heterocyclic compounds derivatives of [1,3]oxazolo[5,4-*d*]pyrimidine and N-sulfonyl substituted of 1,3-oxazole on activation of photosynthetic processes in the leaves of 24st-day-old seedlings of cucumber due to increase of synthesis of photosynthetic pigments in the plant cells; the content of chlorophyll *a* was increased in average at the 7–24 %; the content of chlorophyll *b* was increased in average at the 17–20 %; the content of chlorophylls *a*+*b* was increased in average at the 10–16 %; the chlorophylls *a*/*b* ratio was increased in average at the 10–27 %; the content of carotenoids was increased in average at the 12 % as compared with biometric indexes of control seedlings and seedlings grown on water solution with IAA, respectively. The relationship between chemical structure and plant growth regulating activity of tested compounds was found. The application in practice of agricultural biotechnology of synthetic low molecular weight heterocyclic compounds derivatives of [1,3]oxazolo[5,4-*d*]pyrimidine and N-sulfonyl substituted of 1,3-oxazole as new effective substitutes of phytohormones auxins for improving of growth of cucumber (*Cucumis sativus L.*) of cultivar Dzherelo is proposed.

Keywords: *Cucumis sativus L.,* plant growth regulating activity, auxin IAA, [1,3]oxazolo[5,4-*d*]pyrimidine, N-sulfonyl substituted of 1,3-oxazole

UDC 547.786.541.521.54.057

Synthesis and cyclization of the diallyl derivatives of arylsulfones of the isooxazole series

***O.V. Pavliuk*, Yu.V. Bezugly, V.I. Kashkovsky**

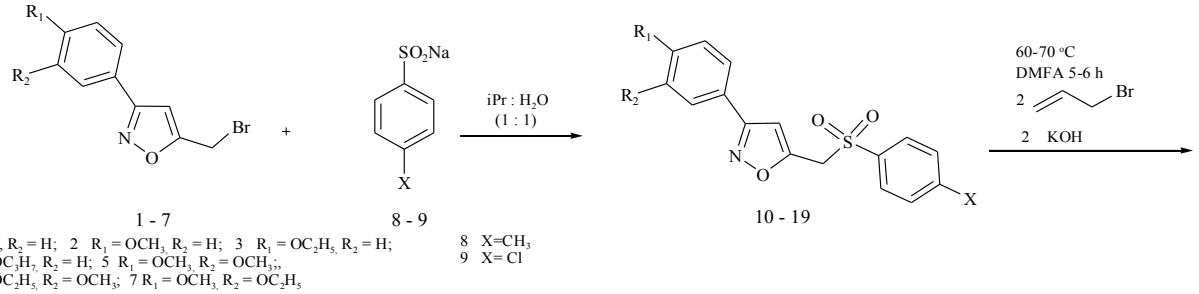
Institute of Bioorganic Chemistry and Petrochemistry, NAS of Ukraine,
Department of organic and petrochemical synthesis

The derivatives of isooxazole have recently attracted considerable attention of the researchers and from year to year their use as objects for pharmacological studies is growing. Among various isooxazole derivatives, the sulfoderivatives are presently one of the most well-known and intensively studied types of compounds.

On the other hand, increased interest in cyclopentane derivatives has been caused by the presence of cyclopentane fragments in molecules of various natural products (such as steroids, sesquiterpenes, pyrethroids, and prostaglandins), the characteristic feature of which is the fact that the cyclopentane ring is often a constituent part of complex ring systems, which transforms the conventional synthetic approaches to such compounds into a complex multi-step process.

In this paper we have studied the possibility of obtaining sulfones, molecules of which contain simultaneously isooxazolic, arylic, and cyclopentenic fragments, by ring-closing metathesis reactions (RCM).

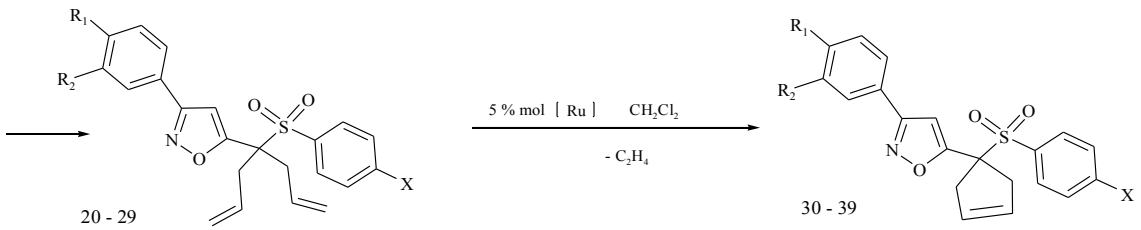
For this purpose, we have synthesized a number of new sulfones of the isooxazole series (10–19) via alkylation of sulfinic acids (8, 9) by bromo-derivatives (1–7) of sodium salts.



1 - 7 8 - 9 10 - 19

1 R_1 =H, R_2 = H; 2 R_1 = OCH_3, R_2 = H; 3 R_1 = OC_2H_5, R_2 = H;
4 R_1 = OC_3H_7, R_2 = H; 5 R_1 = OCH_3, R_2 = OCH_3;,
6 R_1 = OC_2H_5, R_2 = OCH_3; 7 R_1 = OCH_3, R_2 = OC_2H_5

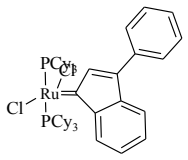
8 X=CH_3
9 X= Cl



20 - 29 30 - 39

10	20	30	R_1 =H, R_2 = H, X= CH_3
11	21	31	R_1 = OCH_3, R_2 = H, X= CH_3
12	22	32	R_1 = OC_2H_5, R_2 = H, X= CH_3
13	23	33	R_1 = OC_3H_7, R_2 = H, X= CH_3
14	24	34	R_1 = OCH_3, R_2 = OCH_3, X= CH_3
15	25	35	R_1 = OC_2H_5, R_2 = OCH_3, X= CH_3
16	26	36	R_1 = OCH_3, R_2 = OC_2H_5
17	27	37	R_1 =H, R_2 = H, X= Cl
18	28	38	R_1 = OC_2H_5, R_2 = H, X= Cl
19	29	39	R_1 = OCH_3, R_2 = OCH_3, X= Cl

[Ru] =



Alkylation of sulfones (10–19) was conducted by their interaction with 2.5 eq. allyl bromide in solutions of DMF in the presence of 3 eq. potassium hydroxide at the temperature of 65–70 °C for 5–6 hours. Diallyl derivatives (20–29) were obtained in 71–78 % yields.

Ring-closing metathesis reactions of the derivatives (20–29) were carried out in solutions of dry degassed dichloromethane in the atmosphere of dry argon at the temperature of 25–30 °C for 8–10 hours using a ruthenium-carbene catalyst ([Ru]) synthesized by us. Target cyclopentanes (30–39) were obtained in 63–85 % yields. The structure of all new compounds has been confirmed by the data of elemental analysis and ^{1}H NMR spectra.

Thus, for the first time, the possibility of combination of cyclopentenic, arylic, and isooxazolic fragments in a single molecule has been shown, and a number of new cyclopentenyl-containing sulfones of the isooxazole series have been synthesized.

Synthesis of halogenated multilayer nanosized carbon clusters by plasmochemical method

Ya.O. Bereznitsky, Ye.V. Polunkin, V.S. Pylyavsky, Ye.V. Sheludko

Institute of bioorganic chemistry and petrochemistry, NAS of Ukraine,
1, Murmans'ka Str., 02660 Kiev, Ukraine; Tel./Fax: (044)

Inversion of the catalytic action of exo-modified fullerenes in the processes of oxidation of organic compounds had been determined and the prospect of their use as high-performance additives for combustible and lubrication materials had been proved in earlier studies at IBCP NAS of Ukraine. The development and study of more affordable and cheap spherical nano-sized carbonyl clusters of the fullerene type – CNOs (carbon nano onions) – attract the greatest interest.

Several types of spherical carbon nanoclusters have been isolated and investigated. The ideal CNOs have been synthesized from nano-diamonds (2–10 nm), which are carbon spheres nested within each other with a central fullerene structure (C_{60}) and a distance between the shells of 0.34 nm. However, the real structure of CNOs is not consistent with the ideal model.

One of the common methods for obtaining spherical nanocarbon materials (CNOs) is the plasma-chemical method.

In the synthesis of CNOs by high-frequency discharge-pulse method, a non-equilibrium plasma is created owing to the high frequency of short-wave high-voltage impulses-discharges of a kilohertz band in the environment of gaseous hydrocarbons. In this case, maintenance of high gradients of temperatures and pressures (the necessary conditions for nano-carbon synthesis) is achieved by high rate of input of energy to the plasma channels.

The non-equilibrium plasma generated by discharges with a kilohertz frequency of repetition, allows to involve sufficiently large volumes of gas in the process of synthesis, that is, to exert a volumetric effect (energy pumping) on the gas medium.

Gases from the homologous series of alkanes C_nH_{2n+2} (sp^3-hybridization), alkenes C_nH_{2n} (sp^2-hybridization) and alkynes C_nH_{2n-2}, in particular, acetylene (sp-hybridization), can be used as a starting material for obtaining nanocarbon materials. Experimental data indicate that degree of hybridization of bonds in raw material molecules influences the yield of final synthesis products.

We are the first to propose and use halogenated alkanes $C_nH_mHal_x$ as a starting material for the synthesis of nano-sized spheroidal carbonic clusters.

When using Freon R-134a (CF3CH2F), fluorinated carboxylic spheroidal nanoclusters were obtained. Dimensions, structure, chemical composition and morphology of the nanoparticles obtained were confirmed by methods of atomic force and electron microscopy, elemental analysis, Raman and IR spectroscopy.

УДК 542.97:547.1

Hybrid acid-base nanocatalysts of fructose hydrolysis process

D.V. Molodyi

Institute of bioorganic chemistry and petrochemistry of the NAS of Ukraine,
Department of Catalytic Synthesis

Hybrid acid-base nanocatalysts on the basis of phosphoric-molybdenum and phosphoric-tungsten heteropolyacids (HPA) with lysine, inside the mesoporous space of the silicate carrier were obtained.

The interaction of HPA with a silica skeleton and lysine was studied by IR spectroscopy. It was shown that when the HPA is applied to a silicate substrate, a new intensive band appears at 962 cm^{-1}. This band is characteristic of the Keggin structure in heteropolyacids. It was determined that during the HPA-SiO_2-lysine interaction, the deformation of both the Keggin's anion and the silicate skeleton occurs.

Hydrolysis of fructose on the synthesized heterogeneous catalysts shown that the formation of 5-hydroxymethylfurfural (5-HMF) under hydrothermal treatment with the same temperature depends on the reaction time, with the maximum yield of 5-HMF reaching 12 % when the reaction time makes up 10 h. This indicates that they can sufficiently effective synthesize 5-HMF together with other compounds at a temperature of 90 °C in an aqueous medium.

УДК 661.719.2:665.12.621.892

Synthesis, properties and applications of nitrogen-containing surfactants on the basis of oils

O.I. Safronov, G.S. Pop

Institute of Bioorganic Chemistry and Petrochemistry, NAS of Ukraine

One of the priority directions of solution to the problem of energy and resource conservation in conjunction with the ecological balance preservation is the transition from fossil to reproducible plant and animal raw materials, in particular, to technical oils and fats. However, triglycerides of fatty acids, which are the basis (95–98 %) of these substances, have low thermal oxidation stability of ester and double bonds, which limits their common use.

To eliminate the double bonds, we carried out the epoxidation of acyl residues of unsaturated acids with subsequent nucleophilic introduction of amines both to the epoxy ring and to the carbonyl group. In the process of synthesis it was established that elongation of the hydrocarbon chain of amines by a carbon atom requires an average increase in the temperature of the reaction mixture by 5–10 °C with simultaneous increase in the duration of the process by 0.5 hours. The introduction of metal hydroxides as catalysts can reduce the temperature and the reaction duration by 20–30 °C and 4–5 hours, respectively.

The transamination of technical rapeseed oil with high content of the erucic acid by ethanolamines in the presence of calcium oxide at 120–125 °C resulted in a complex homogeneous mixture of surfactants, in which ethanolamides exhibited high surface activity, and acylglycerol acids and calcium glycerol phosphatides ensured stability of the oleodispersed systems.

A series of invert emulsions and plastic greases was developed with the use of synthesized surfactants. It was shown that owing to the surface activity, the synthesized surfactants are effective emulsifiers-stabilizers of disperse systems, while owing to high protective and antioxidant properties they can serve as effective polyfunctional additives to lubricants.

It was found that the developed inverted emulsions and lubricants are resistant to corrosion-active factors and can be characterized by improved antioxidant properties, are thermostable and can be used under harsh conditions with elevated temperatures.