GEORGIAN TECHNICAL UNIVERSITY

ASSOCIATION OF PROFESSIONAL CHEMISTS OF GEORGIA

# SECOND INTERNATIONAL CONFERENCE OF YOUNG CHEMISTS

# ICYC - 2012


**April 21-23, 2012**
**Tbilisi, Georgia**

www.chemistry.ge/conferences/icys-2012

# Wellcome!

Organizing committee is please to announced that Second International Conference of Young Scientists – "Chemistry Today" will be held on April 21-23, 2012 in Tbilisi, Georgia.

Conference is organized by Professional Association of chemists of Georgia and Faculty of Chemical Technology and Metallurgy of the Georgian Technical University.

The meaning of chemistry is very important in everyday life. It plays a central role in permanently growing and widening chemical industry as well as in such fields as health care, nutrition, environment protection, energy sector, transport, etc.

The goal of present conference is finding many opportunities to exchange scientific views and ideas as well as promotion joint collaborations.

Our understanding of material world and of the fact how chemistry solves lots of actual modern problems depends on our knowledge, responsibility and ability of application of discoveries.

Achievement of these goals, in the first place, is related to the future of chemical science – the young generation of scientists who must stand in the forefront of new discoveries and innovative researches.

In the work of the conference we would be glad to see the chemical companies as participant or guests.

Finally, once again we cordially invite all of you to join the vital and fruitful discussion in all fields of modern chemistry.

Inga Lomadze

Chairman of Conference

## Organizers

Georgian Technical University

Association of Professional Chemists of Georgia

Young Chemists Club of Georgia

Conference Scheduler

## SESSIONS OF THE CONFERENCE

### SESSION A – April 21, 20112

***13.30-13.50.***

Evaluation of Dibenzothiophene Metabolism by Corynebacterium Variabilis Sh42 as a Degrader for Poly Aromatic Sulfur Heterocyclic Compounds

**Sherif A. Younis, Nour Sh. El-Gendy, Yasser M. Moustafa**
Egypt

***13.50-14.10.***

Study of Different Bioremediation Processes for Water Contaminated with Petroleum Hydrocarbons in Batch Flasks System

**Sherif A. Younis, Nour Sh. El-Gendy, Yasser M. Moustafa**
Egypt

***14.10-14.30.***

Synthesis of New Amino Derivatives and Heterocyclic Systems on the Basis of Condensed Furo[3,2-D]Pyrimidines.

**A. Hovakimyan, S. Sirakanyan, A. Noravyan**
Armenia

***14.30-14.50.***

Study of Deuterium Exchange of Protons in Azine Systems

**A. Tumanyan, A. Danagulyan, A. Boyakhchyan, G. Danagulyan**
Armenia

***14.50-15.10.***

Reduction of Nitrile Group in Pyrrolidinecarbonitriles
**G. Harutyunyan, M. Alexanyan, S. Gasparyan**
Armenia

## SESSION B- April 21, 20112

***16.00-16.20***.

Azodye-Containing Polarization-Sensitive Materials
**I.Chaganava, G. Kakauridze, B. Kilosanidze**
Georgia

***16.20-16.40.***

Separation of Enantiomers of Chiral Dihydropyridine Derivatives Using Polysaccharide-Based Chiral Columns in HPLC with the emphasis on the enantiomer elution order

**G.Jibuti, A. Mskhiladze, N. Takaishvili, M. Karchkhadze, L. Chankvetadze,T. Farkas, B. Chankvetadze**
Georgia

***16.40-17.00***.

Synthesis some of dipeptydes on the base of isocyanides via ugi reaction

**U. Kazmaier, T. Bukia, D. Zurabishvili, Sh. Samsoniya**
Georgia

***17.00-17.20.***

Condenced Pentacyclic Systems Containing Imidazole and Triazole on the Basis of Dibenzothiophene

**E. Kalandia, N. Gakhokidze**
Georgia

***17.20-17.40.***

Effective way to obtain food fiber by Membrane methods technology

**N.Davitadze, I. Bejanidze**
Georgia

## SESSION C- April 22, 20112

***9.30-9.50.***

The Mathematical Description for the “Polythio- phene Paradox” for Insoluble Polymers in the Presence of Surfactants

**V.Tkach, V. Nechyporuk , P. Yagodynets’, O.Slipenyuk**
Ukraina

***9.50-10.10.***

Electrochemical polymerization of heterocyclic compounds and two methods to describe it he presence of surfactants

**V.Tkach, V.Nechyporuk, P.Yagodynets’, Yu. Meslyuk, B.Chayka, Al.da Rocha**

Ukraina ,Brazil

***10.10-10.30.***

Blackberry (Rubus Caucasicus Focke) Phenol Compounds

**M. Diasamidze, M. Vanidze, A. Kalandia**
Georgia

***10.30-10.50.***

The Anthocyanins of Grapes

**E. Tsetskhladze, I. Jafaridze, E.Qamadadze**
Georgia

***10.50-11.10.***

The Biologically Active Compounds of Honey

**M.Kharadze, I. Djafaridze, E.Qamadadze**
Georgia

# Oral Presentations

# THE MATHEMATICAL DESCRIPTION FOR THE "POLYTHIOPHENE PARADOX" FOR INSOLUBLE POLYMERS IN THE PRESENCE OF SURFACTANTS

**V. Tkach, V.Nechyporuk, P. Yagodynets', O. Slipenyuk**

Chernivtsi National University
volodya@llanera.com

Polythiophene (PT), being one of the most used conducting polymers, attracts more and more attention [1-3]. It was first conducting polymer to gain its commercial use. Moreover it is easy to be modified for specific applications [1].

It can be synthetized either chemically, or electrochemically, but, despite of numerous advantages of electrosynthetized PT, the electropolymerization of thiophene encounters some difficulties.

One of them is known as "the polythiophene paradox". It is possible for thiophene itself and its derivatives, substituted with electronodonoric groups. Its polymerization potential is very high (+2,03 V comparing to the saturated calomel electrodes) due to its high resonance energy, whereas its overoxidation potential is in the same potential range (a little bit more, equal or even lower). It was described in [2], that both overoxidized and electrosynthetized polyehiophenes contained carbonile groups and the yield of the resulting PT was decreased to 60%. This was caused by irreversible degradation of PT.

The electropolymerization of PT in surfactant matrix usually resolves the problems of the polymer stability, because it can limit the chain propagation. But sometimes the polythiophene paradox succeeds even in the presence of them.

This phenomena, certainly, manifests itself in electrochemical instabilities, occurring while the electrooxidative polymerization of thiophene. It's necessary to build the mathematical model of this process to explain them in terms of the most probable mechanism of temporal evolution of this system.

The mathematical model, that describes this system, is represented as

$$\begin{cases} \dfrac{dc_t}{dt} = \dfrac{2}{\delta}\left( r_{-1} - r_1 + \dfrac{D}{\delta}\left(c_{t,bulk} - c_t\right)\right) \\ \dfrac{d\Theta_t}{dt} = \tilde{A}_{t,\max}\left(r_1 - r_{-1} - r_2\right) \\ \dfrac{d\Theta_p}{dt} = \tilde{A}_{p,\max}\left(r_2 - r_3\right) \end{cases}$$

In which $C_t$ stands for the thiophene concentration in the pre-surface layer, $\Theta_t$ for the thiophene coverage, $\Theta_p$ – the polythiophene coverage, in which In which $r_{-1}$ and $r_1$ are thiophene adsorption and desorption rate, $r_2$ is the polymerization rate and $r_3$

is the polythiophene degradation rate, $c_{t,bulk}$ stands for the thiophene bulk concentration, $\tilde{A}_{t,\max}$ and $\tilde{A}_{p,\max}$ stand for maximal surface concentrations of thiophene and polymer.

The stable steady-state conditions were found using the Rauss-Gurwitz criterium. The oscillatory instability conditions are also found and we conclude that they can be caused by attractive adsorbate-adsorbate interactions, and also anodic oxidation of strong reducents forming during the electropolymerization (it also deals with the concurrence between the reactions of formation and oxidative degradadation of polythiophene).

**References**


[1] E. Mackenzie Peters. Thes. Part. Fulf. M.Sc. Ottawa (1987)
[2] Krische B, Zagorska M// Synth. Met. 28(1989)
[3] Roncali J.; Chem. Rev., 92(1992), 711

# SYNTHESIS OF NEW AMINO DERIVATIVES AND HETEROCYCLIC SYSTEMS ON THE BASIS OF CONDENSED FURO[3,2-*D*]PYRIMIDINES

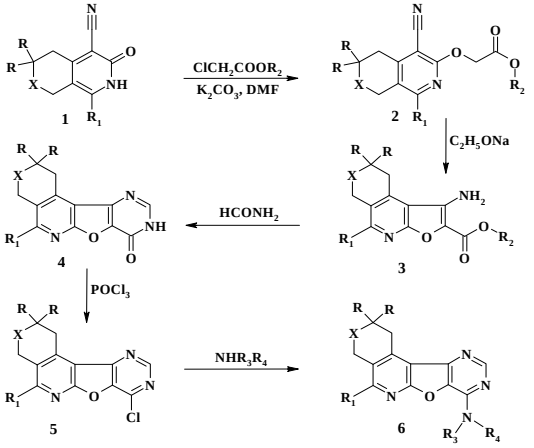
**A. Hovakimyan, S. Sirakanyan, A. Noravyan**

The Scientific and Technological Centre of Organic and Pharmaceutical Chemistry NAS RA,
Institute of Fine Organic Chemistry
anush.hovakimyan@gmail.com

Recently we have reported on synthesis of condensed furo[3,2-*d*]pyrimidines on the basis of pyrano[3,4-*c*]pyridines [1,2]. The present work is the continuation of our previous studies in this field.

The goal of our investigations was the synthesis of new biologically active heterocyclic compounds. We used 3-oxohexahydroisoquinolines **1** and 6-oxotetrahydropyrano[3,4-*c*]pyridines **1** as starting compounds, which were converted into the corresponding 8-chloro derivatives of condensed furo[3,2-*d*]pyrimidines **5**, under the similar conditions previously described by us [1,2] shown in the scheme 1. Reaction of the chlorides **5** with functional substituted amines led to the required new 8-amino derivatives of condensed furo[3,2-*d*]pyrimidines **6** (scheme 1).

scheme 1

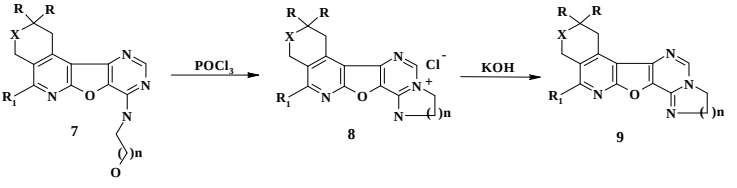



It is known from literature that condensed derivatives of imidazole and pyrimidine have a wide range of biological activities such as antidepressive activity [3], anti-platelet aggregation activity [4,5], antipsychotic activity [6]. Thus, we have decided to prepare the new heterocyclic compounds which have the above mentioned rings.

Imidazo[1,2-*c*]pyrimidines and pyrimido[1,2-*c*]pyrimidines **9** were synthesized from

the hydroxylamino derivatives of condensed furo[3,2-*d*]pyrimidines **7** as shown in the scheme 2. Cyclization of the latters **7** with phosphorus oxychloride gave corresponding imidazo[1,2-*c*]pyrimidinium and pyrimido[1,2-*c*]pyrimidinium chlorides **8**, which were isolated and identified. Then treatment of pyrimidinium salts **8** with potassium hydroxide gave the final products **9**.

scheme 2




**n = 1, 2**
**X = $CH_2$, R = R = H, X = O, R = R = $CH_3$, $R_1$ = alkyl, aryl, $R_2$ = $CH_3$, $C_2H_5$**
**$R_3$ = H, $R_4$ = alkyl, aryl, cycloalkyl, $R_3$ = $R_4$ = cycloalkyl**

The synthesized four new heterocyclic systems provide great perspectives to the discovery of a novel biologically active compounds.

**References**


[1] S. N. Sirakanyan, A. A. Hovakimyan, A. S. Noravyan, Chemical Journal of Armenia, 64 (2011), 3, 401-410.

[2] S. N. Sirakanyan, E. G. Paronikyan, M. S. Ghukasyan, and A. S. Noravyan, Chem. Het. Comp., 6 (2010), 736-741.

[3] T. Hirota, K. Sasaki, Y. Tashima and T. Nakayama, Chem. Het. Comp., 28 (1991), 263-267.

[4] K. Sasaki, T. Arichi, H. Ohtomo, T. Nakayama, and T. Hirota, Chem. Het. Comp., 33 (1996), 1663-1669.

[5] T. Nagamatsu, K. Kinoshita, K. Sasaki, T. Nakayama and T. Hirota, Chem. Het. Comp., 28 (1991), 513-515.

[6] H. A. DeWald, N. W. Beeson, F. M. Hershenson, L. D. Wise, D. A. Downs, T. G. Heffner, L. L. Coughenour and T. A. Pugsley, J. Med. Chem., 31 (1988), 454-461.

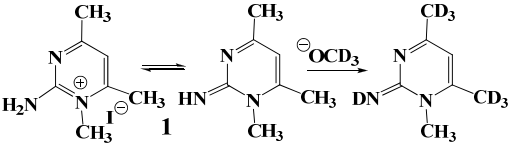
## STUDY OF DEUTERIUM EXCHANGE OF PROTONS IN AZINE SYSTEMS

**A. Tumanyan, A. Danagulyan, A. Boyakhchyan, G. Danagulyan**

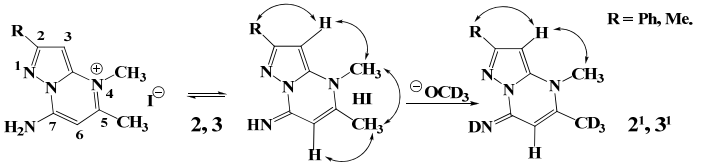
The Scientific Technological Centre of Organic and Pharmaceutical Chemistry NAS RA
Institute of Organic Chemistry
araks.tumanyan@gmail.com

It is known that methyl groups in some heterocyclic systems are able to enter into a reaction of basic [1, 2] or acidic [3-5] deuterium exchange. The basic exchange of hydrogen atoms of alkyl groups proceeds by the carbanion mechanism, the slow stage of which is proton tearing off by the base followed by stabilization at the expense of deuterium addition [6-8]. Similar studies on some mono- and bicyclic pyrimidine systems were previously carried out in our laboratory [9, 10].

Based on already known data, to reveal possible directions of the attack of the nucleophilic particle on the molecule of 1,2-dihydro-2-imino-1,4,6-trimethylpyrimidine hydroiodide (**1**), we have conducted $^1$H NMR spectral research in deuteronmethanol in the presence of $CD_3ONa$. The control experiment showed that in the spectrum, obtained in deuteromethanol ($CD_3OD$) without addition of deuterated sodium methylate, signals of all protons (except NH proton subjected to the exchange) were detected. Whereas in NMR spectrum registered after addition of $CD_3ONa$, the basic deuterium exchange of protons of only C-methyl groups of pyrimidinium salt proceeded easily, quantitatively, and what is more important – selectively. 77-84% decrease in the signal integral of protons of $C_6$-methyl group and 30-70% decrease of that of $C_4$-methyl group was observed for 1-5 minutes. Both signals of C-methyl groups disappeared within several hours at room temperature. It is important to note that the signals of protons of 5-H pyrimidine ring and N-methyl group were retained (i.e. did not disappear) up to the end of the experiment.



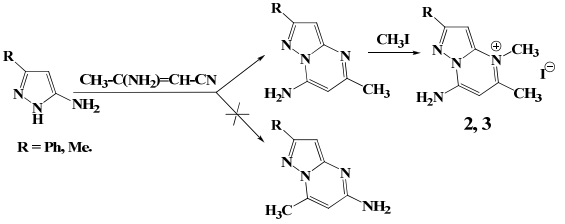

Similar exchange under the action of $CD_3ONa$ was also observed in spectra of annealed pyrimidines. Thus, in $CD_3ONa/CD_3OD$ solution the dynamics of changes in spectra of 2-substituted 7-amino-4,5-dimethylpyrazolo[1,5-a]pyrimidinium iodides (**2** and **3**) containing phenyl and methyl groups in the azole ring was studied. The basic deuterium exchange was shown to affect protons of only $C_5$-methyl group of pyrimidine. 3-H and 6-H protons (of pyrazol and pyrimidine rings), those of methyl group of quaternized nitrogen atom, as well as of substituents in the five-member cycle ($C_6H_5$ , $CH_3$) were not subjected to deuterium exchange.




The position of the methyl group subjected to isotope exchange was unambiguously determined by NOESY two-dimensional spectroscopy. In particular, in spectra of $2^1$ and $3^1$ compounds isolated after deuterium exchange no nuclear effects of NOE between methyl groups N-Me and C5-Me as well as between C5-Me and 6-H present in the NOESY spectra of non-deuterated compounds **2** and **3** were observed. In spectrum of $\mathbf{3^1}$ (R=Me) cross-peaks between protons of $C_2$-Me methyl group and 3-H, as well as between 3-H and N-Me were present. This was confirmed by the deuterium exchange in $C_5$-Me of the pyrimidine ring but not in the methyl group of pyrazol. Thus, deuterium exchange of the methyl groups of the pyrimidine ring is a specific marker of the most electrophilic position of the molecule on which the nucleophilic attack is directed.

Deuterium exchange in compounds $\mathbf{1^1}$-$\mathbf{3^1}$ was also confirmed mass-spectrometrically. In particular, by the presence of peaks 177, 178, 179 and 180 of the appropriate ($M^+$+1), ($M^+$+2), ($M^+$+3) and ($M^+$+4) in mass spectrum of compound $\mathbf{3^1}$.

Synthesis of the investigated bicyclic models was carried out by interaction of the appropriate 3-aminopyrazols with 3-aminocrotononitrile followed by methylation by methyl iodide. Position of the amine group in pyrazolo[1,5-a]pyrimidine was proved by NMR spectra according to NOESY method based on spectra of alkylation products **2** and **3**.




Disappearance of signals of NH protons and C-methyl groups of the pyrimidine ring in NMR spectra as well as appearance in mass spectra of peaks exceeding mass of the molecular ion of the initial compounds proved basic deuterium exchange of protons of the registered groups. It is possible with the attack by $CD_3O^-$ ion on NH and methyl groups followed by carbanion formation stabilized by deuterium addition. Naturally, similar formation of carbanions, as well as of a negative charge on exocyclic nitrogen atom also occurred in non-deuterated alkali or alcoholate solutions where it can compete or even completely prevent the attack of the nucleophilic particle in the course of nucleophilic recyclizations of pyrimidine

systems.

The phenomenon of selective deuterium noted by us will undoubtedly become an important tool in studying the structures of various azines and if necessary, in targeted isotope exchange in heterocyclic systems.

**References**


[1] A.F. Pozharskii, V.A. Ozeryanskii, E. A. Filatova, Chem. Heterocycl. Compd. (2012), # 1, p. 208.

[2] L.M. Mironovich, V.K. Promonenkov. 1,2,4-triazines. In the book “The results of science and technology”, Series of “Organic Chemistry”, Vol. 22 (1990), p. 6.

[3] D.V. Kovalevsky, A.B. Permin, I.V. Perminova, D.V. Konnov, V.S. Petrosyan, Vestnik. Moskovskogo Universiteta. Ser. 2. Chemistry, Vol. 40 (1999), # 6, p. 375.

[4] Juan-Miguel del Amo, Uwe Fink, Bemd Reif. Journal of Biomolecular NMR, Vol. 48(2010),#4, p. 203.

[5] J. M. Mc Andless, R. Stewart, Canadian Journal of Chemistry, Vol. 48 (1970), p. 263.

[6] N. N. Zacepina, I. F.Tupicin, L. S. Efros – J. Org. Chem. (Russ), Vol. 34 (1964), p. 4065.

[7] N. N. Zacepina, I. F.Tupicin, L. S. Efros – J. Org. Chem. (Russ), Vol. 34 (1964), p. 4073.

[8] B-Nowak-Wydra, M. Szafran, J. Org.Chem., Vol.48 (1983), p. 2327.

[9] M.G. Zalinyan, G.G. Danagulyan, N.G. Balasanyan, Chem. J. of Armenia, Vol. 39 (1986), #10, p. 661.

[10] G.G. Danagulyan, M.G. Zalinyan, R.S. Sagitullin, Chem. Heterocycl. Compd. (1987), # 7, p. 996.

## REDUCTION OF NITRILE GROUP IN PYRROLIDINECARBONITRILES

**G. Harutyunyan, M. Alexanyan, S. Gasparyan**

The Scientific and Technological Centre of Organic and Pharmaceutical Chemistry of NAS RA, Yerevan
goharhk@mail.ru

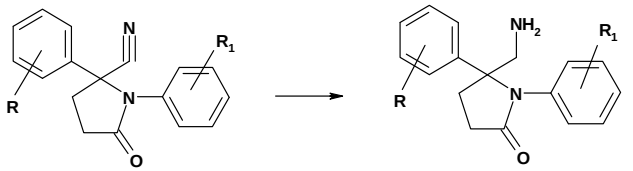
The development of selective and universal methods for reduction of functional groups plays an important role in organic chemistry. Sodium borohydride is a mild reducing agent with high selectivity. The combination of sodium borohydride with cobalt, nickel, iridium, osmium, zirconium, copper, platinum, titanium, and rhodium halides has been employed to reduce functional groups such as nitriles, amides, and olefins, which are inert to sodium borohydride alone.

On the other hand is well established that crown ethers accelerate reaction rates and induce high selectivity in reactions by the crown ether-activated anion species. Polyethylene glycol (PEG) is an excellent substitute for crown ethers. That's why it has been used as a co-solvent in the reduction of carbon-carbon triple or double bonds [1].

The use of metal complexes as catalysts with sodium borohydride significantly simplifies the process, making it suitable for extensive application [2-4]. It was shown, that in metal-complexes the selectivity of reduction depends on nature of the metal [5].

However, the ratio *reduced compound:metal salt:sodium borohydride - 1:2:10* is a major disadvantages of methods described above because of the large quantities of the reagents employed.

For reduction of nitrile group, we offer a new system with ratio of *reduced compound:sodium borohydride:PEG:$CoCl_2$ - 1:0.2:1:5*. By this system, synthesized substituted pyrrolidinecarbonitriles **1** [6] were reduced to corresponding aminomethylpyrrolidines **2** in methylene chloride at -5 - 0°C.




**1** **2**

**R = H , 4-iso-$C_3H_7O$ , 2,6-$Cl_2$ , 4-($C_6H_5CH_2O$) , 4-(2,6-$Cl_2C_6H_3CH_2O$) , 2-($C_6H_5CH_2O$) .**
**$R_1$ = H , 4-$CH_3$ , 3,5-$(CH_3)_2$ .**

This selective reduction system can be used for reduction of nitrile groups only. The advantage of offered method is in employment of small quantities of the reagents.

**References**


[1] N. Suzuki, Y. Kaneko, T. Tsukanaka, T. Nomoto, Y. Ayaguchi, Y. Izawa, Tetrahedron 41, (1985), pp. 2387-2392.
[2] T. Sorrell, P. Pearlman, J. Org. Chem. 45 (1980), pp. 3449-3451.
[3] E. Fleischer, M. Krishnamurthy, J. Am. Chem. Soc. 94 (1972), pp. 1382-1384.
[4] V. Madakyan, R. Kazaryan, A. Stepanyan, T. Kurtikyan, R. Boroyan, M. Ordyan, Arm. Khim. Zh., 38 (1985), pp. 386-390.
[5] A. Martirosyan, V. Hovhannesyan, S. Gasparyan, R. Ghazaryan, V. Madakyan, S.Mamyan, Chem. Heterocycl. Compd. 2 (2006), pp. 205-208.
[6] S. Gasparyan, Chem. J. Arm. 64 (2011), pp. 117-122.

## AZODYE-CONTAINING POLARIZATION-SENSITIVE MATERIALS

**I. Chaganava, G. Kakauridze, B. Kilosanidze**

Georgian Technical University, Institute of Cybernetics,
Laboratory of Holographic Recording and Processing of Information
cybernetics.ge@gmail.com

One of the most promising and unique optical methods for information processing and storage is the polarization-holographic method [1] with great potential of its application, because the information capacity of this method essentially increases when together with other characteristics of light the polarization state is taken into account and the additional parameters of information processing and coding appear: ellipticity, the direction of rotation and the azimuth of the polarization ellipse and also a degree of polarization that enables optical devices with unique, qualitatively new functions to be created by the methods of polarization holography.

In polarization holography special polarization-sensitive materials are used for recording the polarization state of light and in the recording process the corresponding anisotropy of optical parameters is induced in such materials under the action of polarized light. Among the materials with such properties the materials based on solid solutions of organic dyes in polymer matrices, as well as media with chemically covalent bonds between them (side-chain and main-chain azopolymers) have the best properties. The stable and dynamic azodye-containing polarization-sensitive materials has been developed and investigated by us [2].

The components molecular structure influence on the material photoanisotropic properties has been researched and also the photoanisotropy induction mechanism in such materials was carried out. The optimal conditions for obtaining and the optimal quantitative characteristics of the components of photoanisotropic materials were determined. It was revealed that the increase of the polarity of the components of the recording photoanisotropic material in most cases results in increasing the maximum possible level of achievable photoanisotropy in materials obtained on their basis [3].

The recommendations for the desired structural modification of the components have been developed and applied for purposefully synthesis of functional azodyes, on the basis of which a great number of materials with improved photoanisotropic properties was obtained (high-efficient, stable or dynamic, with high resistance to temperature and atmospheric moisture). The material in which the maximal value of effective photoanisotropy up to 100% can be achieved has been obtained by means of introducing a large quantity of ionogenic functional groups into the molecule of the chromophore component and by introducing the obtained dye into the polar polymer matrix.

The obtained polarization-sensitive materials were used for the recording of

polarization-holographic elements, which make it possible to carry out a complete analysis of the polarization state of light in real time and to operate in a wide spectral range [4]. The application of this element in the tasks of polarimetric remote sensing, in the creation of high-precision, portable, real-time polarization-holographic saccharimeter, in the creation of a polarization-holographic system of the high-level protection of important documents, securities and industrial products is considered. The application of dynamic polarization-sensitive materials for the demonstration of the possibility of the creation of all-optical commutator in optical communication systems on the basis of matrix of re-programmable dynamic polarization microholograms is also considered.

**References**


[1] Sh. Kakirchashvili, Polarization holography, Nauka Publish., Leningrad, 1989.
[2] B. Kilosanidze, G. Kakauridze, I. Chaganava, Appl. Optics, 48 (2009) 1861-1868.
[3] I. Chaganava, G. Kakauridze, B. Kilosanidze, SPIE Proc. Vol. 7957 (2011) 7957-14.
[4] G. Kakauridze, B. Kilosanidze, SPIE Proc. Vol. 7957 (2011) 7957-28.

# SEPARATION OF ENANTIOMERS OF CHIRAL DIHYDROPYRIDINE DERIVATIVES USING POLYSACCHARIDE-BASED CHIRAL COLUMNS IN HPLC WITH THE EMPHASIS ON THE ENANTIOMER ELUTION ORDER

**G. Jibuti[1], A. Mskhiladze[1], N. Takaishvili[1], M. Karchkhadze[1], L. Chankvetadze[1], T. Farkas[2], B. Chankvetadze[1]**

[1] I. Javakhishvili Tbilisi State University
[2] Phenomenex Inc
george.jibuti@gmail.com

Polysaccharide-based chiral stationary phases are most widely used for analytical and preparative scale separation of enantiomers [1-4]. Understanding of chiral recognition mechanisms by these materials is very important as for a design of new even more effective chiral selectors, as well as for optimization of separations with existing materials. Many attempts have been made in the past for getting some idea regarding the intermolecular interactions involved in analyte-selector interactions with polysaccharide derivatives [5-9]. Several instrumental techniques, as well as molecular mechanics calculations and statistical methods have been involved in these studies. Despite all of these efforts our current understanding of molecular mechanisms of chiral recognition by polysaccharide derivatives is very far from the status that would allow us to predict a separation result based on the structure of analyte, kind and composition of a mobile phase or any other separation condition, as well as to design new tailor-made materials.

Our strategy for understanding chiral recognition mechanisms of polysaccharide derivatives is to focus on unusual phenomena observed over the years in HPLC separation of enantiomers with these materials. To these belong the reversal of enantiomer elution order (EEO) depending on separation temperature [10-12], mobile phase modifier [9, 13-18], content of the given mobile phase modifier [9, 11] or small additives to the mobile phase [11, 18].

Chiral dihydropyridine derivatives represent rather large group of compounds many of which are used as $Ga^{2+}$ channel-blocking drugs [19]. The advantage of this group of chiral compounds for mechanistic studies is that the effect of fine differences in molecular structure of analytes on their chiral recognition can be studied with various chiral selectors and under various experimental conditions. Separation of enantiomers of chiral dihydropyridine derivatives are reported in many studies [20-23]. However, the EEO has not been studied in most of them.

In the present study separation of enantiomers of 5 different dihydropyridine derivative was studied on 5 polysaccharide-based chiral column under normal-phase, polar organic and reversed-phase conditions. The effect of small amount of formic acid additives on EEO was studied for all compounds on various columns and under various conditions.

As shown in this study the enantiomers of chiral dihydropyridine derivatives can be

resolved with the chiral columns under polar-organic, normal-phase and reversed-phase conditions. The enantiomer elution order of studied 5 compounds was the same in all 3 types of mobile phases. Elution order reversal for amlodipine depending on the content of formic acid in the mobile phase previously observed in acetonitrile-based eluents on some columns of Lux series was also confirmed under normal-phase conditions but was not the case in aqueous (reversed-phase) mobile phase. Such a reversal of enantiomer elution order was not the case for any other dihydropyridine studied for any column or mobile phase.

**References**


[1] Tachibana, K., Ohnishi, A., J. Chromatogr. A 2001, 906, 127-154.
[2] Yamamoto C., Okamoto Y., Bull. Chem. Soc. Jpn. 2004, 77, 227-257.
[3] Peng, L., Farkas, T., Jayapalan, S., Chankvetadze, B., J. Chromatogr. A 2010, 1217, 6942-6955.
[4] Ikai T., Okamoto Y., Chem. Rev. 2009, 109, 6077–6101.
[5] Chankvetadze, B., Chankvetadze, L., Sidamonidze, Sh., Kasashima, E., Yashima E., Okamoto, Y., J. Chromatog. A 1997, 787, 67-77.
[6] Yamamoto, C., Yamada, K., Motoya, K., Kamiya, Y., Kamigaito, M., Okamoto, Y., Aratani, T., J. Polym. Sci., Part A: Polym. Chem. 2006, 44, 5087-5097.
[7] Yamamoto, C., Yashima, E., Okamoto, Y., Bull. Chem. Soc. Jpn. 1999, 72, 1815-1825.
[8] Yamamoto, C., Yashima, E., Okamoto, Y., J. Am. Chem. Soc. 2002, 124, 12583-12589.
[9] Ma, S., Shen, S., Lee, H., Eriksson, M., Zeng, X., Xu, J., Fandrick, K., Yee, N., Senanayake, C., Grinberg, N., J. Chromatogr. A 2009, 1216, 3784–3793.
[10] Balmer, K., Lagerström, P.-O., Persson, B.-A., Shill, G., J. Chromatogr. A 1992, 592, 331-337.
[11] Chankvetadze, L., Ghibradze, N., Karchkhadze, M., Peng, L., Farkas, T., Chankvetadze, B., J Chromatogr A 2011, 1218, 6554-6560.
[12] Aranyi, A., Ilisz, I., Pataj, Z., Szatmari, I., Fülöp, F., Peter, A., J. Chromatogr. A 2011, 1218, 4869-4876.
[13] Okamoto, M., J. Pharm. Biomed. Anal. 2002, 27, 401-407.
[14] Okamoto, M., Nakazawa, H., J. Chromatogr. 1991, 588, 177-180.
[15] Balmer, K., Persson, B.-A., Lagerström, P.-O., J. Chromatogr. A 1994, 660, 269-273.
[16] Dossou, K. S. S., Chiap, P., Servais, A.-C., Fillet, M., Crommen, J., J. Pharm. Biomed. Anal. 2011, 54, 687-693.
[17] Wang, F., O'Brien, T., Dowling, T., Bicker, G., Wyvratt, J. J Chromatogr A 2002, 958, 69–77. [
[18] [18] Dossou, K.S.S., Edorh, P.A., Chiap, P., Chankvetadze, B., Servais, A.-C., Fillet M., Crommen, J., J Sep Sci 2011, 34, 1772-1780.
[19] Goldmann, S., Stoltefuss, J., Angew. Chem. Int. Ed. Engl. 1991, 30, 1559-1578.
[20] Inotsume, N., Nakano, M., J. Biochem. Biophys. Meth. 2002, 54, 255-274.
[21] Okamoto, Y., Aburatani, R., Hatada, K. Honda, M., Inotsume, N., Nakano, M., J. Chromatogr. 1990, 513, 375-378.
[22] Chankvetadze, B., Chankvetadze, L., Sidamonidze, Sh., Yashima, E., Okamoto, Y., J. Pharm. Biomed. Anal. 1996, 14, 1295-1303.
[24] Fu, Q., Matsunaga, H., Haginaka, J., Anal. Sci. 2001, 17, 897-900.

## SYNTHESIS SOME OF DIPEPTYDES ON THE BASE OF ISOCYANIDES VIA UGI REACTION

**U. Kazmaier[2], T. Bukia[1], D. Zurabishvili[1],**

**Sh. Samsoniya[1]**

[1]I. Javakhishvili Tbilisi State University
[2] Saarland University
t.bukia@yahoo.com

Peptides play a crucial role in fundamental physiological and biochemical functions of life. For decades now, peptide research is a continuously growing field of science.

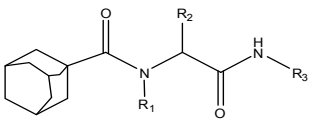
Peptides (proteins) are present in every living cell and possess a variety of biochemical activities.They appear as enzymes,hormones,antibiotics, receptors, etc.

Synthetic peptides may be useful in structure-function studies of polypeptides, as peptid hormones and hormone analogues, in the preparation of cross-reacting antibodies, and in the design of novel enzymes.[1]

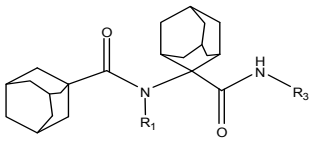
It is know that The adamantine line organic compound because of wide spectrum of pharmacological activity are used widely in the medicine and presence of adamantane radicals in molecules of medicinal preparations, enhances their activity and depresses the toxicity

It is know a lot of synthetic methods to obtain Peptides, but developments in isocyanide based multicomponent reactions is more interesting [2]. In that way the adamantane containing peptides which are obtained via Ugi-reaction is less studied [3]. Therefore, new developments for the synthesis of adamantane containing new peptides and study of its properties are of a great interest.

The aim of the research is to synthesis of adamantane containing new dipeptides by using aminoadamantane, adamantanone and adamantane carbocylic acide, in which 1-2 structure was obtained**.**




1




2

$R_1$=$C_6H_5CH_2$; $C_6H_5$; n-$C_4H_9$; Ad; $R_2$=i-$C_3H_7$; $C_4H_9$; $R_3$=$CH_2$-$COOC_2H_5$; $C_6H_5$;

The structure of the products was established by NMR and Mass-spectra date.

Acknowlegment: The designated project has been fulfilled by financial support of the Shota Rustaveli National Science Foundation *(Grant #YS/60/6-420/11*). We also want to thank the Deutsche Akademische Austauschdienst (DAAD) for supporting

the partnership and the exchange program between the Ivane Javakhishvili Tbilisi State University and the Saarland University.

**References**

[1] Peptide Guide. (2007-2011) http://www.peptideguide.com/
[2] A. Domling. Recent Developments in Isocyanide Based Multicomponent Reactions in Applied Chemistry. Chem. Rev. 106 (2006**)**, pp 17-89
[3] M. Oikawa, M. Ikoma and M. Sasaki.. Tetrahedron Letters 46 (2005),pp 415-418

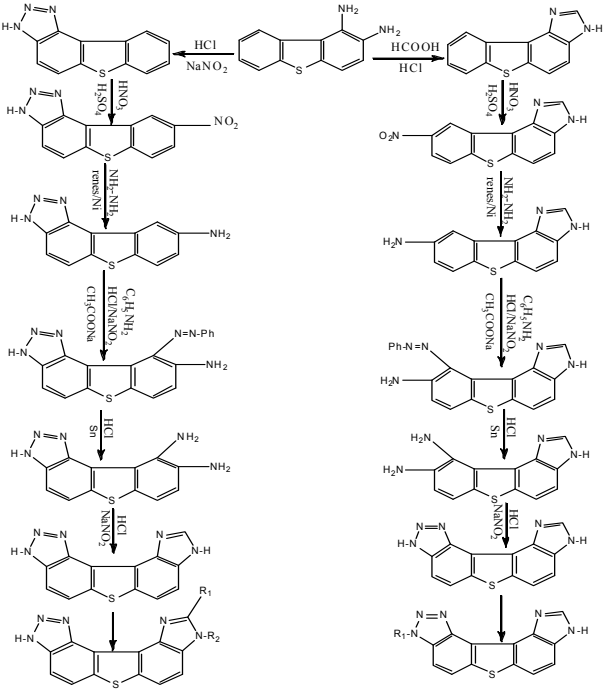
## CONDENCED PENTACYCLIC SYSTEMS CONTAINING IMIDAZOLE AND TRIAZOLE ON THE BASIS OF DIBENZOTHIOPHENE

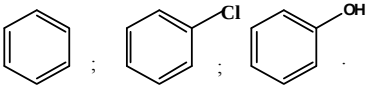
**E. Kalandia, N. Gakhokidze**

Georgian Technical University
caca8408@mail.ru

It is a well-known fact that among the methods of creating new remedies, chemical modification of the physically active molecule is one of the most important approach. Chemical modification also means the unification of biologically active molecules in one molecule which in most cases is followed by the change in insensity or spectrum in biological activity .The subject of our scientific research is to create condenced pentacyclic heterocyclic systems which will unite the molecules of imidazole,triazole and dibenothiophene.Such heterocyclic systems aren't described yet and thus are interesting from the point of view of biological activity.Moreover, each heterocycle is characterized by quite a high level of biological activity.

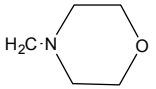
The goal of our work is to get heterocycles,benzothiophene-benzimidazole and benzothiophene-benzotriazole from 1,2-diaminodibenzothiofene.Pentacyclic heterocyclic systems among them.

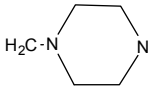





R1= $CH_3$; $C_2H_5$; $COCH_3$; $CH_2Cl$; $CH_2OH$

R2= $CH_2N(CH_2CH_3)_2$




$R_1$, $R_2$ can have a significant influence on the biological activity of these structures.

**References:**

[1] Pozharsky A.F, Anisimova V.A, Tsupak V.A "Practical Works in The Chemistry of Heterocycles" Rostov 1988

[2] М. Майсурадзе, Т. Хоштария, Л. Курковская, Н. Гахокидзе Синтез первых представителей новой гетероциклической системы-бензо[b]тиено[3,2-e]бензимидазолов. ХГС 2008-8. с 1267

## EFFECTIVE WAY TO OBTAIN FOOD FIBER BY MEMBRANE METHODS TECHNOLOGY

**N. Davitadze, I. Bejanidze**

Shota Rustaveli State University
irina_bejanidze@live.ru

Abstract: In this paper we propose a new efficient and free from the use of reagents technology of pectin from the waste of juice, which uses the techniques of membrane technology, in particular, to obtain isolates of pectin - electrodialysis for the concentration – UF. Acid and base solutions will be obtained from natural water by electrodialysis method will be used to get pectin from juice production waste. Pectin isolates will be prepared, their precipitation by different chemical reagents will be done, optimal mode of preconcentration by electrodialysis and ultrafiltration methods will be studied (electrical parameters, process productivity dependence on pressure, membrane type and pore size, isolate nature, concentration, acidity, temperature, filtration time in static and dynamic mode in straight and circulated flow conditions).

Dietary fiber, due to its versatility, today is one of the most popular and most widely used food ingredients. On the one hand, the fiber is used as processing aids, changing the structure and chemical properties of food products, with another – dietary fiber are excellent functional ingredients that can have a beneficial impact both on individual systems of the human body, and on the whole body. For a long time, fiber was considered ballast material in the diet, from which sought to release the products to improve their nutritional value, so treat them both by professionals and ordinary consumers have been negative. It was believed that dietary fiber has no value to the body, and even slow down the digestion. XX century brought radical changes in lifestyle and in the structure of power, when it created the so-called theory of adequate nutrition, which focused its attention on ballast substances. At the same time in Japan, emerging trend of healthy eating, which has received support, both in Europe and America. According to these new ideas, a group of dietary fiber combines the substances as vegetable, animal and mineral origin, or received their modification, which can positively regulate metabolic processes. Scientific studies have shown that dietary fiber is good for the body and includes polysaccharides, oligosaccharides, lignin and associated plant substances.

In this paper we propose a new efficient and free from the use of reagents technology of pectin from the waste of juice, which uses the techniques of membrane technology, in particular, to obtain isolates of pectin - electrodialysis for the concentration – UF.

Preconcentration of pectin isolates will be done by membrane methods: electrodialysis and ultrafiltration. Acid and base solutions will be obtained from natural water by electrodialysis method. Hydraulic and electrical parameters of electrodialysis plant will be studied: Hydraulic flow in the working chambers, power

strength and density, voltage, solution flow velocity and plant productivity depending on all the factors above. Different schemes of obtaining acid and base by ion-exchange and bipolar membranes will be studied. Acid and base concentration and pH dependence on power strength and density, water flow velocity, salinity, circulation time and productivity will be determined. Optimal scheme and parameters of process will be established, acid and base analysis will be done.

Obtained acid and base will be used to get pectin from juice production waste : Pectin isolates will be prepared (squeeze), their precipitation by different chemical reagents will be done (calcium chloride, citrate, ethanol, acetone, oxalic acid), optimal mode of preconcentration by electrodialysis and ultrafiltration methods will be studied (electrical parameters, process productivity dependence on pressure, membrane type and pore size, isolate nature, concentration, acidity, temperature, filtration time in static and dynamic mode in straight and circulated flow conditions).Conditions of pectin excretion from isolates depending on following factors will be studied: wastes shredding quality, acid and base concentration, precipitant type, concentration and number, temperature and heating duration of isolate, pectin precipitation time.

The proposed technology is the selection of dietary fiber from plant material, will address important issues such as environmental- the problem of waste, economic and most importantly, to obtain high quality fiber – pectin with therapeutic and preventive properties.

Conclusion**.** In the project following problems are solved: Electrodialysis optimal technological and hydraulic schemes of plant; Optimal technological mode of concentration of pectin isolates by ultrafiltration; Conditions of obtaining high ester pectin and samples; Optimal terms of obtaining pectin isolates; Optimal mode of obtaining acid and alkali simultaneously in electrodialysis plant; Optimal conditions for pectin extraction from pectin isolates concentrates obtained by electrodialysis method; Optimal conditions for pectin extraction from pectin isolates by traditional (chemical) methods; Obtaining concentrated solutions of acid and alkali by electro-dialysis method; Optimal technological mode of concentration of pectin isolates by ultrafiltration method; Optimal modes for clarification and concentration of pectin extracts by cavitation method; Optimal conditions for pectin extraction from pectin isolates concentrates obtained by ultrafiltration method; Pectin samples appropriate to standarts; Concentrate of pectin isolate and pectin samples obtained by ultrafiltration appropriate to standarts; By processing wastes and using pectin important ecological, economical and social problems will be solved:

In terms of scientific and technological progress: complex technology of obtaining ecologically clean pectin from the fruit and vegetable industrial processing waste, reagent-free and by modern membrane technologies;

Economical: The preliminary technical and economic study shows that counting all the capital and experiment expenses, 1kg of pectin obtained from juice production

waste will cost 8$ (instead of 12$), medical pectin- 40-50$ (instead of 80-90$).

Social:

Development and technical modernization of agricultural complex processing industry has national importance; Environment polution problem will be solved by processing industrial waste Natural plant pectin obtained from waste can be used as food additives in food products which have prophylactic properties.

**References**

[1] J. F. Cotton, R. Smith, J. Chem. Thermodyn. vol (year) page range

## ELECTROCHEMICAL POLYMERIZATION OF HETEROCYCLIC COMPOUNDS AND TWO METHODS TO DESCRIBE IT

**V. Tkach[1], V. Nechyporuk , P. Yagodynets', Yu. Meslyuk, B. Chayka[2], Al. M. da Rocha[3]**

[1] Chernivtsi National University, Ukraine
[2]Bukovynean University, Chernivtsi, Ukraine
[3]Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
volodya@llanera.com:

The interest in conducting polymers has been increasing for the last 4 decades. It is very high, cause the conducting polymers are capable to combine the properties of plastics (light weight, tough, resiliency in shaping and corrosion stability) with metal conductivity

This gives the conducting polymers vast and rich spectrum of use, beginning with the corrosion protection coatings and ending with its use in sensors.

The electrochemical instabilities have been found to occur during their electrochemical synthesis and two mathematical models have been built to describe them mathematically. It was also found that the chain growth kinetics isn't responsible for the oscillatory behaviour in this system [1-4].

### References

[1] M.S.Ba-Shammakh, S.U.Rahman, M.A. Abul-Hamayel, R. Kahraman // AC 1 – Organic and Bioorganic electrochemistry general session. – Paris. – 27th of April – 2nd of May 2003. – No 2468
[2] K. R. Lemos Castagno. Tés. D. Sc. UFRS, Porto Alegre, 2007
[3] V.V. Tkach, V.V. Nechyporuk. Abstracts 6th Nanoscience and Nanotechnology conference. Istanbul, 2010
[4] V.V. Tkach, V.V. Nechyporuk, P.I. Yagodynets' and Yu. V. Meslyuk. Rev. Soc. Quím. Perú. V. 77 N. 4. – 2011

## BLACKBERRY (RUBUS CAUCASICUS FOCKE) PHENOL COMPOUNDS

**M. Diasamidze[1], M. Vanidze[2], A. Kalandia[3]**

Shota Rustaveli State University
mzia.diasamidze@yahoo.com

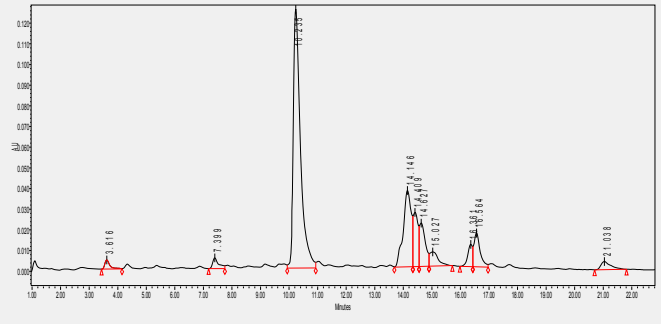
The flora of Georgia is very diverse, which is determined by the most ancient groups of plant species richness and a relic. Adjarian endemic flora occupy a special place in the name Rubus L. - a representative of the Blackberry - Rubus caucasicus Focke. Blackberry fruit is rich in biologically active compounds, antioxidants [1], which leads to its wide use for industrial purposes.

Despite intense research in the world of this family of plants [2-4], we have the available literature which shows that these surname plant in Georgia are practically not studied. In addition, given that the plant in different agro-ecological conditions of the biologically active substances of different raw materials and collects in the base is quite big, very important in terms of rational use of raw materials for its chemical research.

Our research aims to study in the Blackberry - Rubus caucasicus Focke fruit and leaves of biologically active phenol compounds, which are qualitative and quantitative analysis for sample extraction was 80% ethanol 70-80° C temperature conditions, anthocyanins if they extragents was acidified for hydrochloric acid (The conditions of -18°C). Quantitative determination of phenol compounds we used spectral method to extract the chemicals added: flavonols - aluminum chloride, leukoanthocyanidins - acidified butanol [5], catechins - vanillin chemicals [6], while the qualitative analysis of these compounds were carried out - a HPLC method [7]. HPLC analysis of flavonoids - Samples (20 µL) were analysed using a Waters HPLC system equipped with a model 525 pump, UV/Vis detector. Separation was carried out using a 4,6x150 Symmetry C 18 column (Waters Corp, Milford, MA, USA) with a 3,9 mmx20mm C 18 guard column. The mobile phase was a linear gradient of 5 % formic acid (A) band methanol (B) from 2 % B to 60 % B for 60 min at 1 ml $min^{-1}$. The system was equilibrated for 20 min at the initial gradient prior to each injection. Detection wavelengths used were 370 nm for flavonols. Flavonols were quantified as rutin equivalents.

Blackberry leaves from the tea preparation can be very useful, because it is rich in biologically active substances, which are mainly flavonols (3711,3±111,3 mg/100 g), and leukoanthocyanidins (105,1±3,1 mg/100g) and catechins (46,5±1,4 mg/100 g) a relatively small number. Blackberry fruit, along with significant quantities of these compounds contain anthocyans. When the fruit anthocyanins maximum accumulation of the fetus are changing green to 301,9 ±11,2 mg/100 g, in pink anywhere in the fetus 499,5±15,3 mg/100 g and a maximum of ripe black fetus in 1675,7±35,2 mg/100 g, suggesting to the consumer at full maturity.

| Sample name | | Flavonols mg/100 g 80% $C_2H_5OH$ | | Catechins mg/100g 80% $C_2H_5OH$ | | Leukoanthocyanidins mg/100 g 80% $C_2H_5OH$ | | Anthocyanins mg/100 g 3%HCl 40% $C_2H_5OH$ | |
|---|---|---|---|---|---|---|---|---|---|
| | | Raw weight | Dry weight | Raw weight | Dry weight | Raw weight | Dry weight | Raw weight | Dry weight |
| Blackberry | Unripe green fruit | 375,8±11,3 | 2086,2±62,6 | 13,43±0,4 | 70,8±2,1 | 30,8±0,9 | 162,4±4,9 | 54,5±1,6 | 301,9±9,0 |
| | Unripe Pink fruit | 208,7±6,3 | 1098,9±32,9 | 9,75±0,3 | 54,7±1,6 | 16,1±0,48 | 89,4±2,7 | 81,9±2,4 | 499,5±14,9 |
| | Ripe black fruit | 173,9±5,22 | 964,9±28,9 | 4,31±0,13 | 23,9±0,7 | 8,9±0,27 | 49,9±1,5 | 318,9±9,5 | 1675,7±50,3 |
| | Leaf | 1510,8±45,3 | 3711,3±111,3 | 18,87±0,6 | 46,5±1,4 | 42,7±1,3 | 105,1±3,1 | - | - |




Flavonoids HPLC revealed that the fetus in the dominant compound cyanidin-3-glucoside, the total content of 64.7%.

In conclusion we can say that the blackberry fruit anthocyanins accumulation of vegetation period, while flavonols, catechins and leukoanthocyanidins reduction occurs. Most of these compounds from the ripe fetus are anthocyanins, while the leaf flavonols.

**References**


[1] R. A. Moyer. K. E. Hummer, C. E. Finn, B. Frei, R. E. Wrolstad. J. Agric. Food Chem. 2002, 50, 519−525 519.

[2] Häkkinen, Sari. Medical Sciences 221. 2000. 90 p.

[3] N. M. A. Hassimotto, R. V. da Mota, B. R. Cordenunsi, F. M. Lajolo. Ciênc. Tecnol. Aliment., Campinas, 28(3): 702-708, 2008.

[4] I. Tosunl, N. Sule Ustunl, B. Tekgulerl. Sci. Agric. (Piracicaba, Braz.), v.65, n.1, p.87-90, 2008.

[5] Swain T.,Hillis W.E. J. sci food agric. 1959. 10.63.

[6] E. X. Botinov, A. A. Drenin, A.B. Makarova. Chemistry of vegetative raw materials. 2006. №1. p. 45-48.

[7] M. J. Cho, L.R. Howard, R. L. Prior, J. R. Clark. J.Science of Food and Agriculture. 84;1771-1782. 2004.

## THE ANTHOCYANINS OF GRAPES

**E. Tsetskhladze, I. Jafaridze, E. Qamadadze**

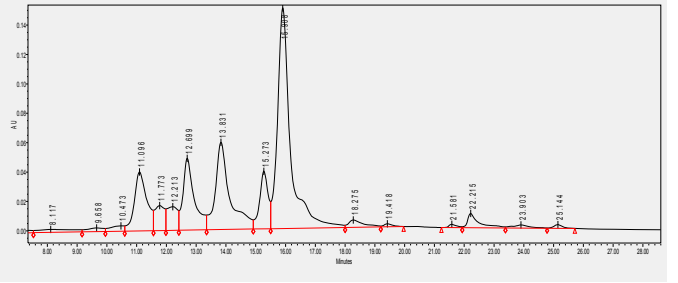
Shota Rustaveli State University
enu-88@mail.ru

There are 450 famous indigenous type of vines in Georgia from the world 4000 spacies vines, including 29 wine grape variety. Grape wine is produced in the most basic and precious product, which benefits the most important role in the evaluation of biologically active compounds - phenol compounds. Phenol compounds are present in the wine catechins, leukoanthocyanidins, anthocyanins, phenol carbonic acids, phenolic aldehydes and others. Phenol compounds involved in wine become out of date - maturing of oxidation - the process of restoring, suffer from condensation, interacting with other compounds of wine and a decisive influence on its taste, color, and transparency of bouquet. The quality of the wine grape varietal characteristics are also an important impact on soil - climatic conditions and its production technology.

Our aim was to study common of Georgia in grape variety and red wine is made from anthocyanins research. Qualitative research was conducted by the firm pigments waters- HPLC [1], and anthocyanins spectral quantitative research of method (on 528 nm ) Sample extraction was carried out with slightly ethyl alcohol on (-18)-(-20)0 C temperature.HPLC analysis of anthocyanins - Samples (20 µL) were analysed using a Waters HPLC system equipped with a model 525 pump, UV/Vis detector. Separation was carried out using a 4,6x150 Symmetry C 18 column (Waters Corp, Milford, MA, USA) with a 3,9 mmx20mm C 18 guard column. The mobile phase was a linear gradient of 5 % formic acid (A) band methanol (B) from 2 % B to 60 % B for 60 min at 1 ml min-1. The system was equilibrated for 20 min at the initial gradient prior to each injection. Detection wavelengths used were 510 nm for anthocyanins.

The research object presented Guria – Adjara's spread of red vine varieties: Aladasturi, Cheishvili, Chkhaveri, Kachichi. They are high quality red table wines, they do more abundantof crop than others. The grapes were picked in full maturity.

| Name of sample - Grains | Number of anthocyanins, mg/kg | |
|---|---|---|
| | Raw weight | Dry weight |
| Cheishvili | 327,0 ±9,81 | 1676,9±50,3 |
| Aladasturi | 389,7±11,7 | 2141,5±64,2 |
| Kachichi | 859,8±25,8 | 4194,4±125,8 |
| Chkhaveri | 250,56±7,5 | 986,4±29,6 |




HPLC chromatogram of anthocyanins

Anthocyanins HPLC revealed that the dominant compound was malvidin-3-glucoside (peak 16.9). Anthocyanins relatively large number of grain in the Kachichi's grain 4194,4±125,8 mg/kg less Aladasturi and Cheishvili, a small number of Chkhaveri (986,4±29,6 mg/kg). The ratio is represented by pigments in the wine and the corresponding wine color intensity, particularly in the Kachichi's wine it's 1765,1±52,9 mg/l, in the Aladasturi it's 544,4±16,3mg/l, in the Cheishvili it's 398,0±11,7 mg/l and 241,6±7,2 mg/l in the Chkhaveri's wine.

## References

[1] M. J. Cho, L.R. Howard, R. L. Prior, J. R. Clark. J.Science of Food and Agriculture. 84;1771-1782. 2004

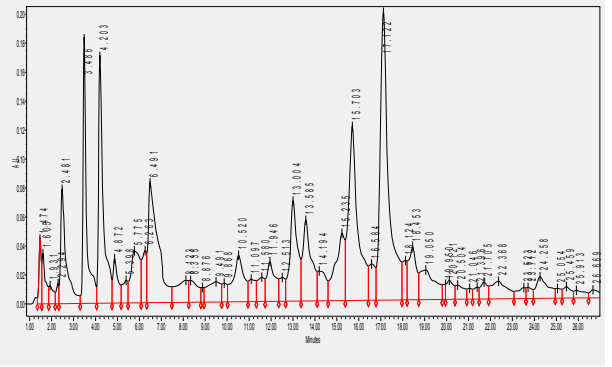
## THE BIOLOGICALLY ACTIVE COMPOUNDS OF HONEY

**M. Kharadze, I. Djafaridze, E. Qamadadze**

Shota Rustaveli State University
maixaradze88@mail.ru

Metabolism in the process of being, as well as oxidative and recovery processes, which are strictly balanced. As a result, there are many other factors, which aren't desirable, the balance is gradually being violated and there is excessive formation of free radicals, which are the basis for many diseases. Although the organism has the ability, but the existence of natural conditions such mechanism is very difficult battle with aggressors.Therefore it is necessary to supplement the food used to be antioxidants - a group of biologically active substances, which have the ability to halt or reduce the intensity of free radical oxidation. Antioxidant activity of honey with a plug, which is rich in biologically active substances - phenol compounds. Honey is the nectar of plants obtained from the product, according to its chemical composition depends on the features of the plant, as well as its distribution area .

The aim of our study consisted of honey harvested in the highlands of biologically active substances - phenol carbonic acids and compounds of the flavanols HPLC research method. HPLC analysis of flavonoids and phenolic acids - Samples (20 µL) were analyzed using a Waters HPLC system equipped with a model 525 pump, UV/Vis detector. Separation was carried out using a 4,6x150 Symmetry C 18 column (Waters Corp, Milford, MA, USA) with a 3,9 mmx20mm C 18 guard column. The mobile phase was a linear gradient of 5 % formic acid (A)band methanol (B) from 2 % B to 60 % B for 60 min at 1 ml $min^{-1}$. The system was equilibrated for 20 min at the initial gradient prior to each injection. Detection wavelengths used were 370 nm for flavonols and 280 nm for phenolic acids. Flavonols were quantified as rutin equivalents.



**HPLC chromatograme of honey (280 nm)**

Research has been undertaken in Adjara's variety of honey harvested in the valley. Samples for chromatography we've worked ethyl acetate or diethyl ether. We evaporeted and raised filtered in the solvent. A few are found with the chromatography nature flavonols compound, which are dominated by compounds peak - 3.486 min, peak – 4.203 min, peak – 11.122 min.

**References**

[1] K.Siddappa, M. Metre, T. reddy, M. Tambe and m. Gavanna. World journal of Chemistry 4(1): 15-20, 2009

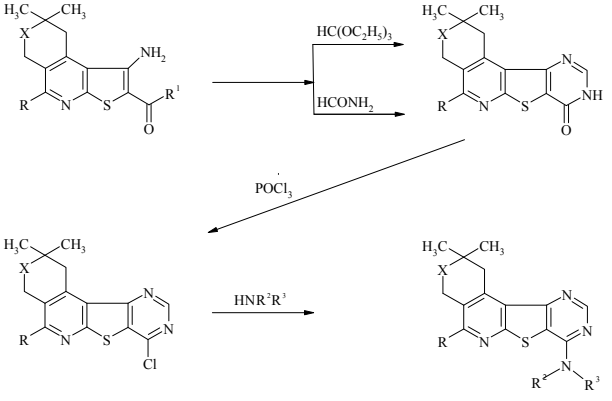
## Poster Presentations

## SYNTHENSIS OF CONDENSED AMINO DERIVATIVES OF TIENO[3,2-*D*]PIRIMIDINES

**Sh. Dashyan, E. Paronikyan, A. Noravyan**

A. L. Mnjoyan Institute of Fine Organic Chemistry The Scientific technological centre of Organic and Pharmaceutical chemistry NAS RA
Shdashyan@gmail.com

Derivatives of thieno[3,2-*d*]pyrimidines have attracted attention due to the high biological activity of these heterosystems [1,2]. We have developed methods for obtaining amino derivatives of thieno[3,2-*d*]pyrimidines, on the basis of condensed thieno[2,3-*b*]pyridines [3].




X=O, $CH_2$; R=morpholino, pyrrolidino; $R^1$=OEt, $NH_2$; $R^2$=$R^3$=H, alk, aryl, cycloalk.

### References

[1] PCT Int Appl wo 9924440
[2] J. Taltavull, J. Serrat, A. Gavalda, et. al., J. Med. Chem., 53, (2010) 6912-6922.
[3] E. G. Paronikyan, G. V. Mirzoyan, A. S. Noravyan, et. al., Kim.-farm. Zh., 31(10), (1997) 34-36.

# A SIMPLIFIED GREEN CHEMISTRY APPROACH TO THE SYNTHESIS OF CARBON-CARBON DOUBLE BONDS VIA KNOEVENAGEL CONDENSATION CATALYZED WITH $ZrOCL_2.8H_2O$

**M. Amirabedi[1], A. Akbari[2], B. Eftekhari-Sis[2]**

[1]Department of mechanics, Engineering branch, Islamic Azad University, Ajabshir, Iran,
[2]Department of Chemistry, Faculty of Science, University of Maragheh
aliakbari291@gmail.com

Green chemistry has now attained the status of a major scientific discipline and the studies in this area have led to the development of cleaner and relatively benign chemical processes with many new technologies being developed each year. The organic reactions in aqueous media have attracted much attention in synthetic organic chemistry, not only because water is one of the most abundant, cheap, and environmentally friendly solvents but also because water exhibits unique reactivity and selectivity, which is different from those in conventional organic solvents. Thus, development of novel reactivity as well as selectivity that cannot be attained in conventional organic solvents is one of the challenging goals of aqueous chemistry. Indeed, industry prefers to use water as a solvent rather than toxic and volatile organic solvents, particularly chlorinated hydrocarbons [1].

The Knoevenagel condensation, first reported in 1894 [2], is the synthesis of electrophilic olefins from active methylene and carbonyl compounds [3]. Many modifications have been made to this process in recent years using Lewis acid catalysis, ionic liquids, microwave irradiation, quaternary ammonium salts, heterogeneous catalysts, and organo-base mediation. However, in many of these methods relatively harsh conditions are required, expensive reagents are involved, or a combination of several additives is employed.

Due to their remarkably low toxicity, low cost, good stability, ease of handling and higher catalytic efficiencyin aqueous media, $ZrOCl_2.8H_2O$ have recently attracted much attention, to the best of our knowledge, this catalyst has not yet used in the Knoevenagel condensation. In continued of our work on organic transformations [4], [5], we have synthesized the carbon-carbon double bonds by Knoevenagel condensation of various aldehydes with Malononitrile, ethyl cyanoacetate, barbituric acid, malonic acid and dimedone in the presence of triethylamine and catalytic amount of $ZrOCl_2.8H_2O$ in aqueous media. The $^1$HNMR, $^{13}$C-NMR, IR, and mass spectra of the products were obtained. Figure1.

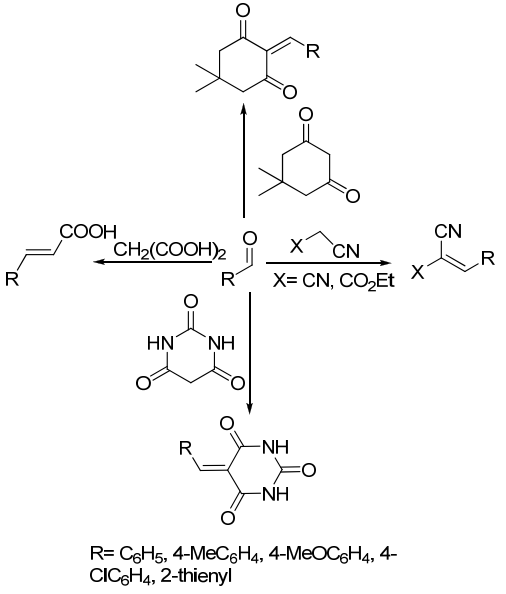



Figure 1

We are going to invistigate the mentioned reaction by $ZrOCl_2.8H_2O$ in solvent free condition as called Grind Chemistry and the results will be reported due course.

**References**


[1] Anastas, P.; Williamson, T. Green Chemistry, Frontiers in Benign Chemical Synthesis and Procedures; Oxford Science Publications: 1998.

[2] Knoevenagel, E. Chem. Ber. 1894, 27, 2345-2346.

[3] Jones, G. Organic Reactions, John Wiley & Sons: New York, 1967, Vol. 15, p 204.

[4] B. Eftekhari-Sis, M. Zirak, A. Akbari, M. M. Hashemi, J. Heterocycl. Chem. 2010, 47, 463-467

[5] B. Eftekhari-Sis, A. Akbari , M. Amirabedi. Chem. Heterocycl. Compd;2011 Vol. 46, No. 11, 1330-1334

# SYNTHESIS AND GROWTH STIMULANT ACTIVITY OF 4-AMINO-5-(3-ALKYL-4-METHYL-2-THIOXO-3H-THIAZOL-5-YL)-3H-[1,2,4]TRIAZOLE-3-THIONES DERIVATIVES

**A. Knyazyan[1], K. Eliazyan[2], V. Pivazyan, E.Ghazaryan[2], A. Yengoyan[1,2]**

[1]Armenian-Russian (Slavonic) State University
[2]State Agrarian University of Armenia
knyazyan86@inbox.ru

[1,2,4]Triazoles and thiazoles and their substituted derivatives occupy an unique position in heterocyclic chemistry due to their application in medicine, agriculture and industry. are As reported in the literature these derivatives possess a broad spectrum of biological activities such as antifungal, antimicrobial, hypoglycemic, antihypertensive, analgesic, antiparasitic, hypocholesteremic, antiviral, anti-inflammatory, antitumor, antitubercular, anticonvulsant and antidepressant properties [1-11]. There are known agrochemicals (herbicides, fungicides, pesticides, insecticides and growth regulators) containing [1,2,4]triazole and thiazole rings. [12-15]. At the same time the great practical interest is the synthesis of compounds with combination of two heterocycles that can leads to the appearance of new physiological properties in the novel undescribe systems.

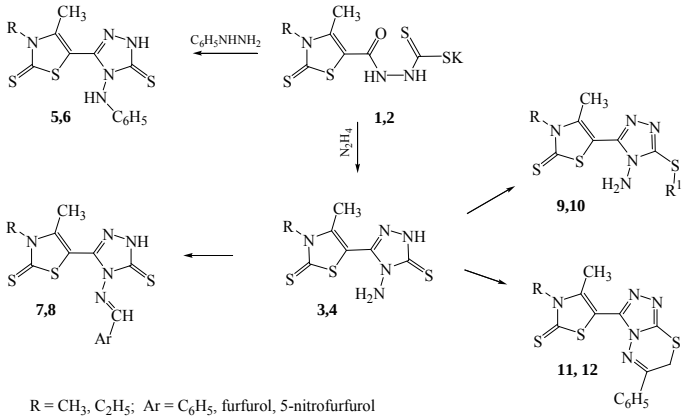
The purpose of the present research was to synthesize a new series of compounds, which molecules contain thiazole and 3-S- or 4-N-substituted [1,2,4]triazole cycles directly connected to each other, and study their physiological activity.

At boiling of mixture of potassium dithiocarbazates (**1,2**), of hydrazinhydrate (95%) in 1 mL of water for 2 h, the cyclization process is accured and 3-thioxo-4-amino-[1,2,4]triazole ring is formed (**3,4**). When boiling a mixture of potassium dithiocarbzates (**1,2**) and phenilhydrazin for 4 h corresponding 3-thioxo-4-phenylamino-[1,2,4]triazoles (**5,6**) were obtained.

The Schiff bases (**7,8**) were formed when the mixture of 3-thioxo-4-amino-[1,2,4]triazole derivatives (**2,3**),aldehyde, and conc.HCl in ethanol was boiled for4 h.

3-Sulfanyl derivatives (**9,10**) were obtained by the interaction of **3,4** with dimethylsulfate or other alkylating agents in the presence of potassium hydroxide in methanol solution at room temperature.

At boiling of mixture of 3-thioxo-4-amino-[1,2,4]triazole derivatives (**3,4**) and bromoacetophenon in ethanol for 4 h the [1,2,4]triazolo[3,4-b][1,3,4]thiadiazine system (**11,12**) was formed.



R = $CH_3$, $C_2H_5$; Ar = $C_6H_5$, furfurol, 5-nitrofurfurol

$R_1$ = $CH_3$, $CH_2CN$, $CH_2COOCH_3$, $CH_2CONH_2$, $CH_2$=CH-$CH_2$, $C_6H_5CH_2$, o,p-$Cl_2$-$C_6H_3OCH_2CH_2$

The preliminary biological screening indicates that some of synthesized compounds show simultaneously expressed fungicidal and grow stimulant activity.

## References


[1] H. Yuksek, O.Ucuncu, M.Alkan, Z.Ocak and S.Bahceci, Molecules vol. 10 (2005) pp. 961-970.

[2] R. Dulare, M.K.Bharty, S.K.Kushawaha, N.K.Singh, J.Mol.Struct. 985 (2011) pp. 323–329.

[3] P. K. Goyal, A. Bhandari, A. C. Rana, C.B. Jain, Ind. J. Chem Tech. Res. vol.2 (2010) pp. 1992-1997.

[4] H. Yuksek,S.Kolayli, M.Kucuk, M.O.Yuksek, U.Ocak, E. ahinbas,Ind. J.Chem. ol 45B (2006) pp. 715-718.

[5] R.J. Singh, and D.K. Singh, Eur. J. Chem. vol 7 (2010) pp. 37-40.

[6] O.Pintilie, L.Profire,V.Sunel, M.Popa ,A. Pui, Molecules vol 12 (2007) pp. 103-113.

[7] A. R. Farghaly, E.D.Clercq, and H. El-Kashefa, ARKIVOC vol x (2006) pp. 137-151.

[8] E. S. H. El Ashry, A. A. Kassem, H. Abdel-Hamid, F. F. Louis, Sh. A. N. Khattab, and M. R. Aouad, ARKIVOC vol xiv (2006) pp. 119-132.

[9] M.De Almeida, S. H. Cardoso, J. V. De Assis and V. N. Dw Souza, J. Sulfur Chem. vol 28 (2007) pp. 17–22.

[10] W. Tingting, B. Guifang, Z. Xin, Z.Qin, D. Hong, M. Wenke, S. J. Fang, Bioorg Med. Chem. Lett. vol 20 (2010) pp. 348–3351.

[11] I.Argyropoulou,A.Geronikaki,P.Vicini,F. Zanib, ARKIVOC vol vi (2009) pp. 89-102.

[12] Y. Ma, R. Liu, X. Gong, Z. Li, Q. Huang, H. Wang, abd G. Song, J. Agric. Food Chem. Vol. 54 (2006) pp. 7724-7728.

[13] Y. Sun, J. Wu, L.L. Feng, and M. W. Ding, ARKIVOC vol vii (2009) pp. 111-118.

[14] W. Tingting, B. Guifang, Z. Xin, Z. Qin, H. Yu, Q. Xue, D. Hong, M. Wenke, S. J. Fang, Bioorg. Med. Chem. Lett., vol20. (2010) pp. 3348–3351.

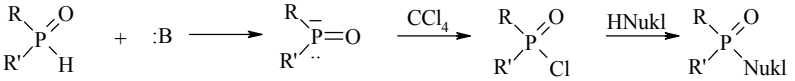
[15] B. A. Lakshman, and R. L. Gupta, Ind. J. Chem. vol. 49B (2010) pp. 1235-1242.

## PHOSPHORYLATION OF SEVERAL CH-ACIDS BY DIALKYLPHOSPHITES IN THE PRESENCE OF CARBON TETRACHLORIDE AND BASES

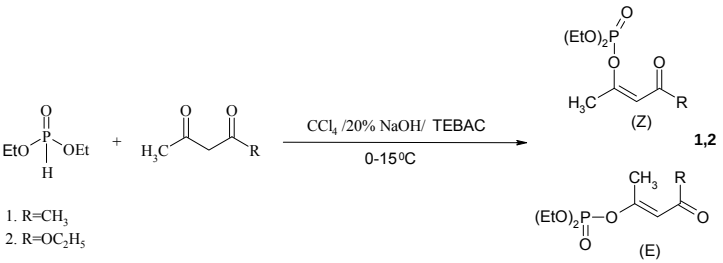
**V. Kirakosyan, G. Minasyan, V. Akopyan, M. Injikyan**

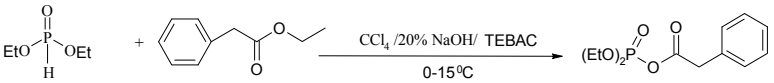
The Scientific Technological Centre of Organic and Pharmaceutical Chemistry NAS RA
virab.kir@rambler.ru

The phosphorylation of nucleophiles by dialkylphosphites and other neutral hydrophosphoryl compounds in the presence of carbon tetrachloride and bases at the present time are fully studied. This reaction opened and investigated by Todd and Atherton [1-3], probably, consists in the deprotonation of hydrophosphorylic compound under the action of base with the following transformation of the formed anion into the chloranhydride of the corresponding acid of pentavalent phosphorus. The last is acting as a the phosphorylating reagent towords to the selected nucleophile.




We have used the reaction of Todd - Atherton in the synthesis of some organophosphorus compounds with the use of CH-acids as the nucleophiles. Investigations showed that these ketoenol CH-acids are phosphorylated on the oxygen of acetic or ethoxycarbonyl group.




On the basis of NMR $^{1}$H spektral data compounds **1** and **2** are characterized as the mixture of Z and E – isomers in 85 % : 15 % and 75 %: 25 % ratio correspondingly.

The present investigation is undertaken with the purpose of further study of the chemical behavior of synthesized phosphates, which would make possible to pass from organophosphoru compounds to the heterocycles. Is it so? The further investigations should show.

The synthesized compounds are described by physical-chemical constants, and their structure is proven by IR, NMR $^{1}H$, $^{31}P$ spectral data. The purity of substances was controlled by the TLC method.

**References**


[1] F. R. Atherton, N. T. Openshaw, A. R. Todd. J. Chem. Soc., 1945, 660.
[2] F. R. Atherton, A. R. Todd. J. Chem. Soc., 1947, 674.
[3] F. R. Atherton, N. T. Noward, A. R. Todd. J. Chem. Soc., 1948, 1106.

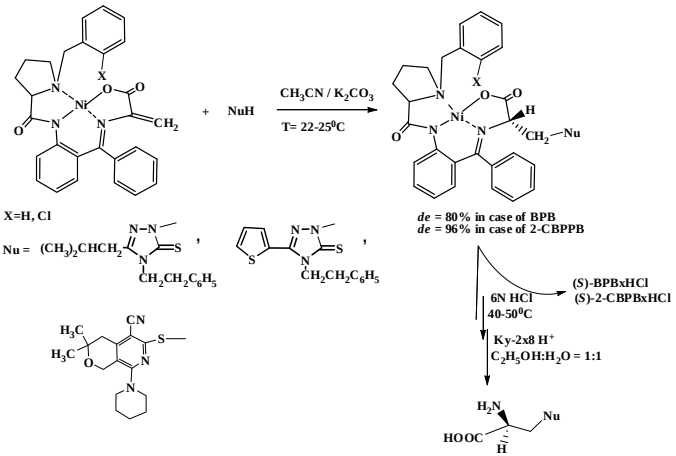
# ASYMMETRIC SYNTHESIS OF NEW HETEROCYCLIC SUBSTITUTED (*S*)-α-AMINO ACIDS

**H. Simonyan, A. Saghyan, L. Manasyan, S. Petrosyan, A. Geolchanyan**

Yerevan State University
hayarpi.simonyan@ysu.am

Purposeful synthesis of biologically and pharmacologically active chiral compounds is an important domain of modern biotechnology and bioorganic chemistry [1]. A special place among such compounds has non-proteinogenic α-amino acids which possess a wide physiological activity and present a special interest in pharmacology, medicine, microbiology and in various fields of science and technology [2].

Efficient high-selectivity method for asymmetric synthesis of new heterocyclic substituted amino acids (*S*)-β-[4-phenethyl)-3-izobutyl-5-thioxo-1,2,4-triazole-1-yl]-α-alanine, (*S*)-β-[4- phenethyl-3-(thiophene-2-yl)-5-thioxo-1,2,4-triazole-1-yl]-α-alanine and (*R*)-β-[3,3-dimethyl-5-cyano-8-(piperidine-1-yl)-3,4-dihydro-1H-pyrano [3, 4-c]pyridin-6-yl]cysteine was elaborated. The asymmetric addition of 4-phenethyl-5-izobutyl-4H-1,2,4-triazole-3-thiol, 4- phenethyl-5-(thiophene-2-yl)-4H-1,2,4-triazole-3-thiol and 6-mercapto-3,3-dimethyl-8-(piperidine-1-yl)-3,4-dihydro-1H-pyrano [3,4-c]pyridin-5-carbonitrile to the C=C bond of dehydroalanine moiety in $Ni^{II}$ complexes of Shiff's base with chiral auxiliaries (*S*)-2-N-(N'-benzylprolyl) aminobenzophenone and (*S*)-2-N-(N'-2-chlorbenzylprolyl)aminobenzophenone proceeded in $CH_3CN$ in the presence of $K_2CO_3$ of 25$^0$C (see Scheme).




The results shown, that the stereoselectivity of the reaction of nucleophilic addition in case of the complex containing Cl-atom at 2 position of Ph-group of N-benzyl prolyn moiety is incresed (up to 96%).

Heterocyclic substituted derivatives of (*S*)-α-alanine and (*S*)-α-cystein were isolated

with high optical purity (*ee*>99%) after decomposition of the mixture of the diastereomeric complexes and ion-exchange purification of the target amino acids.

The work has been carried out in the frame of ITC Project A-1677

**References**

[1] C. Cativiela and M. Diaz-de-Villegas, *Tetrahedron: Asymmetry.* vol 9 (1998), 3517-3599.
[2] M. Northa, *Synlett*. vol 1993 (1993), 807-820.

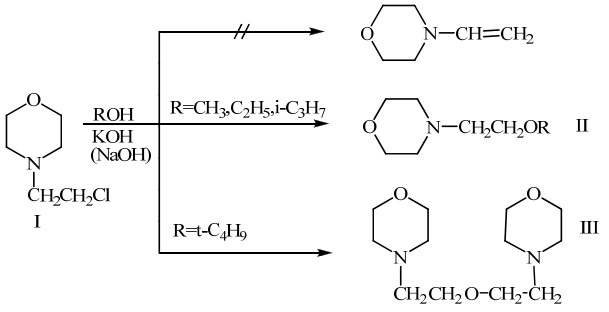
# THE BEHAVIOR OF 4-(2-CHLOROETHYL)MORPHOLINE IN THE ALCOHOLIC SOLUTIONS OF ALKALIS

**G. A. Baghdasaryan**

Armenian Institute of Applied Chemistry "ARIAK'', Artashat ave. 5/2, Yerevan, 0053 Armenia,
baghdasaryangayane@rambler.ru

The main method of synthesis of 4-vinyl morpholine is the direct vinylation of morpholine by acetylene at the high pressures and temperatures [1]. The alkalis are used as catalysts in the reaction.

Recently [2] we have shown the possibility of synthesis 4-(2-chloroethyl)morpholine (I) by direct alkylation of morpholine with 1,2- dichloroethane. The dehydrochlorination of the last could allow to obtain 4-vinylmorpholine without the use of explosive acetylene. The conversion of 4-chloroethyl)morpholine to 4-vinylmorpholine was meant to be realized by the treatment with alcoholic solutions of alkalis according to the following scheme:




However, as it was revealed, in all cases, independently from the nature of alcohol the reaction proceeds with the formation of corresponding morpholine ethers (II). The reaction of 4-(2-chloroethyl)morpholine in *tret*-butyl alcohol (considering that *tret*-butyl alcohol would prevent the formation of ethers [3]) leads to the formation of dimorpholinodiethyl ether (III).

## References

[1] V. P. Pivnenko // Chem. Het. Comp., 1971, Vol. 7, No. 8, p. 963.

[2] A. J. Markosyan, G. A. Baghdasaryan, G. P. Oganesyan, H. S. Attaryan, G. V. Asratyan // Rus. J. Gen. Chem., 2012, Vol. 82, No. 2, pp. 344–345.

[3] O. S. Attaryan, G. V. Asratyan, G. A. Eliazyan, G. A. Panosyan, F. S. Kinoyan, Darbinyan E. G. // Chem. Het. Comp., 1989, No. 4, pp. 414-420.

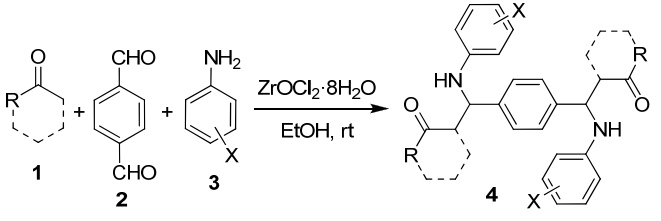
# $ZrOCl_2 \cdot 8H_2O$-CATALYZED STEREOSELECTIVE SYNTHESIS OF BIS-β-AMINO KETONES VIA MANNICH-TYPE REACTION OF 1,4-BENZENDICARBALDEHYDE

**B. Eftekhari-Sis[1], M. Saraei[2], M. Bonyad-Bagheri[2]**

Department of Chemistry, Faculty of Science, University of Maragheh[1]
Department of Chemistry, Payame Noor University[2]
eftekharisis@maragheh.ac.ir

β-Amino carbonyl compounds are attractive targets for chemical synthesis because of their privilege, wide utility as biologically active molecules [1]. The Mannich reaction is a classical method for the preparation of β-amino carbonyl compounds [1-2], and has been one of the most important basic reactions in organic chemistry for its use in natural product and pharmaceutical synthesis [3-7].

In continuation of our work on Mannich reaction [7, 8], in this paper we described a simple and environmentally benign method for the synthesis of bis-β-amino ketones **4** via three-component direct Mannich-type reaction of terephthalaldehyde (1,4-benzendicarbaldehyde) **2** with ketones **1** and aniline derivatives **3** in the presence of $ZrOCl_2 \cdot 8H_2O$ as catalyst in EtOH at room temperature (Scheme 1). A number of examples of the $ZrOCl_2 \cdot 8H_2O$-catalyzed direct Mannich-type reaction of **2** with cyclic ketones and anilines were investigated.




**Scheme 1:** $ZrOCl_2 \cdot 8H_2O$-catalyzed Mannich-type reaction of terephthalaldehyde **2** with ketones **1** and aniline derivatives **3**.

The *anti-anti* selectivity was determined by $^1$H NMR, using the intensity of the $H_a$ and $H_{a'}$ (Figure 1). It is well known that the chemical shift of $H_a$ and $H_{a'}$ signals in *syn* form was down-field shifted from that in the case of *anti* form [7]. For instance, in the $^1$HNMRspectrumof2,2'-{1,4-phenylenebis[(phenylamino)methylene]}dicyclo-

pentanone, the signals at δ = 4.46-4.50 ppm ($^3J$ = 6.1 and 5.8 Hz) are contributed by the *anti-anti* and *anti* center of the *anti-syn* isomers, while the one at 4.71-4.72 ppm ($^3J$ = 3.9 Hz) is contributed by the *syn* center of the *anti-syn* and (or) *syn-syn* isomers with low intensity.

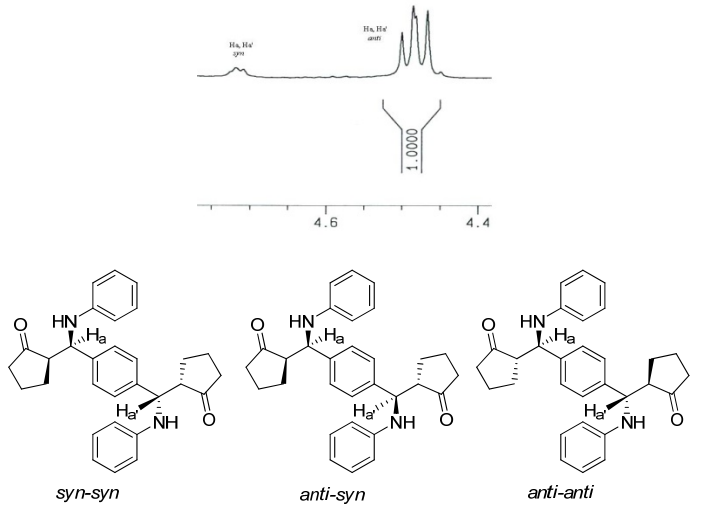
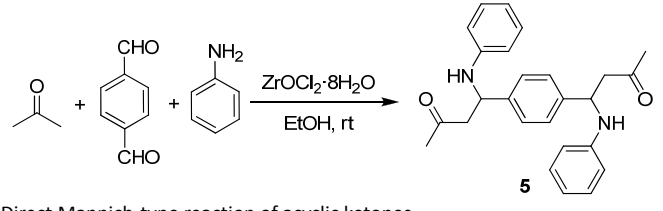



**Figure 1:** Identification of stereoselectivity by 1H NMR spectroscopy.

Also, Mannich reaction of terephthalaldehyde and aniline with acyclic ketone such as acetone in the presence of $ZrOCl_2 \cdot 8H_2O$ in EtOH at room temperature was investigated. When 3 equiv. of acetone was treated with 0.5 mmol of **2** and 2 equiv. of aniline under the Mannich reaction conditions, the corresponding bis-β-amino ketone, 4,4'-(1,4-phenylene)bis[4-(phenylamino)butan-2-one] **5**, was obtained in 75% yield (Scheme 2).

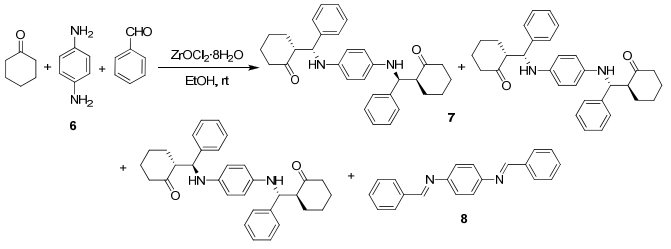



**Scheme 2:** Direct Mannich-type reaction of acyclic ketones.

As shown in Scheme 3, also, the synthesis of bis-amino ketones by the Mannich-type reaction of 1,4-phenylenediamine 6 was investigated, in which 3 equiv. of cyclohexanone was treated with 0.5 mmol of 6 and 2 equiv. of benzaldehyde in EtOH in the presence of 10 mol% of ZrOCl2·8H2O at room temperatureand2,2'-[1,4-phenylenebis(azanediyl)]bis(phenylmethylene)dicyclohe-

xanone 7 was obtained in 53 yield with 60% anti-anti selectivity.

The stereoselectivity was determined by 1H NMR spectra of the crude products mixture. In addition to Mannich adduct, the bis-imine 8 was determined in the reaction mixture using 1H NMR spectrum. The ratio of 7/8 was determined 40/60 using 1H NMR spectrum of the crud product mixture.




**Scheme 3:** Mannich reaction of 1,4-phenylenediamine **6** in the presence of $ZrOCl_2 \cdot 8H_2O$.

In conclusion, three-component Mannich-type reactions of terephthalaldehyde, anilines, and ketones are efficiently catalyzed by ZrOCl2·8H2O to afford bis-β-amino ketones in good to high yields. We have found that anti-anti selectivity was observed in the ZrOCl2·8H2O-catalyzed Mannich-type reaction of cyclic ketones and in-situ generated bis-imines in short reaction times, at room temperature in EtOH.

## References


[1] M. Arend, B. Westermann, N. Risch, Angew. Chem., Int. Ed. 37 (1998) 1044-1070.

[2] R. A. Volkmann, in *Comprehensive Organic Synthesis*; B. M. Trost, I. Fleming, Eds.; Pergamon: Oxford, Vol. 1 (1991) p 355.

[3] E. F. Kleinmann, in *Comprehensive Organic Synthesis*; B. M. Trost, I. Fleming, Eds.; Pergamon Press: New York, Vol. 2 (1991) Chapter 4.1.

[4] S. Kobayashi, H. Ishitani, Chem. Rev. 99 (1999) 1069-1094.

[5] S. Denmark, O. J. –C. Nicaise, in *Comprehensive Asymmetric Catalysis*; E. N. Jacobsen, V. Pfaltz, H. Yamomoto, Eds.; Springer: Berlin, Vol. 2 (1999) p. 93.

[6] R. Robinson, J. Chem. Soc. (1917) 762-768.

[7] B. Eftekhari-Sis, A. Abdollahifar, M. M. Hashemi, M. Zirak, Eur. J. Org. Chem. (2006) 5152-5157.

[8] M. Samet, B. Eftekhari-Sis, M. M. Hashemi, F. Farmad, Synth. Commun. 39 (2009) 4441-4453.

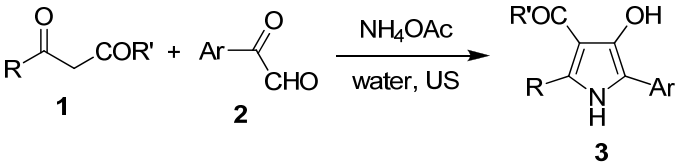
## EFFICIENT SYNTHESIS OF PYRROLES AND PYRIDAZINES IN WATER UNDER ULTRASOUND IRRADIATION

**B. Eftekhari-Sis, S. Vahdati**

Department of Chemistry, Faculty of Science, University of Maragheh
eftekharisis@maragheh.ac.ir

Pyrroles are important heterocycles broadly used in material science [1] and found in naturally occurring and biologically important molecules [2]. Pyrroles can be found in a tremendous range of natural products [3] and bioactive molecules [4], including the blockbuster drug, atrovastatin calcium [4a] as well as important anti-inflammatants [4b], antitumoragents [4c], andimmunosuppressants [4d]. Additionally, the pharmacological properties of pyridazine derivatives [5-7] continue to stimulate various interests in the development of novel pyridazine-directed chemical methodologies, in particular within the scope of combinatorial chemistry.

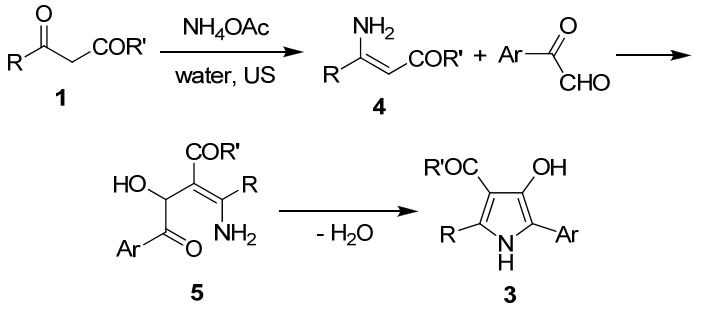
In this contribution, we report the one-pot synthesis of pyrroles **3** via reaction of 1,3-dicarbonyl compounds **1** with arylglyoxals **2** in the presence of excess amount of ammonium acetate in water under ultrasound irradiation (Scheme 1). Different 1,3-dicarbonyl compounds, such as acetyl acetone, ethyl acetoacetate, methyl acetoacetate, *t*-buthy acetoacetate and ethyl butyroacetat and different arylglyoxals such as phenylglyoxal and its 4-Br, 4-Cl derivatives were subjected to the reaction and afforded the corresponding pyrroles in short reaction time, in good to high yields.




R = Me, *n*-Pr
R' = Me, OMe, OEt, O*t*-Bu
Ar = Ph, 4-ClC$_6$H$_4$, 4-BrC$_6$H$_4$

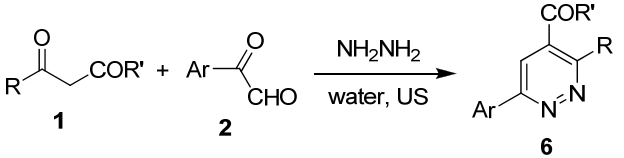
**Scheme 1: One-pot synthesis of pyrroles 3 under ultrasound irradiation.**

As illustrated in Scheme 2, the proposed mechanism, involve the in-situ generation of enamino ester **4** followed by nucleophilic attack to the aldehyde group of arylglyoxal. Then by condensation of amine **5** with ketone group and removing of a water molecule, the desired pyrrole derivatives were obtained.




**Scheme 2: The proposed mechanism of synthesis of pyrroles 3.**

Also, as shown in Scheme 3 the similar methodology was applied to construction of pyridazines **6** via reaction of 1,3-dicarbonyl compounds with arylglyoxals in the presence of excess amount of hydrazine hydrate in water under ultrasound irradiation. The pyridazines were obtained in a short reaction time in high yields.




R = Me, *n*-Pr
R' = Me, OMe, OEt, O*t*-Bu
Ar = Ph, 4-$ClC_6H_4$, 4-$BrC_6H_4$

**Scheme 3: One-pot synthesis of pyridazines 6 under ultrasound irradiation.**

In conclusion, we have described a green synthesis of pyrrole and pyridazine derivatives by reaction of 1,3-dicarbonyl compounds with arylglyoxals in the presence of ammonium acetate and hydrazine hydrate in water under ultrasound irradiation, respectively. Short reaction time, simple workup, high efficiency and good yields of products and using water as a green solvent of the reactions are some advantageous of this methodology.

## References

[1] (a) S. Higgins, Chem. Soc. Rev. 26 (1997) 247-257. (b) C. –F. Lee, L. –M. Yang, T. –Y. Hwu, A. –S. Feng, J. –C. Tseng, T. –Y. Luh, J. Am. Chem. Soc. 122 (2000) 4992. (c) K. Ogawa, R. C. Rasmussen, J. Org. Chem. 68 (2003) 2921-2928.

[2] B. A. Trofimov, L. N. Sobenina, A. P. Demenev, A. I. Mikhaleva, Chem. Rev. 104 (2004) 2481-2506.

[3] R. A. Jones, *Pyrroles, Part II*; Wiley: New York, 1992.

[4] (a) R. B. Thompson, FASEB J. 15 (2001) 1671. (b) J. M. Muchowski, Adv. Med. Chem. 1 (1992) 109. (c) P. Cozzi, N. Mongelli, Curr. Pharm. Des. 4 (1998) 181. (d) Fürstner, R. B. Thompson, FASEB J. 15 (2001) 1671.
[5] C. G. Wermuth, J. J. Bourguignon, G. Schlewer, J. P. Gies, A. Schoenfelder, A. Melikian, M. J. Bouchet, D. Chantreux, J. C. Molimard, M. Heaulme, J. P. Chambon, C. Biziere, J. Med. Chem. 30 (1987) 239–249.
[6] A. V. Velentza, M. S. Wainwright, M. Zasadzki, S. Mirzoeva, M. Schumacher, J. Haiech, P. J. Focia, M. Egli, D. M. Waterson, Bioorg. Med. Chem. Lett. 13 (2003) 3465–3470.
[7] C. G. Wermuth, J. J. Bourguignon, R. Hoffmann, R. Boigegrain, R. Brodin, J. P. Kan, P. Soubríe, Bioorg. Med. Chem. Lett. 2 (1992) 833–838.

# INFLUENCE OF MICRO-OXYGENATION IN RED WINES MADE FROM SAPERAVI GRAPE VARIETY

**A. Khitarishvil[1], M. Gagolishvili[1], M. Bezhuashvili[2]**

[1] I. Gogebashvili State University, Telavi
[2]Georgian Agrarian University Tbilisi, Institute of Viticulture, Oenology and Horticulture
akhitarishvili@gmail.com

***Introduction:*** Red wines are rich by diverse chemical substances; phenolic compounds take major place. Some of the phenolic compounds are: proanthocyanidins, anthocyanins, flavonols, catechins, stilbens, phenolic acids and etc. These substances are important for red wines, as they participate in oxidative-reduction processes and influence the quality of wine. Phenolic compounds, as high antioxidant substances give the curative-prophylactic value to the red wines. Red wine formation process includes oxidative-reduction transformation, which enhances wine maturation, ageing and improves the quality index. Lately due to red wine ageing intensification, lots of scientific researches have been conducted, for this purpose micro-oxygenation was offered, which means oxygen addition. Oxygen can be used for macro and micro oxygenation purposes. Micro oxygenation is modern toolkit, which involves the regulated continuous bubbling of the oxygen into the wine, during different period of winemaking (before MLF or after). It was first used in Madiran region, France [1], early in 1990, by winemaker Patrick Ducournau[2]. The wines from Madiran region are characterized by astringency and tannic character (especially Tannat vine sort), because of that Docournau was motivated to develop micro-oxygenation in order to soften the tannic structure and produce wines that could be consumed earlier. The reason for developing new winemaking tool was to create cost-saving and short-term method, which will replace expensive long-term barrel ageing method [3-4]. The oxygen doses are calculated according to the wine character and application time (whether we are using it before MLF or after)[5];[6]. Today lots of companies produce micro-oxygenation equipment, such as: (www.oenodev.com); (www.parsec-enologia.com); (www.stavin.com) and etc. Almost all authors indicate that due to the micro-oxygenation wine becomes softer and organoleptic substances are improved. Due to the actuality of the micro-oxygenation method we have conducted the study in this area. Our aim was to study the effect of micro-oxygenation in Georgian red dry wines on organoleptic substances, volatile acidity and phenolic compounds.

**Methods and Materials:** We have used as a research object Georgian red wines, harvested in 2011 (made from Saperavi vine variety cultivated in Akhasheni and Nafareuli micro region). The wines were oxygenated after alcoholic fermentation. We used single pure oxygen dose for each wine – 480ml/l. The experiment lasted for one month; the oxygen was added 4 times (after each week intervals), the temperature was stabile 15 °C. Oxygen bubbling was done at low rate during 1 hour. After the micro-oxygenation the wines were kept at 10-12 °C to be fined naturally.

We studied the wines after second racking and determined volatile acidity, total phenolic compounds and organoleptic substances. Total phenolic compounds were studied by spectophotometer analysis using folin-ciocalteu method [7].

Results and Discussions:

Effect of micro-oxygenation on some wine indices made from Saperavi vine variety

| # | Wine Samples | Organoleptic substances | Volatile Acidity g/l | PH | Total Phenols g/l | Tartaric Acidity g/l |
|---|---|---|---|---|---|---|
| 1 | Wine sample I (Akhasheni Saperavi) initial | Dark ruby color, phenolic compounds, astringent flavor | 0.39 | 3.3 | 4.5 | 9.1 |
| 2 | Control - I | Ruby color, varietal aroma, less astringency caused by low amount of phenolic compounds | 0.41 | 3.52 | 3.75 | 6.9 |
| 3 | Micro-oxyegenation I | Ruby color, distinct varietal aroma, soft, and harmonic flavor | 0.43 | 3.54 | 3.38 | 6.8 |
| 4 | Wine II (Nafareuli Saperavi) initial | Dark ruby color, phenolic compounds, astringent flavor | 0.46 | 3.42 | 4.2 | 8.8 |
| 5 | Control II | Ruby color, varietal aroma, less astringency caused by low amount of phenolic compounds | 0.47 | 3.6 | 3.5 | 6.8 |
| 6 | Micro-oxygenation II | Ruby color, distinct varietal aroma, soft, and harmonic flavor | 0.49 | 3.61 | 3 | 6.8 |

As the experiment data shows the quality of young wines made from Saperavi grape variety due to the micro-oxygenation method are improved organoleptically. Namely the low flow of oxygen used during micro-oxygenation (by 0.02 g/l) increases the volatile acidity insignificantly (calculated according to the acetic acid) that is regarded as positive effect. Total phenolic compound are decreased, e.g. in Akhasheni wines total amount are decreased by 0.37g/l, and in Nafareuli wines is decreased by 0.5g/l. This decrease is expressed in the organoleptic index of wine;

the astringency is decreased that causes the wine softening. This experiment is a good premise to broaden the research in this area, to determine the oxygen doses in different wine formation stages

**References**


[1] Lemaire, T., Gilis,J.F., Fort, J.P & Ducournau,P. Micro-oxygenation in extended maceration and early stages of red wine maturation - immediate effects and long-term consequences. Adelaide : Eds: R.J. Blair, P.j.Williams and P.B.H Proceedings of the Eleventh Australian Wine Industry Technical Conference, 2002. pp. pp.33-43.

[2] Micro-oxygenation in wine. Dempsey, C. 2001. Wine Business Monthly. p. 8(11).

[3] Blackburn, D. Micro oxygenation. Lessons from decade of experience. s.l. : Winery & Vineyard , 2004 March/April. pp. 32-39.

[4] Zoeklein, B.W., Carey, R. & Sullivan, P. Current theory and applications of micro-oxygenation. s.l. : Wine east, 2002. pp. 28-34.

[5] Rieger, T. Micro - oxygenation presents promise with potential peril for quality winemaking. s.l. : Vineyard & Winery Management,2000 May/June .pp.83-88.

[6] Zoeklein, B.W., Carey, R. & Sullivan, P. Micro-oxygenation of red table wines. s.l. : Wine East, 2003. pp. 28-33.

[7] Сейдер А. И., Датунашвили Е. Н. О методиках определения фенольных веществ в винах. б.м. : «Виноделие и Виноградарство СССР»,, 1972. Т. №6.-с.31-33.

## OBTAINING AND STUDY OF BIOLOGICAL ACTIVITIES OF CHITOSAN LAYERS WITH 1-VINYLPYRAZOLE-4-CARBOXYLIC ACIDS

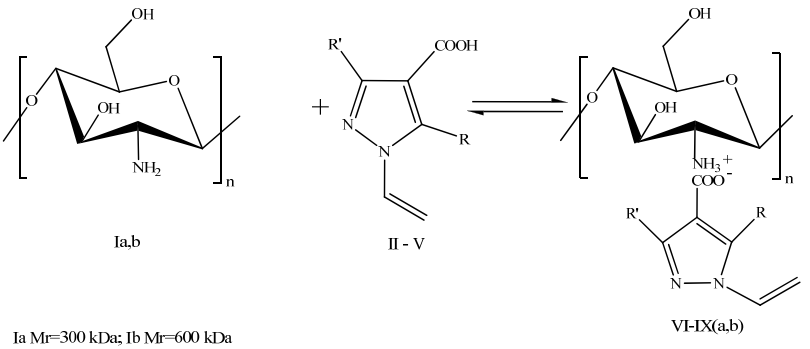
**A. A. Sahakyan, S.O. Buloyan**

The Scientific-Technological Centre of Organic and Pharmaceutical Chemistry NAS RA,
Azatutyan ave. 26, Yerevan, Armenia 0014,
sahakyan.arsen@gmail.com

Chitosan – a natural polysaccharide is widely used in industry and medicine [1] due to its antibacterial [2], wound curative [3], radio protective [4] and anti cancer properties [5], which proves expansions of researches in this field.

Containing in composition two reactive amino and hydroxyl groups chitosan easily undergoes chemical modifications [6]. It is known that the change in the molecular weight of chitosan increase its biological activity [7]. We found that above enumerated properties of chitosan make expedient its modification by 4-functionally substituted pyrazoles, which synthesis we studied in work [8]. We selected vinyl derivatives of pyrazole since vinyl group would let to obtain chitosan-pyrazole polymeric derivatives with possibility to regulate properties of polymers (VI-IXa,b).

The reaction between chitosan (Ia,b) and compounds (II-V) proceeds easily in the distilled water and boiling conditions according to the following diagram:




Ia Mr=300 kDa; Ib Mr=600 kDa
II, VIa,b R=R'=H; III, VIIa,b R=$CH_3$, R'=H; IV, VIIIa,b R=H, R'=$CH_3$; V, IXa,b R=R'=$CH_3$

Boiling of obtained products in water does not give the product of thermal initiated polymerization, which is confirmed by NMR $^1H$ and IR spectroscopic methods, which allows to decrease polymerization temperature (30-40$^oC$) with use of water-soluble initiators.

Preliminary macro-photographic, planimetric, cytological and histological studies showed that the synthesized compounds manifest antiburn activity on experimentally provoked burns of 2$^{nd}$ degree. Already on 15$^{th}$ day after burn is observed almost complete regeneration of the epidermal tissue of white rats,

which is not noted in control animals.

With 700 R single exposure of white rats was observed sharp decrease of body mass, worsening in appetite and passiveness in motions. After 14 days the rats that obtained synthesized compounds with meal, was noted an increase in appetite and mass of body, activity in motions, which is not observed in control animals.

According to the antibacterial studies by diffusion method showed that compounds have weak bactericidal action and suppressing an increase of gram-positive and gram-negative microorganisms in 10-15 mm by diameter. Anti cancer study established that the compound (VIa) at the dose of 250 mg/kg by oral method, reliably suppresses an increase of mouse sarcoma 37 to 39%. Investigations are in process.

The investigations described in the publication were carried out by funds of ECSP-10-13-GRSP provided by the National foundation of science and advanced technologies (NFSAT), National academy of sciences of Armenia and the U.S. civilian research and development fund (CRDF USA).

**Reference**

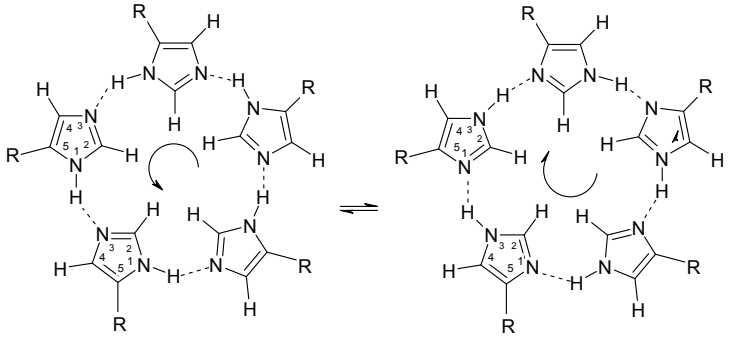
[1] S. N. Kochetkov, A. K. Gaponenko, M., Nauka. 2002. 368 p.
[2] El-Refaie Kenawy, F. Imam Abdel-Hay, Ahmed Abou El-Magd, Yehia Mahmoud, J. of Bio. and Comp. Pol., 2005. Vol. 20. P. 95-111.
[3] C. Alemdaroglu, Z. Degim, N. Celebi, F. Zor, S. Ozturk, D. Erdogan, Burns. 2006. Vol. 32. N 3. P. 319-327.
[4] A. S. Korjagin, A. E. Mochalova, L. A. Smirnova, M. N. Talamanova, Rus. Acad. of Sci., 2009. Vol. 11. N 1. P. 1291-1296.
[5] Omid Veiseh, Conroy Sun, Chen Fang, Amer. Assoc. for Cancer Research, 2009. 69: (15). P. 6200-6207.
[6] Tae-Hee Kim, Hu-Lin Jiang, Dhananjay Jere, Progress in Polymer Science, 2007. Vol. 32. N. 7. P. 726-753.
[7] S. N. Kulikov, S. N. Chirkov, A. V. Ilyina, S. A. Lopatin, V. P. Varlamov, Applied Biochem. And microbial., 2006. Vol. 42. N. 2. P. 224.
[8] A. O. Baltayan, A. A. Saakyan, O. S. Attaryan and G. V. Asratyan, Rus. J. of Gen. Chem., 2010. V. 8. N 5. P. 834-836.

# QUANTUM-CHEMICAL MODELING OF THE CYCLIC-PENTAMERIC MECHANISM FOR THE 1H-3H TAUTOMERIC TRANSFORMATION OF IMIDAZOLE

**M. Kvaraia[1], J. Kereselidze[2], Z. Phachulia[2]**

[1] Sokhumi State University
[2] Tbilisi State University
mariqvaraia@yahoo.com

Eenergy of activation ($\Delta E^{\#}$) and reaction ($\Delta E$), charges on heterocyclic nitrogen atom ($q_N^5$) and constant of tautomeric equilibrium ($K_T$) of the proton transfer in cyclic - pentameric structure of imidazole derivatives by means of quantum-chemical DFT method are calculated. Is seen, that for nitro-imidazole a proton transfer is energetically more profitable.The values of activation energy ($\Delta E^{\#}$) and energy of reaction ($\Delta E$) of the proton transfer, constant of tautomeric equilibrium ($K_T$) are changed in quite reasonable limits. It indicates on competence of the proposed cyclic-pentameric model for the proton transfer in imidazole.



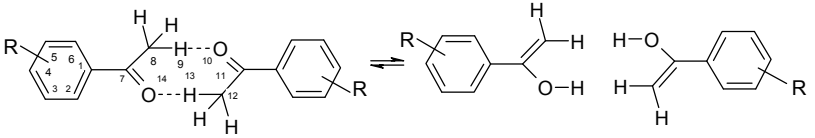
The pentameric structute of the 1H-3H proton transfer in imidazole (R = H, $NH_2$, $NO_2$).

# QUANTUM-CHEMICAL STUDY OF SUBSTITUTES EFFECT ON THE TAUTOMERIC TRANSFORMATION OF DERIVATIVES OF ACETOPHENONE

**T. Kuchukhidze[1], M. Kvaraia[1], J. Kereselidze[2], Z. Phachulia[1]**

[1]Tbilisi State University
[2]Sokhumi State University
mariqvaraia@yahoo.com

Energetic and kinetic characteristics of the tautomeric of transformation of acetophenone derivatives by means quantum-chemical DFT (Density Function Theory) method are calculated. Is shown, that the electronodonore substitutes promotes, and electronoacceptore – hindrances of of the tautomeric of transformation.



R = H, p-Cl, p-$NO_2$, p-$CH_3$, p-$OCH_3$, p-$NH_2$, m-Cl, m-$NO_2$, m-$CH_3$, m-$OCH_3$, m-$NH_2$.

# NUCLEOAMINO ACID-BASED COMPOUNDS: FROM CHEMICAL SYNTHESIS TO BIOMEDICAL APPLICATIONS

**G. Roviello[1], D. Musumeci[1], E. Bucci[1], C. Pedone[1], A. Di Napoli[1], M. Pirtskhalava[2], M. Mirtskhulava[2]**

[1]IBB-CNR, [1]Naples-Italy, [2] Geomedi University
giovanni.roviello@cnr.it

Nucleobase-containing amino acids, also referred as nucleoamino acids, and nucleobase-containing peptides (nucleopeptides) are molecules of increasing interest in biomedicine due to their useful binding properties towards natural targets such as nucleic acids and proteins [1], as well as their good resistance to enzymatic degradation [2].

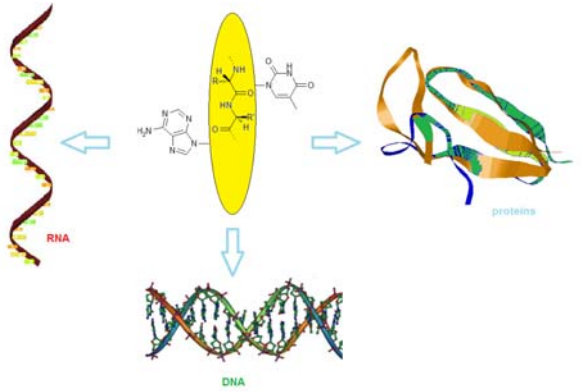



**Figure 1. Nucleoamino acid-based compounds and their biological targets**

More particularly, the interaction ability of such molecules with DNA, RNA and proteins (Figure 1) is a fundamental characteristic for the possibility to modulate those biochemical processes in which nucleic acids and proteins play a key role. The stability *in sero* is another appreciable feature of nucleoamino acid-based molecular probes, also in consideration of the scarce enzymatic resistance of natural oligonucleotides. Some of these molecules are natural like the antimicrobial peptidyl nucleosides or the wiillardiine-containing peptides recovered from vegetal sources (Figure 2). Nevertheless, many examples are also known of artificial nucleobase-containing amino acids and peptides (Figure 2) which were obtained by

chemical synthesis both in solution and in solid phase as reported in literature [2].

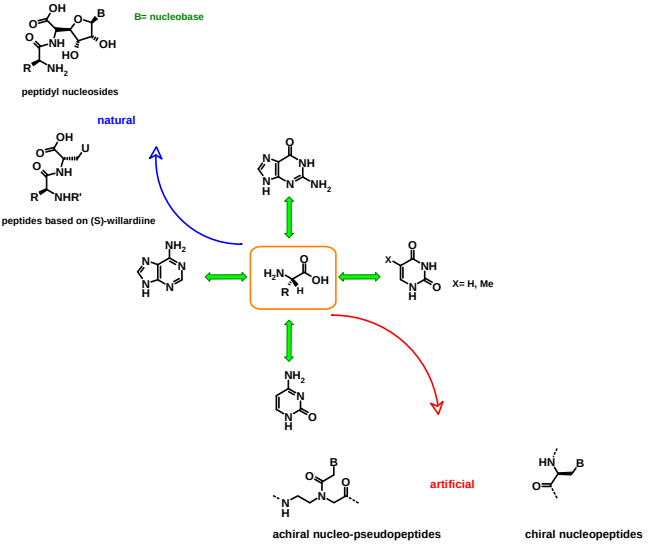



**Figure 2. Natural and artificial nucleoamino acid-based compounds**

In this work, we report some examples of nucleoamino acid-based compounds which were recently studied for their possible utilization in biotechnological and medical strategies. More particularly, a description not only of their structural characteristics but also of the synthetic routes to these hybrid nucleic-peptide molecules, as well as some properties of molecular recognition which could be beneficial in the development of innovative drugs for anticancer and antiviral therapies will be presented.

## References

[1] G. N. Roviello, S. Di Gaetano, et al. J. Med. Chem. 54 (2011) 2095-101.
[2] G. N. Roviello, E. Benedetti, C. Pedone, E. M. Bucci Amino Acids 39 (2010) 45-57.

## SYNTHESIS OF NEW HYDRAZONES FOR FUTURE OBTAINING 3- AND 8-DERIVATIVES OF 4-OXO-3H,5H-PYRIDAZINO[4,5-B]INDOLE

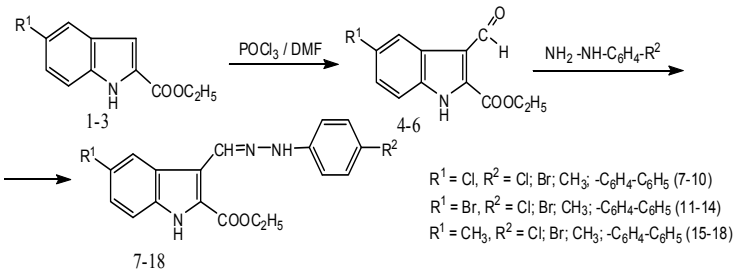
**Sh. Oboladze, Sh. Samsoniya, I. Chikvaidze, A. Kalatozishvili**

Iv. Javakhishvili Tbilisi State University
shota_oboladze@yahoo.com

Heterocyclic compounds which contain indole and pyridazine rings are subjects of great interest among researchers. They are taking an active part in vital processes of organism. Among them, were found compounds with antidepressant, analgesic, antibacterial, antihypertensive, and antitumor activities [1,2].

Compounds with hydrazine and azomethine groups are not less interesting, as far as among them are found a lot of pharmacologically active compounds [3-6]. Types of these compounds are useful as intermediate compounds and also for the synthesis of other special pharmacy. There are very important hydrazones of oxo-compounds and acid based hydrazides. Based on them are obtained condensed mono- and bi-pyridazinoindoles` derivatives [7-8].

Our investigation goal is to obtain new hydrazones from 5-substituted 2-ethoxycarbonylindole. We use traditional method by mixing 2-ethoxy-3-carbonylindoles 4-6 and derivatives of hydrazones in ethanol or dioxane-water solution, derived hydrazones 7-18 are easy to obtain with high yield. By variation of indole-ring and aryl-fragment substitute it is possible to get various pharmacological activities in hydrazones. Therefore from 7-18 hydrazones is planned to obtain 4-oxo-3H,5H-pyridazino[4,5-b]indoles with various substitutes on the 3rd and 8thcarbon atoms.




The structures of the all newly synthesized compounds were established using spectral methods.

## References


[1] El-Gendy A.A., El-Banna H.A. Arch. Pharm. Res, 2001, N1, p.21-26.

[2] Palluotto F., Campagna F., Carotti A., and etc. Farmaco, 2002, v. 57, N 1 p. 63-69

[3] Vicini, P.; Zani, F.; Cozzini, P.; Doytchinova, I. *Eur. J. Med. Chem*. 2002, *37*, 553-564.

[4] Mamolo, M.G.; Falagiani, V.; Zampieri, D.; Vio, L.; Banfo, E. *IIFARMACO* 2001, *56*, 587-592.

[5] Ajani, O.O.; Obafemi, C.A.; Nwinyi, O.C.; Akinpelu, D.A. *Bioorg. Med. Chem.* 2010, *18*, 214-221.

[6] Zheng, L.W.; Wu, L.L.; Zhao, B.X.; Dong, W.L.; Miao, Y.J. *Bioorg. Med. Chem.* 2009, *17*, 1957-1962.

[7] Ferzaz B., Braukt E., Bourkiaud G. and ets. J. Pharmacology and Experimental Therapeutics, 2002, 301, 3, 1067-1078

[8] Velezheva V.C., Brennan P.J., Marshakov V.Yu.and ets. J. Med. Chem., 2004,47, 13, 3455-3461

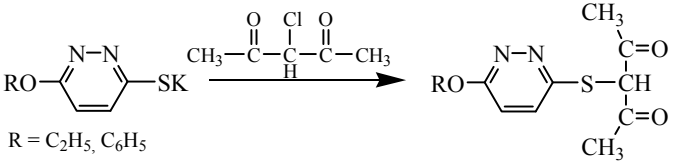
## PYRAZOLYLPYRIDAZINES

**A.Karapetyan[1], T.Gomktsyan[1], A.Yengoyan[1,2]**

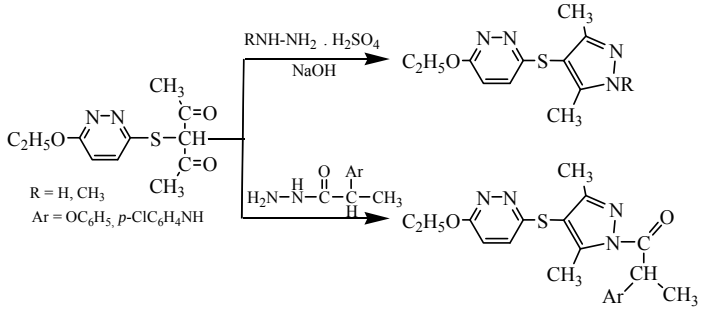
[1]State Agrarian University of Armenia
[2]Russian-Armenian (Slavonic) State University
armkar@inbox.ru

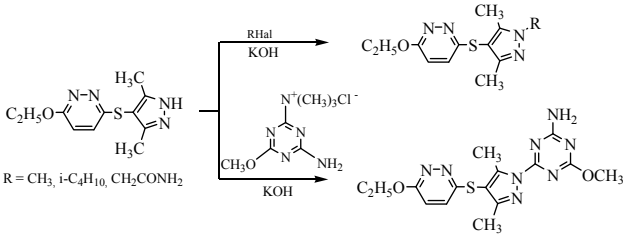
In recent years a growing interest in compounds containing a pyrazole ring, due to a fairly large spectrum of their biologically activities is observed [1-9]. Pyridazine derivatives are also of interest as a biogenic systems [10-13]. Our studies have shown that especially in the series of thiopyridazine derivatives there are many compounds with expressed growth regulatory activity. [14]. For this reason, the synthesis of a new series of compounds, which molecules simultaneously contain, pyridazine and pyrazole cycles, looks actual.

For this purpose, by the interaction of 3-methoxy(phenoxy)pyridazine-6-thiol potassium salts with chloroacetyl acetone corresponding diketopyridazines were obtained, which are of interest not only as potentially biologically active compounds, but also as precursors for synthesis of new active substances.




The interaction of the synthesized diketones with hydrazine sulfate, methylhydrazine sulfate and 2-arylpropionylhydrazides, leads to corresponding pyrazolylthiopyridazines.






N-Substituted pyridazinyl derivatives were also synthesized by the other pathway. The potassium salt of 3-(3,5-dimethylpyrazol-4-yl)thio-6-ethoxypyridazine were interacted with alkyl halides, and chlorocarboxylic acid derivatives. The reaction of mentioned potassium salt with [1,3,5]-triazine trimethylammonium chloride leads to a tricyclic 6-(4-(6-ethoxypyridazin-3-yl)thio-3,5-dimethylpyrazol-1-yl)-2,4-disubstituted triazine.

**References**


[1] H. Chen, Zh. Li, Y.J. Han., Agric. Food Chem. 2000, 48,11, 5312.

[2] Th.L. Siddall, D.G.Ouse, Z.L. Benko, G.M. Garvin, J.L. Jackson, J.M. McQuiston, J.A. Turner, J.C.VanHeertum, M.R.Weimer, PestManag. ci. 2002, 58, 12, 1175.

[3] R. Ohno, A. Watanabe, H. Sakurai, M. Hori, K. Hirai, J. Pest. Sci. 2004, 29, 2, 96.

[4] Ch.B. Vicentini, S.Guccione, L. Giurato, R. Ciaccio, D. Mares, G. Forlani, J. Agric. Food Chem. 2005, 53, 10, 3848.

[5] M. Nishioka, H. Nakashita, M. Yasuda, S. Yoshida, I. Yamaguchi, J. Pest. Sci. 2005, 30, 1, 47.

[6] Y. Li, H.Q. Zhang, J. Liu, X.P. Yang, Zh.J. Liu, J. gric. Food Chem. 2006, 54,10, 3636.

[7] W.M. Liu, Y.Q. Zhu, Y.F. Wang, B. Liu, X.M. Zou, H.Z. Yang, J. Heterocycl. Chem. 2007, 44, 4, 967.

[8] C. Vicentini, C. Romagnoli, E. Andreotti, D. Mares, *J. Agric. Food Chem.* 2007, 55, 25, 10331.

[9] H. Dai, Y.Q. Li, D. Du, X. Qin, X. Zhang, H.B. Yu, J.X. Fang, J. Agric. Food. Chem. 2008, 56, 22, 10805.

[10] E. Bellasio, A. Campi, N. Di Mola, E. Baldoli, J. Med Chem. 1984, 27, 8, 1077-1083.

[11] N. Di Mola, E. Bellasio, Farm. Sci. 1985, 40, 7, 517-533.

[12] G. Cignarella, D. Barlocco, G. A. Pinna, M. Loriga, O. Tofanetti, M. Germini, F. Sala, J. Med Chem. 1986, 29, 11, 2191-4.

[13] D. Barlocco, A. Martini, G.A. Pinna, M. M.Curzu, F. Sala, M. Germini, Farm. Sci. 1987, 42, 8, 585-594.

[14] A.P.Yengoyan, T.A.Gomktsyan, A.V.Karapetyan, S.V.Harutyunyan, Pat. Armenia, № 2588A, 2012

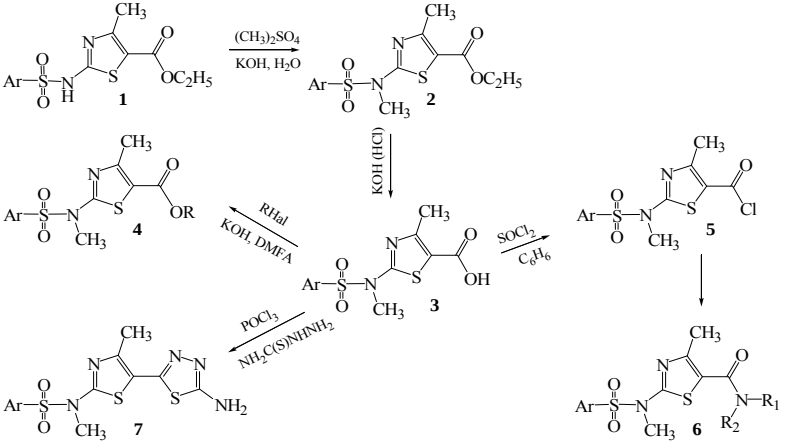
# SYNTHESIS OF POTENTIALLY BIOLOGICAL ACTIVE DERIVATIVES OF 2-N-METHYL-ARYLSULFAMIDO-4-METHYL-THIAZOL-5-YL CARBOXYLIC ACIDS ETHYL ESTERS

**R.Hakobyan[1], K.Eliazyan[1], V. Pivazyan[1], E.Ghazaryan[1], A. Yengoyan[1,2]**

[1]State Agrarian University of Armenia
[2]Russian-Armenian (Slavonic) State University
ayengoyan@mail.ru

Sulfonamido derivatives of some heterocyclic systems have a wide spectrum of biological activity. Among them there are known medicines, chemical means of plant protection and growth regulators [1,2]. The purpose of our study was the synthesis of novel 2-arylsulfamido-4-methyl-thiazol-5-yl derivatives on the base of corresponding carboxylic acids ethyl esters (**1**) [3]. The latters, as NH-acids, are easily methylated at low temperatures under the action of dimethyl sulfate in an aqueous medium (**2**). It is proved that in an aqueous or alcoholic solution of alkali the reaction takes place exclusively at the ester function with preservation of the heterocycle and the formation of corresponding acids (**3**). Their potassium salts were esterified in water or dimethylformamide with different active halides, which leads to a series of new 2-(aryl-methylamino)-4-methylthiazol-5-carboxylic acids esters (**4**). Under the action of thionyl chloride on acids in benzene medium the chloranhydrides (**5**) were synthesized, which react readily with various alkyl and heteryl amines and form the corresponding N-substituted amides (**6**).

By the heterocyclization of acids (**3**) under the action of thiosemicarbazide in phosphorus oxychloride medium a series of previously unexplored N-[5-(5-amino-[1,3,4]-thiadiazol-2-yl)-4-methyl-thiazol-2-yl]-N-methyl-arylsulfonamides (**7**) were obtained.The synthesized compounds are currently under biological testing.



## References


[1] See http://www.alanwood.net/pesticides/class_pesticides.html

[2] М.Д.Машковский, Лекарственные средства, Новая волна, 2002, vol 1,2

[3] V.V.Dovlatyan, K.A.Eliazyan, V.A.Pivazyan, E.A.Ghazaryan, A.P.Yengoyan, *Chem. Heterocycl. Comp*., vol.40, 2004, pp 84-89

# ENANTIOMER ELUTION ORDER REVERSAL OF FLUORENYLMETHOXYCARBONYL-ISOLEUCINE IN HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY BY CHANGING THE MOBILE PHASE TEMPERATURE AND COMPOSITION

**L. Chankvetadze[1], N. Ghibradze[1], M. Karchkhadze[1], L. Peng[2], T. Farkas[2], B. Chankvetadze[2]**

[1]Institute of Physical and Analytical Chemistry, School of Exact and Natural Sciences, Tbilisi State University
[2]Phenomenex Inc
nghibradze@gmail.com

In this paper the elution order reversal of enantiomers of fluorenylmethoxycarbonyl- or FMOC-isoleucine is described depending on the separation temperature and composition of the mobile phase when using the polysaccharide-based chiral column Lux Cellulose-1 in HPLC with normal-phase eluent. Reversal of the enantiomer elution order (EEO) in HPLC depending on the column temperature and content of the polar modifier in the mobile phase has been reported before in the literature. However, EEO reversal by changing the content of acidic modifier in the mobile phase seems to be described for the first time in the present work.

This study reports the reversal of enantiomer elution order of FMOC-isoleucine based on chiral selector, content of the polar organic modifier of the mobile phase, separation temperature and

for the first time, the acidic modifier content in the mobile phase. Further studies on these effects may provide valuable information for better understanding the mechanism of chiral recognition on polysaccharide-based

chiral stationary phases.Furthermore,such susceptibility of enantiomer separation to the content of organic modifiers and separation temperature must be considered in chiral separation method development and optimization.

**References**

[1] B. Chankvetadze, Electrophoresis 23 (2002) 4022.
[2] M. Okamoto, J. Pharm. Biomed. Anal. 27 (2002) 401.
[3] B.-A. Persson, S. Andersson, J. Chromatogr. A 906 (2001) 195.
[4] J.A. Perryt, J.D. Rateike, J.T. Szczerba, J. Chromatogr. 389 (1987) 57.
[5] T.J. Wozniak, R.J. Bopp, E.C. Jensen, J. Pharm. Biomed. Anal. 9 (1991) 363.
[6] K.S.S. Dossou, P. Chiap, A.-C. Servais, M. Fillet, J. Crommen, J. Pharm. Biomed. Anal. 54 (2011) 687.
[7] S. Ma, S. Shen, H. Lee, M. Eriksson, X. Zeng, J. Xu, K. Fandrick, N. Yee, C. Sananayake, N. Grinberg, J. Chromatogr. A 1216 (2009) 3784.
[8] F. Gasparrini, D. Misiti, M. Pierrini, C. Villani, J. Chromatogr. A 724 (1996) 79.
[9] T.L. Xiao, B. Zhang, J.T. Lee, F. Hui, D.W. Armstrong, J. Liq. Chromatogr. Relat. Technol. 24 (2001) 2673.

[10] J. Hermansson, G. Schill, in: M. Zief, L.J. Crane (Eds.), Chromatographic Chiral Separation, Marcel Dekker, New York, 1988, p. 245.
[11] J. Haginaka, J. Wakai, K. Takahashi, T. Katagi, Chromatographia 29 (1990) 587.
[12] M. Okamoto, H. Nakazawa, J. Chromatogr. 588 (1991) 177.
[13] K. Balmer, B.-A. Persson, P.-O. Lagerstrцm, J. Chromatogr. A 660 (1994) 269.
[14] K. Balmer, P.-O. Lagerstrцm, B.-A. Persson, G. Schill, J. Chromatogr. 592 (1992) 331.
[15] W.H. Pirkle, P.G. Murray, J. High Resolut. Chromatogr. 16 (1993) 285.
[16] A. Aranyi, I. Ilisz, Z. Pataj, I. Szatmari, F. Fыцр, A. Peter, J. Chromatogr. A, in press.
[17] K.S.S. Dossou, P.A. Edorh, P. Chiap, B. Chankvetadze, A.-C. Servais, M. Fillet, J. Crommen, J. Sep. Sci., in press, doi:10.1002/jssc.201100339.
[18] B. Chankvetadze, E. Yashima, Y. Okamoto, J. Chromatogr. A 670 (1994) 39.

# DETERMINATION OF SELECTED OPIATE DRUGS AND THEIR METABOLITES IN BIOLOGICAL SAMPLES USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY

**A. Dadianidze, B. Chankvetadze**

Department of Physical and Analytical Chemistry, School of Exact and Natural Sciences, Tbilisi State University
al.dadianidza@mail.gov.ge

Toxicological Analysis for drug tests used Imunnohrom test, it gives fast results but incomplete. The test gives a positive or negative result only for opiates group drugs. For detailed analyses can be used GC-MS technique.

The goal was to research metabolism process of Codeine in human body. To recover metabolites and find out how practical method it would be for further research in forensic analysis. For the experiment we used GC-MS of Perkin Elmer, model Clarus-500MS.

Extraction of Urine samples was performed by Liquid-liquid extraction.

GC-MS conditions:

Chromatographic analysis was carried out following conditions:

Oven temperature, programmable: 100°C -15°C/min- 280 °C. Injection temperature: 250°C.

Carrier gas: He 1ml/min. Split: 1:50. Detector: MS. Source: EI Rhenium filament (70ev)

Scan range m/z: 35-500 .

The results show that the method is suitable to determine presents of Codeine and it's metabolites in urine.

Also, it is partially possible to determine origin of drugs during analysis according to its content.

## SYNTHESIS SOME OF ADAMANTANE-CONTAINING AMIDES

**G. Pantsulaia, I. Gogolashvili, D. Zurabishvili, M.Trapaidze,**

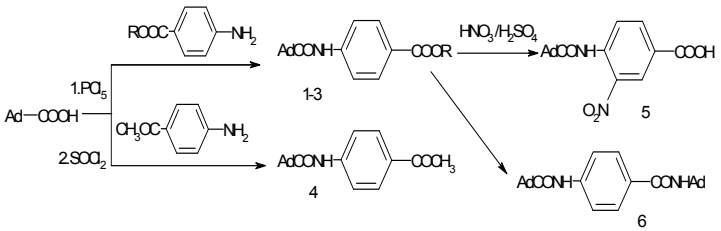
**Sh. Samsoniya**

Research Institute of Organic Chemistry, Faculty of Exact and Natural Sciences
Tbilisi State University
giorgi_pantsulaia@yahoo.com

The derivatives of aminoadamantane and adamantane-1-carboxylic acid have a broad spectrum of biological activity [1-3]. It is known that the derivatives of *p*-aminobenzoic acid (Anestezine, benzocaine, procaine, dikaine, novokainamide) are widely used in medicine as a local anesthetic agent in various disorders of heart rate, as well as against some pathogenic microorganism [1,4].

It is known that the transferring of the pharmacophore adamantane into of the molecule of the substance reduces the toxicity, and often enhances the pharmacological effects [1].

In order to study the biological activity we have synthesized some of adamantane containing *p*-aminophenol and *p*-aminoacetophenone according to the scheme:




**R=H (1), $CH_3$ (2), *n*-$C_4H_9$ (3)**

Compounds 1-4 were prepared by reacting of adamantane-1-carboxylic acid chloride with the corresponding amines in presence of three ethylamine or NaOH in the area of benzene, or ester. Compound 6 was obtained by acylation of aminoadamantane by N-adamantoyl-p-aminobenzoic acid chloride in presence of NaOH in the area of ester/dichloromethane .

A Virtual bio-screening of synthesized compounds 1-6 was made by using internet program PASS online (http://www.pharmaexpert.ru/). This program predicts the spectra of biological activity of chemical compounds based on their structural formulas. The computer program “PharmaExpert” provides analysis of the results of PASS prediction based on the knowledge of the interactions, "the mechanism of effect" for identify the main mechanisms of action, both as for the individual chemical compounds and as to evaluate the therapeutic effects when taken

together in use [5].

According to PASS program our synthesized compounds in high probability display the following activity in (Pa=0.70-0.92) Antiviral (Arbovirus, Influenza, Picornavirus, Adenovirus, HIV); Antiasthmatic; Antiallergic; Radio protector; Anesthetic local; Antiepileptic, Antineoplastic (brain cancer); Transferase stimulant, Antibacterial, Anthelmintic; Neurotrophic factor enhancer and others.

Acknowlegment: The designated project has been fulfilled by financial support of the Shota Rustaveli National Science Foundation (Grant #GNSF/ST08/4-413).

**References**

[1] I. S. Morozov, V. I. Petrov, S. A. Sergeeva. Pharmacology of Adamantanes. Volgograd Medical Academy, (2001) 320 p.
[2] V. Kovtun, V. Plakhotnik , Chem. Pharm. Journal, vol 28 (1987), 8, 931-940.
[3] I. E. Kovalev, Chem. Pharm. Journal, vol (1977) 3, 19-27.
[4] M. D. Mashkovskii, Medicines, 15-publication, Moscow: Medicine (2005).
[5] D. A. Filimonov, V. V. Poroikov, Russ. Chem. Journal., m. L. (2006) 2, 66-75.

## LIQUID CHROMATOGRAPHIC-MASS SPECTROMETRIC METHOD FOR QUANTITATIVE DETERMINATION OF LISINOPRIL IN HUMAN PLASMA

**A.Ghibradze, K. Kobakhidze, S. Bitadze**

GM Pharmaceuticals Ltd
anukighibradze@yahoo.com

A validated liquid chromatographic-mass spectrometric (LC/MS) method for the determination of lisinopril in human plasma is presented. Enalapril was used as an internal standard. The instrumentation used was an Agilent 6410B Triple Quadrupole LC/MS coupled to an Agilent 1200 LC. Best selectivity was observed using 0.1% formic acid in water /methanol 50/50 (by volume) as a mobile phase. Flow rate was 0.5 ml/min. Agilent Zorbax C8 4.6mmX50mm column with 5um particle size was used as an analytical column. Analysis was performed at constant column temperature 20 degrees C. The mass spectral parameters were optimized using MassHunter Optimizer software, which identifies the most abundant product ions in a mass spectrum along with the most suitable fragmentor voltages and collision energies required for generating these product ions. In our method fragmentor voltage 136V, colisiion energy 20eV Dwell time 20ms was selected for lisinopril. For internal standard enalapril fragmentor voltage 106V, colisiion energy 14eV, Dwell time 20ms were selected. Precursor ion (m/z) of lisonopril was 406.2 and product ion was 84.1, precursor ion (m/z) of enalapil was selected 377.2 and product ion was 303.1; A simple protein precipitation sample preparation technique was used to extract the two drugs, enalapril and lisinopril from100 µL of plasma samples. The linear calibration curves were in the concentration range of 2-500 ng/mL for both analytes in human plasma with good reproducibility, absolute recovery of 91.60% for lisinopril and 90.22% for enalapril, stability for 3.5 months at -20 degrees C have been achieved. Limit of quantitation (LOQ) was 10 ng/mL while limit of detection (LOD) was about 1 ng/mL.

**References**

[1] W. Zhou, Y.Z. Liong, B. M. Chen, P. Wang, X. Chem, F.P. lim, J. Chromatogr. Sci., 2008,46,648
[2] B.M. Tashtoush,F.Q. Alali, N.M. nalib, Pharmazie, 2004, 59, 21
[3] A. Tsakalof, R. Barachtari, M. Georgarakis, J. Chroamatogr. B. Analyt. Technol. Biomed. Life Sci, 2003, 783, 425
[4] W.Qin, Z. Zhang, y.Tian, F.X.N. Wang, Y.Chem, biomed. Chromatogr, 2007, 21, 415
[5] A.A. Padua, R.E. Barrientos-Astigarraga, V.M. Rezonde,G.D. Mendes,G. De Wacci, J.Chromatogr, B.Analyt. Technol. Biomed. Life. Sci. 2004, 809, 211
[6] J. Huang, Y. Xu. F Liu, S Go, Q.Guo, Rapid Commun. Mass Speqtrum. 2006, 20, 248
[7] Rousoulos, G. Tstsou, Y. Dotsikas, Y.L. Loukas, Analytica Chimica Acta, 2005, 551, 177
[8] Guidance on the Investigation of Bioavailability and Bioequivalence. The European Agency for the Evaluation o Medicinal Products. Commitee for Proprietary Medicinal Products 21 July 2011, EMEA/CHMP/EWP/192217/2009

# SEPARATION OF ENANTIOMERS OF SELECTED CHIRAL BETA-BLOCKER DRUGS BY USING NOVEL POLYSACCHARIDE-BASED CHIRAL STATIONARY PHASES IN HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

**L.Mosiashvili, B. Chankvetadze**

Institute of Physical and Analytical Chemistry, School of Exact and Natural Sciences,
Tbilisi State University
levan_mosiashvili@yahoo.com

The goal of this study is systematic screening of novel polysaccharide-based chiral column for separation of enantiomers of selected chiral beta-blocker drugs by using various mobile phase conditions. These new chiral columns were developed by one of us and are currently commercialized and offered worldwide.

In presented studies the emphasis is placed on the elution order of enantiomers and the mechanisms of enantioselective recognition by these new materials. These studies require spiking the racemic samples with enantiomerically pure forms of chiral drugs. Since many of beta-blocker drugs are not available commercially in enantiomerically pure forms, some of them must be resolved in advance by us in the micropreparative way.

Up to now 13 representative drugs of this series were analyzed on 5 different chiral columns of Lux series: Lux Cellulose-1, Lux Cellulose-2, Lux Cellulose-3, Lux Cellulose-4 and Lux amylose-2. The instrumentation used was high performance liquid chromatograph (Agilent 1200 HPLC) equipped with the autosampler, binary pump, column thermostate, variable wavelength detector and Chemstation chromatographic data system.

With the necessity of the preparative separation in mind the screeneng was started with pure methanol and acetonitrile as mobile phases. In contrast to older generation of polysaccharide-based chiral columns the Lux series of chiral columns can be used in all 3 principial modes of chromatography (polar organic-, normal- and reversed-phase conditions). Polar organic mobile phases offer certain advantages for preparative separation os samples. The major advantages are higher solubility of analytes in this mobile phase, sharp chromatographic peaks and shorter analysis time. These advantages translate in high productivity of separation. In this presentation the results of our pleliminary studies on the separation of 13 chiral analytes on 5 above mentioned columns with methanol and acetonitrile as mobile phases are presented.

## THE ROLE OF POLYMERS IN TECHNICS AND LIFE

**N. Gabelaia**

A.Tsereteli StateUniversity
ngabelaia@bk.ru

In the XX – XXI centuries polyethylene bags and plastic materials make serious ecological problem. Creating artificial atuff men interfere the natural cycle providing circulation of materials.Negative qualities of polymers are especially reflected on enbiromental pollution. Household polymeric garbage is not bio-degrable. It takes 10 – 12 years to dispose them.

As for plastic vessel they do not dispose at all. Nevertheless of their negative qualities things made ofpolimeric materials are widely used in technics and every day life. Becouse of its density it is ideal materical in production solid things and details.

Polimers are high-molecular admixture mas of which is more than 5 000. it is the materical which is composed by joining numerous small molecules into one long chain. Polimers are devided into organic and inorganic ones. Organic Polimers are devided into natural, artifical and synthetical macro-molecular admixtures.

Natural macro-molecular admixtures are caoutchouc, albumen, cellulose, starch and bio-polimers.Artifical macro-molecular admixtures are produced by natural chemical reachion but the main chain is not changed during this process. Good example of it is rayon produced from cellulose; or rubber produced by vulcanization of cautchouc.

Synthetical macro-molecular admitures are received by poly-merization and poly-condensation reaction from the matericals which do not exist in mature. Sinthetical materials different from natural ones, do not dispose and do not rot; they satisfy sanitary demands, are light and steady.

Natural cautchouc consists of carbon (C) and hydrogen (H). Its qualities are improved by vulcanization and rubber is received. Rubber is widely used in automobile production to make tyres.

Due to technical development caoutchouc is in great demand. As the natural resourses were not enough, it was necessary to produce synthetic one. Lebedev was the first to receive it.

Izofrenic and Chlorinic synthetical caoutchouc is received Chlorinic caoutchouc is resistable to petrol, oil and high temperature. It is used to produce leads, petrol and oil pipes. Izoprenic caoutchuc is received from natural gas and oil.

Thous, as we have already mentioned polymeric materials plsy great role in household, automobile and aviation industry, etc.

## SYNTHESIS OF SOME NEW THIAZOLE CYCLE CONTAINING POTENTIONAL BIOLOGICALY ACTIVE COMPOUNDS

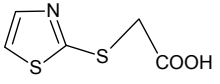
**T. Kirvalidze, M. Miqeladze, T. Tchedlishvili, N. Gongadze, L.Talakvadze**

Georgian Technical University
teonakirvalidze@yahoo.com

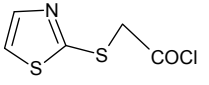
It is known that several new aralkil analogues of melatonine exibit high biological activity. Harmacokinetic investigations have shown that some of them easily over come hematoencephalic barrier and selectively accumulate in brain tumour of rats. This fact indicates the prospects for their use in medical treatment of some brain timour forms [1].

The starting material in our work is benzothiazole, which contains mercaptogroup in position two. It is known that vitamine B1 (Tiamine) and comforment cocarboxylazum consist thiazole cycle [2].

On the ground of above mentioned approaches we have synthesized a new substances: 2(benzenthiazol-2-yl) thioacetic acid (1) and corresponding chloranhydride (II):




(I)




(II)

By interreaction of the compound (II) with the biogenic amines we will carry on synthesis of new corresponding amides, which are the analogues of melatonine.

The structure of these compounds has been established on the basis of elemental analysis and spectroscopic investigations.

### References

[1] J.R.Lagidze, L.I.Talakvadze. Synthesis of melatonine analogues and macroheterocyclic compounds and prospects of their use. Georgia Chemical Journal, v4, N1, 2004.p.51-54. (in Georgian).

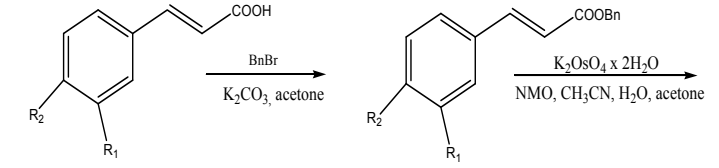
[2] N.A.Tiukavkina, I.I. Baukov. Bioorganicheskaia chimia. M. Moscow, 1991.p.287- 288 (in Russian).

## SYNTHESIS OF FERULIC AND ISOFERULIC ACID DERIVATIVES

**S. Gokadze[1], M. Merlani[2], V. Barbakadze[2], L. Amiranashvili[2], L. Gogilashvili[2]**

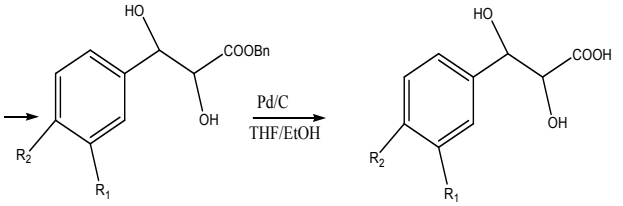
Tbilisi State Medical University, Faculty of Pharmacy[1]
TSMU, I.Kutateladze Institute of Pharmacochemistry, Laboratory of Plant Biopolymers[2]
sofiogoqadze@gmail.com

Recently we have synthesized some dihydroxylated caffeic acid derivatives with high antioxidant and anticancer activities [1,2]. In order to study the influence of substituents in phenylic moiety on antioxidant activity we have synthesized dihydroxylated derivatives of isoferulic (3-hydroxy-4-methoxy-cinnamic acid ) (1) and ferulic acid (2) using modified Sharpless dihydoxylaton procedure (Scheme1). Protection of hydroxy and carboxylic groups with BnBr in dry acetone gives alkylated products 3 and 4, dihydroxylation of them by potassium osmate in the mixture of acetonitrile:acetone:water (3:1:1) with 4-N-methylmorpoline gives dihydroxylated products (5,6) with 90% yields. Deprotection of benzylic groups of (5,6) was carried out using Pd/C in the mixture of ethanol/THF. The structures of new synthesized compounds were confirmed by NMR and IR-spectroscopy data. Antioxidant activity of obtained products (7,8) will be investigated.




$1R_1$= OH, $R_2$= OMe
$2R_1$= OMe, $R_2$=OH

$3R_1$= OBn, $R_2$=OMe
$4R_1$= OMe, $R_2$=OBn




$5R_1$= OBn, $R_2$=OMe
$6R_1$= OMe, $R_2$=OBn

$7R_1$= OH, $R_2$= OMe
$8R_1$= OMe, $R_2$=OH

## References


[1] M.Merlani, V.Barbakadze, L.Amiranashvili, L.Gogilashvili, E.Yannakopoulou, K.Papadopoulos, B.Chankvetadze. Chirality. 22, (2010), p.717-725.

[2] S.Shrotriya, G.Deep, N.Walia, V.Barbakadze, K.Mulkijanyan, M.Merlani, K.Papadopoulos, L.Gogilashvili, L.Amiranashvili, E.Shaburishvili, R.Agarwal. Anti-cancer efficacy of novel polymer from Caucasian species of comfrey and its synthetic monomer against androgen-dependent and -independent human prostate cancer cells. American Association for Cancer Research 100$^{th}$ Annual Meeting, Denver, Colorado, USA. Abstracts. 2009, N 921.

## CHEMICAL ASPECTS OF RESTORATION AND PRESERVATION OF HISTORICAL DOCUMENTS

**T. Gagnidze, R. Kldiashvili**

Tecnical University of Georgia
tamriko.gagnidze@gmail.com

Archival and library collections are a significant part of the historical and cultural heritage of our nation. Their protection and preservation means the preservation of the history. The restoration and the preservation have a pivotal role to reach this goal. This process consists of several stages. Together with the knowledge of fundamentals of biology and history special role is assigned to chemistry in its implementation.

It is mandatory both the fundamental knowledge of chemical composition and structure of basis of document (paper, etrat, leather, papyrus, etc.), writing materials (inks, paints, pencils, printing inks), glues used, and also environmental factors, the study of chemical processes that take place in them as obsolescence and aging of document is largely dependent on them. With the help of chemicals there take place the elimination of biological damage, protection of documents from them,etc. Almost in all phases of restoration work, we meet the chemical processes, starting with disinfection of documents and ending with their washing and neutralization. Formaldehyde $CH_2O$ is most used to disinfect documents as a wide range antiseptic. It works well both to prevent various kinds of biological damage (mold, fungal mycelia, damage caused by insects), as well as to provide the deratisa of repository, and as an antiseptic for restoration glue.

Thymol is in use to disinfect the leather and the etrat.
In the process of washing and neutralization of documents below-mentioned chemicals such as ethyl spirit, methyl cellulose, sodium carboxyl-methyl cellulose, $NH_3$, $H_2O_2$, chloramine-B, suspension of chalk, borate buffer (mixture of aqueous solutions of $H_3BO_3$ and $Na_2BO_4x10H_2O$ (Borax)), $KMnO_4$, $H_3PO_4$, $NaHSO_4$ are in use.
In the process of impregnation and consolidation of the basis of paper hydroxyethyl cellulose and methyl hydroxypropyl cellulose are in use.

Polyvinyl spirit, solution of tungsten and phosphoric acid, benzene $C_6H_6$, carbon tetrachloride $CCl_4$, xylene, toluene, dioxane, hexane, acetone, vinyl copolymer with ethylene, spirit solution of methyl-polyamide resin, polystyrene, ftorlones H, 4H and 6H, acetone, ethyl acetate, amyl acetate in combined solvents in 1:1:1 ratio, and the solution of methylol-polyamide are in use to stabilize the text. Recently, a number of the restorers expressed the opinion that it is necessary to minimize the number of chemical processes in the restoration and to remove certain set of chemicals, for example, formaldehyde. This point of view is completely refuted directly by practical results. Proper selection of chemicals and thoroughly processed document contribute to the maximum extension of its

existence, if conditions of protection (The balance of temperature and humidity) are normal, and if preventive disinfection and deratisation are held in repository, historical material is not in any danger.All documents,especially unique manuscripts, require fundamental study and individual choice of methods of restoration and preservation. Judicious use of chemicals and safety regulations provide high quality of restoration, maximum extension of viability of document and health protection of restorers.

**References**


[1] Baynes-Cope A.D Caring for books and documents / Brit. Museum publ. London, 1981. 32p.

[2] Flieder F. La conservation des documents graphiques. Paris, 1969. 288 p.

[3] В.Ф. Привалов / Реставрация документов на бумажных носителях / Москва 1987. ст. 173-187

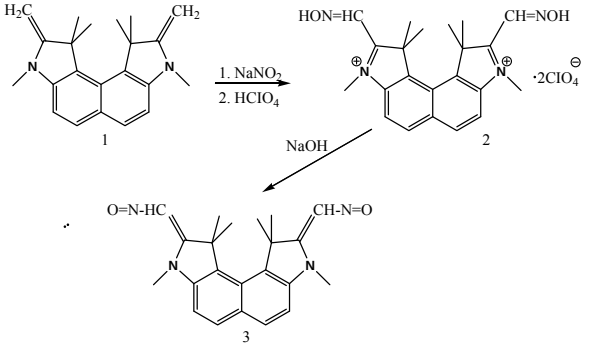
## SYNTHESIS OF 2,9-DI(NITROSOMETHYLIDEN)INDOLO[4,5-E]INDOLE

**T.Shonia, M.Trapaidze, Sh.Samsoniya**

Iv. Javakhishvili Tbilisi State University
marina.trapaidze@tsu.ge

Bisanalog of fischer's base-1,3,3,8,10,10-hexamethyl-2,9-dimethylene-1,2,3,8,9,10-hexahydroindolo[4,5-e]indole (1) and some of it's derivatives were synthesized for researching of biological active compounds [1].

The nitrosation reaction of 2,9-dimethylenindolo[4,5-e]indole (1) is studied. The nitrosation reaction is carried out in acetic acid area by water solution of sodium nitrite. The intermediate product (2) of reaction was isolated as salt of hydrochloric acid.




Synthesized dioxime perchlorate (2) after processing by alkali in water/alcohol solution transferred in dinitroso compound - 1,3,3,8,10,10-hexamethyl-2,9-bis(nitrosomethylene)-1,2,3,8,9,10-hexahydroindolo[4,5-e]indole (3), which after boiling with acetic anhydride was decomposed into dioxyindoloindole and hydrogen cyanide.

### Reference

[1] Sh.A.Samsoniya, M.V.Trapaidze, N.N. Nikoleishvili, K.G.Japaridze, J.P.Maisuradze, and U. Kazmaier. Chemistry of Heterocyclic Compounds, Vol. 46 (2010), No. 8, p. 1016-1019.

## HYDROSILYLATION REACTIONS OF OLIGOMETHYLHYDROSILOXANE TO ALLYL CYANIDE

**N. Jalagonia, E. Markarashvili, T. Tatrishvili**

Iv. Javakhishvili Tbilisi State University
Nati.jalagonia@gmail.com

The hydrosilylation reactions of $\alpha,\omega$–bis(trimethylsiloxy)methylhydrosiloxane (PMHS) with allyl cyanide and vinyltriethoxysilane catalyzed by Karstedt's catalyst (platinum (0)-1,3-divinyl-1,1,3,3-tetramethyldisiloxane complex solution in xylene, Pt ~ 2%) in dry toluene or THF solution ($C \approx 6{,}8 \times 10^{-2}$ mol/l), at 1:70 or 1:28:7 molar ratios of initial compounds in the presence of Karstedt's catalyst at 60-80$^0$C temperature range. It was established that hydride addition does not proceeds completely and after 72 h cross-linking processes takes place. Soluble part about 80 % of reaction presents viscous transparent liquids which is well soluble in organic solvents.

Synthesized oligomers are vitreous liquids with specific viscosities 0.08-0.1. During reactions, partial gelation takes place, causing the decrease in the yield. For further investigations soluble parts were extracted from cross-linked products. Structure and composition of reaction products were established according to NMR, FTIR and elemental analyses data. Molecular masses were measured by GPS analyses.

Dependence of reaction rate and active ≡Si-H bonds' conversion depth on the catalyst was investigated. Even in the excess of allyl cyanide, not all active ≡Si-H groups participate in the hydrosilylation reaction. The reaction order, activation energies and rate constants have been determined for hydrosilylation reactions. The synthesized oligomers were characterized by FTIR, $^1$H, $^{13}$C, NMR spectroscopy. In addition calculations using the quantum-chemical semi-empirical AM1 method for modelling reaction between [$Me(MeO)_2SiH$] methyldimethoxysilane and allyl cyanide were performed to evaluate possible reaction paths. Synthesized oligomers were characterized by gel-permeation chromatography and differential scanning calorimetric, analyses.

Via sol-gel processes of synthesized oligomers doped with lithium trifluoromethylsulfonate (triflate) or lithium bis(trifluoromethylsulfonyl)imide solid polymer electrolyte membranes have been obtained. The dependence of ionic conductivity as a function of temperature and salt concentration has been studied.

## STEVIA - SUGAR IN THE FUTURE

**R. Davitadze , A. Kalandia, M. Vanidze**

Shota Rustaveli State University
davitadze.ruslan@mail.ru

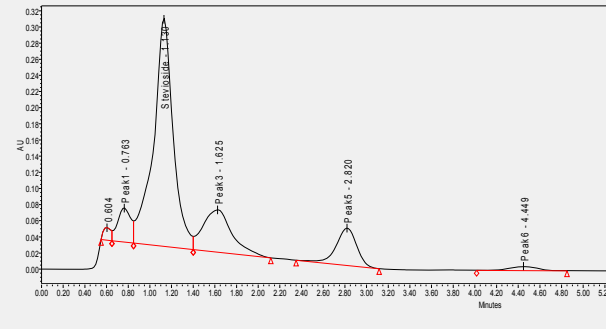
Thousands of people in the world suffer from diabets millitus and the biggest part of our society keeps diets, declines from sweet things, from carbohydrate food because of the high calorie. This poblem is very timely in Georgia too and it can be solved by using plant ,,Sevia". Formerly, when people didn't know anything about sugar Indian tribes used the leaves of Stevia to make delightful food.

The plant Stevia rebaudiana 30-60 cm, is perennial plant which comes from South America. The leaves of Stevia contain low-calorie things in 300 times sweeter than sugar - diterpenoids of glycosides[1]. It must be mentioned that it is thermostable if the temperature is $220^0$C and it makes it possible to use Stevia as the delightful food in the confectionery and food industry.

Our aim is to research gotten diterpenoid glycosides preparations on different processing stages. On this basis we got three preparations with different sweet degree. Rich terpenoid delightful which is 50 times sweeter than sugar is intended for making black tea sweeter; comulative concentrate of Stevia is 200 times sweeter than sugar which is used to make jam, juice and confectionery food-stuffs sweeter and white diterpenoid glycoside represents powder and affervescent tablets which are 300 times sweeter than sugar and it can be used to make all kinds of food-stuff sweet (confectionery and food ) .

The research of the gotten preparation was made by Waters firms HPLC (UV/Visible Detector 2489, Binary HPLC Pump 1525) ( The medicine got its grant within the linits #GNSF/ST08/8-513), detection of the chromatographic column Symmetry C18, 3,5 µm 4,6 x 75 mm, was done for 210 mn. The mobile phase was a linear isocratic of methanol-water (4:1).

**Diterpenes preparations of different frequency.**




**Sweet diterpenes glycosides typical chromatograms.**

To prepare the samples of the preparations their extraction was processes by isobutane. Organic fraction was evaporated until there was a dry sediment which was crystallized by methanol.

The research of the preparations showed that contents does not intrinsically differ. It is dominated by steviosides (peak 1,13), less than rebaudiozidies A (peak 1,625) and C (peak 2,820). Naturally the great difference in the content number of substances. Content of steviosides is until 70-75%. Accordingly in other preparations the universe is until 35-40% and until 20-25%.

## References

[1] A.D. Kinghorn Stevia 2002, 18-19,35-36

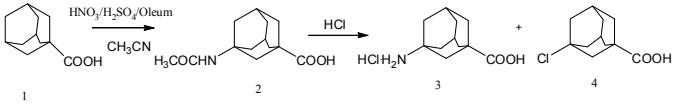
# THE SYNTHESIS OF DERIVATIVES OF ADAMANTANE CONTAINING AMINO ACIDS

**I. Gogolashvili, M. Soselia, D. Zurabishvili, Sh. Samsoniya**

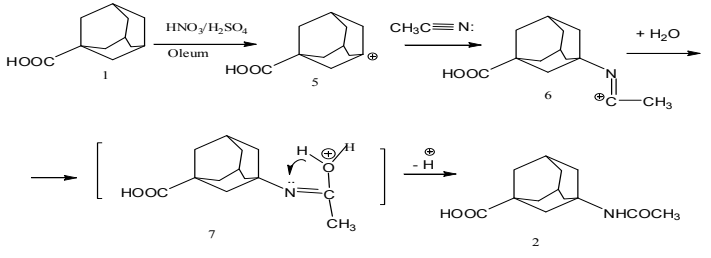
Research Institute of Organic Chemistry, Faculty of Exact and Natural Sciences
I. Javakhishvili Tbilisi State University
mari.soselia@yahoo.com

Adamantane containing amino acids and their derivatives: salts of organic and inorganic acids and bases, esters and amides have antiviral, anti-bacterial, Antiprotozoal and other activities [1-3].

The synthesis of 3-acetaminoadamantane-1-carboxylic acid was carried out in electrophilic area (nitric, sulfuric acid and oleum) according to Ritter reaction. The effect of temperature and correlation of reagents on yield of amino acids was studied. The hydrolysis of synthesized compound was made in hydrochloric area (scheme1).



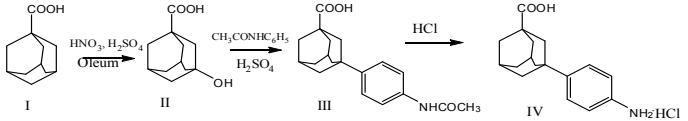

It's shown that 3-chloradamantane is formed by the hydrolysis as a by-product. Here is given a mechanism of formation of 3-acetaminoadamantane-1-carboxylic acid (scheme 2).




Adamantane carboxylic acid in electrophilic area (mixture of nitric acid, sulfuric acid and oleum) forms carbonium ion of adamantane carboxylic acid in position three (5), than carbonium ion is attacked by nucleophilic acetonitrile and supposed to form structure 6 which after addition of water is transferred in intermediate 7. The last one is converted in desired product after deprotonisation and the izomerisation of hydride atom on nitrogen atom.

3-Acetaminophenyladamantane-1-carboxylic acid (III) was synthesized using the

same method (scheme3):




Adamantane-1-carboxylic acid was processed by mixture of sulfuric acid, nitric acid and oleum at 5-10$^0$C temperature for 2.5 hour. Then was poured into ice, boiled for 2 hour and cooled. 3-hydroxyadamantane-1-carboxylic acid (II) was formed as sediment, which was filtered and reacted with acetanilide in presence of sulfuric acid to form 3-acetaminophenyladamantane-1-carboxylic acid (III). The synthesized product (III) was hydrolyzed in hydrochloric acid area and 3-acetamino-phenyladamantane-1-carboxylic acid hydrochloride (IV) was formed.

The synthesized compounds will be used for the synthesis of peptides and benzimidazoles.

## References

[1] Switzerland Patent, №459186. Kl:120,25, Int.Cl.:C 07 C (1968).

[2] S. Novikov, A.P. Khardin, L.N. Butenko, I.A. Kulev, I.A. Novakov, S.S. Radchenko, S.S. Burdenko, J.Org. Chem., v. XVI, №7 (1980), p.1433-35.

[3] A.P. Khardin, L.N. Burdenko, I.A. Novakov, I.A. Kulev, S.S. Radchenko, K.I. Birzniex, Author's certificate, SU1068420 A, C 07 C, 101/42 (1984).

## THE ANNOTHOCYANINS OF BEARWOOD

**I. Qartsivadze, N. Surmanidze, D. Chikovani**

Shota Rustaveli State University
ingako88@mail.ru

Adjarian floristic region, vegetation species diversity, according to the distinguished of the entire ecoregion, and today, when the region (all countries), agriculture and tourism infrastructure development priorities are very relevant to the region's natural resources research, biochemical diversity, establishment and use of biologically active substances rich food and drug production.

The aim of the research in Adjara (Shuakhevi and Kobuleti`s region) of the above-ground parts of the plant Bearwood`s (Frangula alnus MILL), phenol compounds qualitative analysis and quantitative study of the vegetation unsteadiness period.

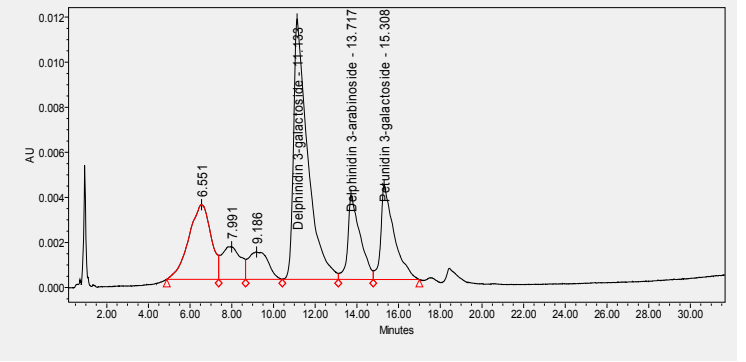
To achieve it were set the following objectives:

- Bearwood`s fetal qualitative study of phenol compounds high pressure`s fluid chromatography. HPLC analysis of flavonoids - Samples (20 µL) were analysed using a Waters HPLC system equipped with a model 525 pump, UV/Vis detector. Separation was carried out using a 4,6x150 Symmetry C 18 column (Waters Corp, Milford, MA, USA) with a 3,9 mmx20mm C 18 guard column. The mobile phase was a linear gradient of 5 % formic acid (A)band methanol (B) from 2 % B to 60 % B for 60 min at 1 ml min-1. The system was equilibrated for 20 min at the initial gradient prior to each injection. Detection wavelengths used were 370 nm for flavonols. Flavonols were quantified as rutin equivalents.

- Biologically active compounds (anthocyanins, leukoanthocyanins , catechins, flavonols) Quantitative variation of the above-ground plant parts.

The scientific novelty of the mountainous zone (Shuakhevi, Kobuleti) qualitative and quantitative composition of the plant pigment Bearwood anthocyans study. Effects of phenol compounds (flanovoids, catechins, leukoanthocyanins, anthocyanins) the dynamics parts are above-ground plant. Under the terms of their savings, as well as the correlation between the phenol compounds in separate groups.

The fruit from Bearwood has been identified and separated 4 anthocyanins: from delfinidin-3-galactose, from delphinidin-3-arabinoside, and from petunidin-3-galactoside, from cyanidin-3- galactoside




**HPLC chromatogram of Bearwood (510 nm).**

## References

[1] C. Cassinese [et al.] // Journal of AOAC International [Electronic resource]. – Technology Industry.2007.Mode of access: http://findarticles.com/p/articles/ mi_7098/is_4_90/ai_n28490137/?tag=rel.res1.

[2] J.-M. Kong [et al.] // Phytochemistry. – 2003. - Vol.64, №5. – P. 923-933.

[3] J.B. Harborne [et al.] // Natural Product Reports. – 2001. – Vol. 18. – P. 310-333.

# SEPARATION OF ENANTIOMERS OF SELECTED CHIRAL BETA-BLOCKER DRUGS BY USING NOVEL POLYSACCHARIDE-BASED CHIRAL STATIONARY PHASES IN HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

**Kh. Gogaladze, B. Chankvetadze**

Institute of Physical and Analytical Chemistry, School of Exact and Natural Sciences,
Tbilisi State University
Khat78@gmail.com

The goal of the present study was systematic screening of novel polysaccharide-based chiral column for separation of enantiomers of chiral beta-blocker drugs by using various mobile phase conditions. These new chiral columns were developed by one of us and are currently commercialized and offered worldwide by Phenomenex In.c (Torranse, CA, USA). In our studies the emphasis was placed on the elution order of enantiomers and the mechanisms of enantioselective recognition by these new materials. These studies require spiking the racemic samples with enantiomerically pure forms of chiral drugs. [1] Since many of beta-blocker drugs are not available commercially in enantiomerically pure forms, some of them must be resolved in advance by us in the micropreparative way. Up to now 16 representative drugs of this series were analyzed on 5 different chiral columns of Lux series: Lux Cellulose-1, Lux Cellulose-2, Lux Cellulose-3, Lux Cellulose-4 and Lux amylose-2.[2]The instrumentation used was high performance liquid chroma-tograph (Agilent 1200 HPLC) equipped with the autosampler, binary pump, column thermostate, variable wavelength detector and Chemstation chroma-tographic software for the instrument management and data treatment. With the necessity of the preparative separation in mind the screening was started with pure methanol and acetonitrile as mobile phases.In contrast to older generation of polysaccharide-based chiral columns the Lux series of chiral columns can be used in all 3 principal modes of chromatography (polar organic-, normal- and reversed-phase conditions)[3].Polar organic mobile phases offer certain advantages for preparative separation of samples. The major advantages are higher solubility of analytes in these mobile phases, sharp chromatographic peaks and shorter analysis time.These advantages translate in high productivity of separation. In this presentation the results of our preliminary studies on the separation of 16 chiral analytes on 5 above mentioned columns with methanol and acetonitrile as mobile phases are presented.

**References**

[1] B. Chankvetadze, E. Yashima, Y. Okamoto, J. Chromatogr. A 670 (1994) 39.
[2] L. Chankvetadze, N. Ghibradze, M. Karchkhadze,L.Peng,T.Farkas, B. Chankve-tadze, Enantiomer elution order reversal of FMOC-isoleucine by variation of mobile phase temperature and composition, J.Chromatogr.A,in press.
[3] M. Okamoto, J. Pharm. Biomed. Anal. 27 (2002) 401.

# SEPARATION OF ENANTIOMERS OF CHIRAL DRUG DIMETHINDENE MALEATE IN CAPILLARY ELECTROPHORESIS USING NATIVE CYCLODEXTRINES AS CHIRAL SELECTORS

**Kh. Gogaladze, B. Chankvetadze**

Institute of Physical and Analytical Chemistry, School of Exact and Natural Sciences,
Tbilisi State University
Khat78@gmail.com

Capillary electrophoresis (CE) represents an useful method not only for separation of enantiomers of chiral compounds but also for better understanding of fine mechanisms of intermolecular selector-selectand interactions. The advantages of CE from this point of view include high plate numbers, and as a result, high separation/recognition power of CE, a presence of both, chiral selector and selectand in free solution, small amounts required, etc. [1].

Cyclodextrins represent a group of most widely used chiral selectors in CE. In spite of this, the nature of forces responsible for cyclodextrin-analyte binding and chiral recognition is not completely understood. Native cyclodextrins differ from each other only with the cavity size and therefore represent interesting objects for better understanding of chiral recognition mechanisms. For finding most likely forces responsible for chiral recognition by cyclodextrins the latter need to be screened on chiral recognition ability towards various chiral analytes [2].

The goal of the present study was to evaluate enantiomer resolving ability of 3 native cyclodextrins $\alpha$-, $\beta$- and $\gamma$-cyclodextrines toward the enantiomers of chiral drug dimethindene. Under experimental conditions of the present study the baseline separation of dimethindene enantiomers was achieved with $\beta$-cyclodextrin [3] at the concentration of 4-mg/ml while the same result with $\alpha$- and $\gamma$-cycclodextrines was possible only at the concentration of 40 mg/ml. The enantiomer migration order was the same with all 3 cyclodextrins S(+) before R(-)-enantiomer.

**References**

[1] B. Chankvetadze, Capillary Electrophoresis in Chiral Analysis, Wiley&Sons, 1997.
[2] B. Chankvetadze, Separation of enantiomers with charged chiral selectors in CE, Electrophoresis 2009, 30, S211–S221
[3] Bezhan Chankvetadze1, Georg Schulte, Dieter Bergenthal, Gottfried Blaschke, Comparative capillary electrophoresis and NMR studies of enantioseparation of dimethindene with cyclodextrins, Journal of Chromatography A, 798 (1998) 315–323

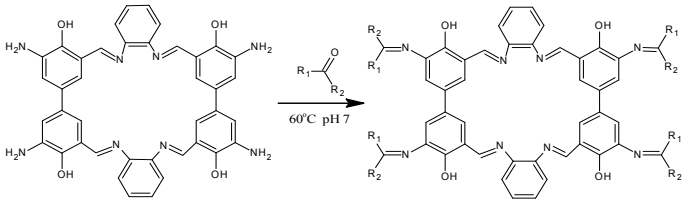
# 24-MEMBER MACROCYCLE POLYAZOMETHINES APPLICATION AS FLUORESCENT MARKERS

**Z. Geliashvili, Kh.Tophuria, N. Obolashvili**

Georgian Technical University
z.geliashvili@gtu.ge

Azomethines as important compounds with its physical, chemical, biological and technical properties have number of application fields. They are actively used in medicine, various scientific directions, diagnostics and industry [1]. It is obvious that their application as fluorescent markers has huge interest.

As it is already know, it is hard to selectively modify hydroqsyle, aldehide and cetone groups, like thirosines, serines, treonines containing hydrocarbons in water and alcohol solutions due to its low reactivity. The mentioned problem can be solved with the application of primary amino-group containing markers [2].




**Scheme- Marking of bio-molecule containing carbonyl group with 24-member macrocycle polyazomethines amino derivatives**

In the current article, we have investigated 24-Member macrocycle polyazomethines amino derivatives as fluorescent markers [3]. The marking of protein solution has been carried out at room temperature in a neutral area with dye at two types of concentrations 1-1.5% (dissolved) and 10-12% (conc.) in alcohol area that was added with proteins in ratio - 10/1. To denaturate the protein completely the one sample was added and heated up to $60^0$C. The colored product is characterized with clear luminescent property transited from yellow to green.

## References

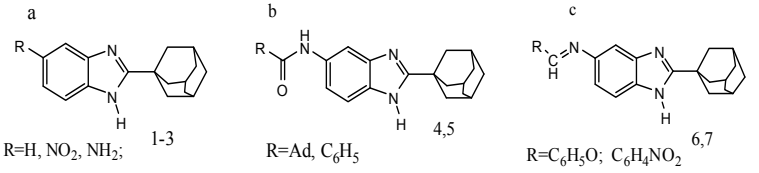
[1] Топурия Х.Д., Оболашвили Н.З., Гелиашвили З.Э, Georgian Engineering News. No. 1, vol. 57 (2011) 112-114;
[2] N.Z. Obolashvili, E.N. Elizbarashvili, I.V. Lagvilava, Kh.D. Topuria, Georgian Engineering News. No. 4, Vol. 52 (2009) 103-106;
[3] W. Laroy, R. Contreras, N. Callewaert, J. Nat. Protoc. 1 (2006) 397-405.

## THE NMR RESEARCH SOME OF 2-(1-ADAMANTYL)BENZIMIDAZOLES

**T. Bukia[1], M. Lomidze[1], G. Buzaladze[1], D. Zurabishvili, [1]**
**E. Elizbarashvili[2], Sh. Samsoniya[1]**

[1] Research Institute of Organic Chemistry, Faculty of Exact and Natural Sciences,I. Javakhishvili Tbilisi State University
[2] Georgian Technical University
zurabishvili_davit@yahoo.com

The synthesis some of the adamantan containing new benzimidazoles by the following structure (a, b, c) have already been published [1,2]. Now here is presented some of synthesized compounds NMR study.




The NMR (1HNMR and 13CNMR) research was carried out at institute of organic chemistry, in Saarlande University, Germany.

It is known that in the 1HNMR spectrum of the CH2 protons of adamantane is characterized signals in the region 1.58-1.18 ppm, and CH Protons- in the regions of 1.96 ppm. By the study of our synthesized compounds has shown that the CH2 and CH protons of the adamantane has been shown signals in the field of 2.099 -1.71 ppm In the compounds (1-7), which is explained by the influence of electro acceptor ring of benzimidazole. By the influence of adamantane ring the aromatic protons signals is displayed 8.428-7.077 ppm in the compounds 2,5 and 7, and the aromatic protons signals is observed in the field 7.87-6.52 ppm in the compounds 1,3,4 and 6.

The 13CNMR research have shown that the signals of carbon atom were displayed in the field 40.85-27.29 ppm. in the compounds 1-7.

In The report will be presented the NMR spectral data and theoretical calculation of NMR by computer program,, Chem Draw Ultra 10.0'' and will be explained the influence of the substituted group in the benzimidazole and adamantine ring.

Acknowlegment: The designated project has been fulfilled by financial support of the Shota Rustaveli National Science Foundation (Grant #GNSF/STO8/4-413). We also want to thank the Deutsche Akademische Austauschdienst (DAAD) for

supporting the partnership and the exchange program between the Ivane Javakhishvili Tbilisi State University and the Saarland University.

**References**

[1] T. J.Bukia, D.S. Zurabishvili, E.N. Elizbarashvili, Sh.A. Samsoniya, Republic Conference of Young Scientists.Chemistry Today-2011 (2011) pp 31.

[2] D. Zurabishvili, T. Bukia, M. Lomidze, M. Trapaidze, E. Elizbarashvili, Uli Kazmaier, Sh. Samsoniya. 2nd International conference on organic chemistry: Advances in Heterocyclic Chemistry,(2011) pp 55-56.

## RECYCLING OF DAIRY WHEY BY MEMBRANE TECHNOLOGY

**N. Davitadze, I.Bejanidze**

Shota Rustaveli State University
irina_bejanidze@live.ru

According to the views of European scientists, milk production - a pyramid whose base are the volumes of whey processing, the upper layers of technology at various levels, from the traditional to the membrane, the peak of the pyramid- specific extraction and fractionation. There is growing interest in the processing of whey in the first place it refers to the deep processing of whey by membrane technology, which generates products such as therapeutic drugs. In recent years, milk production trend to wards the use of membrane technology, which will expand the range of dairy products and lead to fundamental changes in approach to the processing of whey.

By applying the method electromembrane - electrodialysis allows us to solve this important problem of demineralization of whey as 70-80%, resulting in a cottage cheese whey has been successfully used in the manufacture of baby foods, ice cream, drinks, ets.

Despite the large volumes of serum on daily enterprises have not yet resolved the question of their complete recovery, it is poured down the drain than complicate the one hand the environmental situation in the region, on the other hand, the profitability of dairy production is reduced. In this study, determined the possibility concentration of dairy whey by baro (Fig.1,2) and electromembrane methods, ultrafiltration and electrodialysis is shown. Optimum conditions of carrying out of concentration process are investigated and established.

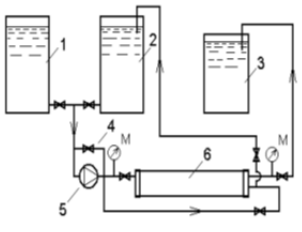



*Fig.1 Scheme of ultrafiltration*

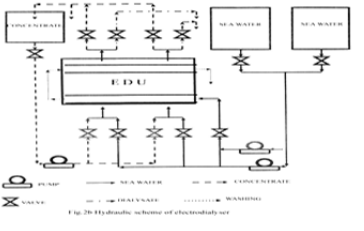



*Fig.2 Scheme of electrodialysis*

The studies were conducted on the cottage cheese and sour cream serum concentration of which was performed by ultrafiltration in a circulation mode, the hollow fibers, demineralization-electrodialysis. We determined the optimal parameters of the process: the dependence of the process of its duration and pressure.

Was conducted full physico-chemical analysis of serum concentrates on the content of fat, protein, water, lactose, was also determined by the density and conductivity

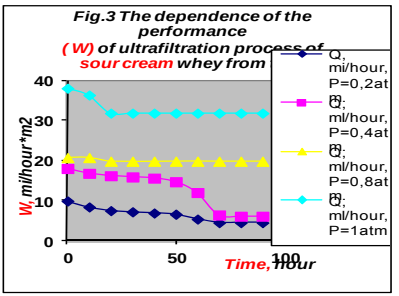
It is established the possibility of concentration the curd and sour whey by , in particular the dependence of (W) of the process of concentration, time and pressure (Fig. 3, 4).

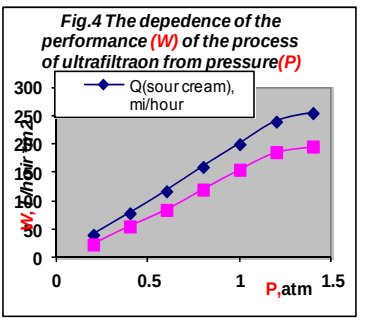
It was found that in the first 20 minutes of the performance of the process drops sharply, and then does not change with increasing pressure, it grows and reaches a maximum at P=0.14 Pa.

It is established that the rate of purification and concentration of cheese whey is higher than sour cream.

Based on the analysis found that the composition of concentrated cheese whey depends on the pressure: with the increasing pressure and the achievement of their maximum value of - 0.1 p, increases in concentrate lactose (L) on 29% protein (P) by 30%., conductivity (S) by 29.8% and density (D) 22.5%; water content (W) isreduced by 58% (Fig.5.6).
When serum of sour cream is concentrated, all indicators of the concentrate is lower than cottage cheese, in particular during concentration is increasing the lactose content (20.2%), protein (12.4%), conductivity (16.5%) and density (18.7%); water content is reduced by 26.6%.

Fig.6 shows the composition of demineralized whey cheese. Found that in the dialysate all indicators, except for the water content is higher than in the concentrate.



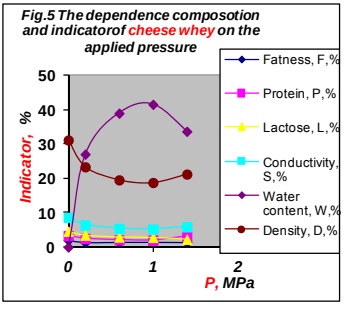


Fig.5 The dependence composotion and indicatorof cheese whey on the applied pressure
Indicator, %
50
40
30
20
10
0
0
1
2
P, MPa
Fatness, F,%
Protein, P,%
Lactose, L,%
Conductivity, S,%
Water content, W,%
Density, D,%

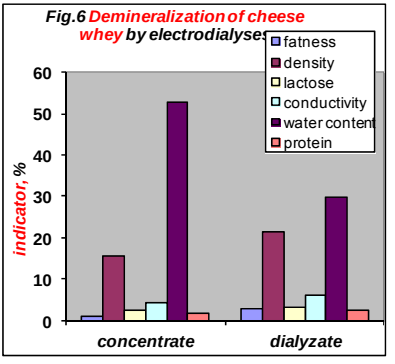


Fig.6 Demineralization of cheese whey by electrodialyses
indicator, %
60
50
40
30
20
10
0
concentrate
dialyzate
fatness
density
lactose
conductivity
water content
protein

# WATER-IN OIL MICROEMULSION LIQUID CHROMATOGRAPHY: COMPARISON OF MOBILE PHASES ON THE BASIS OF BRIJ-30 AND AOT

**M. Gvaramia, R. Chaladze, N. Javakhisvili,N. Khutsishvili, M. Rukhadze**

School of Exact and Natural Sciences, Tbilisi State University
manuchar_gvaramia@yahoo.com

Reverse micelle and water-in-oil microemulsion are the subject of increasing interest due to their use as a model for confined water in biological systems [1]. Reverse micelles represent one of the normal membranous structures in cells. The biological processes occurring in a reverse micellar system dublicate well the membranous environment. Water located in the core of reverse micelle exhibits at least two structures. Water that is close to the barrier molecules i.e. surfactants, reveals more density, is less free and forms hydrogen bonds less, than the molecules in free (pure) water [2].

Water-in-Oil Microemulsion Liquid Chromatography represents an rare mode of liquid chromatography. Microemulsions reveal high solubilisation ability for hydrophilic and hydrophobic compounds, hence their separation may be reached easier due to unique two-phase composition of microemulsions [3].

The goal of the proposed work was study of influence of different factors e.g. concentration of anionic AOT and nonionic surfactant Brij-30, content of water, introducing of chaotropic and kosmotropic ions, also nonionic kosmotropes and chaotropes in the water pockets on the chromatographic behavior of some organic compounds, viz. drugs, vitamins etc.

Microemulsion mobile phases were prepared on the basis of Brij-30 and AOT. Mixed mobile phases are also used for elution of the model compounds. The chromatographic column was a Silasorb $C_2$ stainless steel column. Detection wavelengths were 250 and 280 nm.

Investigations show that more hydrophobic compounds are eluted early in comparison with polar solutes by mobile phase hexane-water-Brij-30 mixture. Decrease of retention of model compounds is observed at the increasing of water/surfactant ratio (W value). Results show that reverse microemulsions on the basis of AOT is preferable for cationic compounds. Separation of anionic samples is performed by mobile phase hexane-water-Brij-30 mixture.

Retention of solutes is changed by introducing of some salts in the water pockets of water-in oil microemulsion. The values of retention factors of the model compounds are higher by using of AOT reverse microemulsion modified with perchlorate ions as compared with elution by mobile phase, modified with acetate ions. In contrast to this, retention factors of samples are higher by elution with reverse microemulsion modified with kosmotropic glucose than by using of the same mobile phase, modified with chloral hydrate.

The presence of micelles in the mobile phase influences the absorbance spectra of model compounds in the ultraviolet region. Absorption spectra of compounds in water-in-oiland ethanol-water mobile phases were compared.
Results may be useful in the investigations of structure of confined water in biological systems.

## References

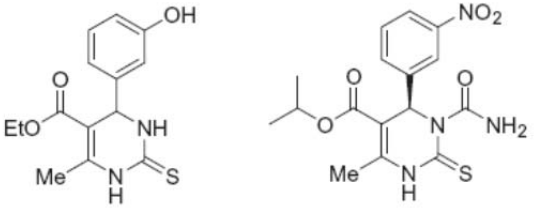
[1] N.Levinger, Science, 2002, 298, 1722.
[2] M.Hoppert and F.Mayer, American Scientist, 1999, 87(6), 518.
[3] Marsh A., Clark B.J., Altria K.J. J.Sep.Sci. 2005, 28, 2023-2032

# ONE- POT MULTICOMPONENT SYNTHESIS OF DIHYDROPYRIMIDINONE DERIVATIVES USING SILICA NANOPARTICLES AS REUSABLE CATALYST

**J. Monjezi, A. Shirmardi-Dezaki**

Department of Chemistry, Masjed soleyman branch, Islamic Azad University
monjezi.j@gmail.com

The 'greening' of global chemical manufacturing by minimizing energy consumption and waste production has become a major concern to organic chemists in present years, A robust, efficient, and cost effective chemical process is normally considered important in pharmaceutical synthesis [1]. Currently, one-pot, multi-component synthesis are practiced extensively due to their prowess to minimize reaction time, the number of steps, energy consumption, waste production, and to maximize synthetic efficiency and environmental benignity [2]. Dihydropyrimidinones (DHPMs) have a wide range of biological activities, acting as calcium channel antagonists, anti-hypertensive, anti-bacterial, and anti-inflammatory agents, while also possessing cytotoxic activity. For example, the anti-cancer agent Monastrol (Fig. 1) has been shown to specifically affect mitosis via a new mechanism consisting of the specific and reversible inhibition of the motility of the motor protein, mitotic kinesin. At the same time, (R)-SQ 32926 has been found to have potent anti-hypertensive activity. It has also been indicated that alkaloids isolated from marine sources containing dihydropyrimidine unit demonstrate interesting biological activity [3-8].



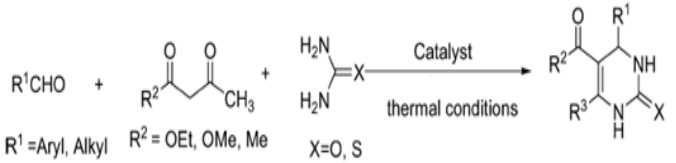

Monastrol (R)-SQ 32926

**Figure 1.** Biologically active dihydropyrimidinones.

A one-pot practical, efficient and multicomponent synthesis of Dihydropyrimidinones (DHPMs) derivatives of biological, pharmacological, and optical applications has been developed using a very mild, neutral, and reusable silica nanoparticles as catalyst. The advantages of using SiO2 NPs are: ease to synthesize at room temperature from readily available and inexpensive materials,

stability at elevated temperatures, neutrality, and biocompatibility. Besides the above mentioned characteristics, higher reactivity and excellent selectivity of the SiO2 NPs prompted us to explore its full potential in other MCRs leading to products with practically important biological, pharmacological, and optical properties.

In this paper, we report $SiO_2$ NP-catalyzed synthesis of Dihydropyrimidinones derivatives via a one-pot three component condensation of aldehydes, β-ketoester such as methyl or ethyl acetoacetate and urea under solvent free condition. (Scheme 1)




Scheme 1: One- Pot Multicomponent Synthesis of Dihydropyrimidinone Derivatives Using Silica Nanoparticles as Reusable Catalyst.

**References**

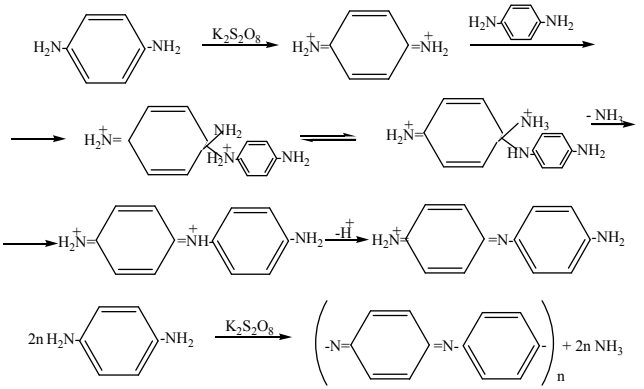

[1] Hota, S. K.; Chatterjee, A.; Bhattacharya, P. K.; Chattopadhyay, P. Green Chem. 2009, 11, 169–174.
[2] Kabri, Y.; Gellis, A.; Vanelle, P. Green Chem. 2009, 11, 201–208.
[3] Roberts, B. A.; Strauss, C. R. Acc. Chem. Res. 2005, 38, 653–661.
[4] D♡mling, A.; Ugi, I. Angew. Chem., Int. Ed. 2000, 39, 3168–3210.
[5] Vedachalam, S.; Zeng, J.; Gorityala, B. K.; Antonio, M.; Liu, X.-W. Org. Lett. 2010, 12, 352–355.
[6] Lorpitthaya, R.; Xie, Z. H.; Kuo, J. L.; Liu, X.-W. Chem. Eur. J. 2008, 14, 1561– 1570.
[7] Gorityala, B. K.; Lorpitthaya, R.; Bai, Y.; Liu, X.-W. Tetrahedron 2009, 65, 5844–5848.
[8] Singh, K.; Arora, D.; Poremsk, E.; Lowery, J.; Moreland, R. S. Eur. J. Med. Chem.2009, 44, 1997–2001

# THE NEW METHOD FOR N,N DISUSTITUTED QUINONEDIIMINE SYNTHESIS

**N.Martikyan, N. Durgaryan, R. Arakelyan, A. H.(A.) Durgaryan**

Yerevan State University
durgaran@ysu.am

Polyaniline (PANi) is one of the most important industrial polymers due to its environmental stability and low synthetic cost[1]. Its remarkable electrical, electrooptical, and tensile properties have drawn attention to the importance of this type of polymer. However, there are still many unresolved problems concerning the structures, properties such as electrical conductivity, and applications of polyanilines because of the complexities in molecular structures, poor solubility in water and most organic solvents as well as the very different structures obtained by different synthesis conditions and post-synthesis treatments. To solve these problems mach work had been focused on the syntheses of electroactive oligomers with well defined structures, as they exhibit similar characteristic redox behavior and electroactivity as polyaniline. We have developed a general strategy for the synthesis of such oligomers based on the fact , that as we have shown recently, the polymer obtained by chemical oxidative polymerization of p-phenylenediamine does not have a structure “similar to pernigraniline”, but is in fact pernigraniline itself, and we believe that the reaction proceeds according to Scheme [4,5].



Obtained results indicated that this reaction undoubtedly proceeded and it form the basis of novel synthetic route for aniline.oligomer.The NH2/ NH2 capped trimer of aniline has been synthesized through this method and was characterized with 1HNMRspectroscopy, Uv, IK spectroscopic methods.

## References


[1.] Handbook of Conducting Polymers. Ed. Skorheim TA,. Elsenbaumer RL, Reynolds JR,second ed., New York: Basel: Hong Kong: Marsel Dekker, Inc, 1998

[2] Yamamoto, I. Nurulla and A.Ushiro Tetrahedron Letters 42(2001)8653

[3] W.J.Zhang,J.Feng,A.G.MacDiarmid and A.J.Epstein,Synth.Met.,1997,84 ,119 -120

[4] A.H. Durgaryan , R.H.Arakelyan, Durgaryan N.A., On the structure of poly(p-phenylenediamine) , 2nd International Caucasian Symposium on Polymers and Advanced Materials, Tbilisi, Georgia, 2010,p.31

[5] Durgaryan N.A., R.H.Arakelyan, A.H. Durgaryan ,Concerning the mechanism of polymerization of p-phenylenediamine,Conducting Polymers Prague,2010, July 10-14 Czech Rebuplic, 46

# NEW SYNTHESIS OF AMINO CAPPED POLYANILINE TETRAMERS FOR TRIAZENE LINKAGES CONTAINIG POLYMERS

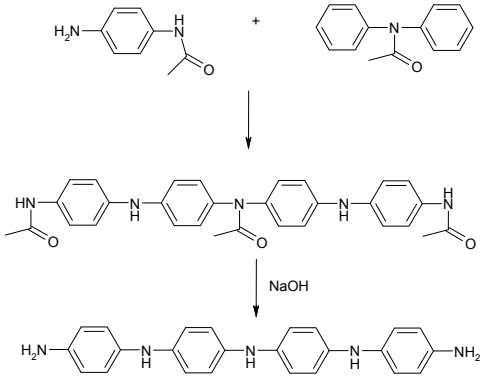
**E. Matinyan, N. Durgaryan, R. Arakelyan, A. H.(A.) Durgaryan**

Yerevan State University
durgaran@ysu.am

Soon after polyaniline was identified as an electrical conductor, different synthetic methods for the preparation of phenylcapped oligoanilines of controlled chain length as models for the poorly defined polymer had been proposed. These compounds proved identical to bulk polyaniline by ESR, UV-vis, and IR spectroscopy and displayed conductivity on the same order of magnitude as that of the bulk polymer, demonstrating that useful electrical properties may be realized even in relatively short oligoaniline systems[1-3].

On the other hand, the new class of compounds - 1-triazene-1,3-diyl-1,4-arylene group containing polymers have been synthesised and investigated. These polymers have the ability to increase conductivity by doping with iodine and by hydrochloric and other acid**s**, as well. The increase in doping concentration affords an increase in conductivity from $10^{-11}$ to $10^{-4}$ S/m due to the doping with hydrochloric acid [4], and to 1 S/m when doping with perchloric acid. The obtained conductivity is in one order inferior to that of PANi, but the feature itself is notable. It has been shown, that this material doped with iodine in 1:1 molar ratio exhibit photoluminescence properties when exited by 265 wavelength. In order to obtain materials with good solubility, superior electrical and optical properties we aim to combine obtained oligomers.

We now reported the synthesis of amino capped tetramers of aniline. For this proposed, firstly, the oxidative condensation of 4-aminoacetanilide with N-acetyldiphenylamine is carried out, then by hydrolysis of obtained 4,4’-bis( 4-acetaminoanilino)N-acetyldiphenylamine corresponding 4,4’-bis(4-aminoanilino)di-phenylamine is obtained.



## References


[1] E.Rebourt,J.A.Joule and .P.Monkman, Synth.Met., 84 (1997)65 -66.

[2] J.P.Sadighi,R.A.Singer and S.L.Buchwald,J.Am.Chem.Soc., 120 (1998) 4960- 4976.

[3] Irena Kulszewicz-Bajer, Izabela Ro ´z ÿalska and Magorzata Kuryek, New J. Chem, 28 (2004), 669 –675

[4] E.E. Matinyan, A.H. Durgaryan, ,R.H. Arakelyan, N.A. Durgaryan, Synth. Met., 160(2010) 180-186.

# EXTRACTION OF HYDROPHILIC BIOLOGICALLY ACTIVE COMPOUNDS FROM THE COPTON OF APPLE

**T. Gabriadze, N. Sinauridze**

A. Tsereteli State University
gabriadze.tamila@mail.ru

Technology development for low-toxic effective medioprophylactic preparations is a pressing problem in contemporary medicine.

The apple processing waste products in kind of the remained copton contain valuable biologically active substances, including thriterpenoids, polyphenols, pectins, amino acids, carbohydrates, vitamins etc. Despite this fact, the apple as a source for biologically active raw material is not applied in contemporary medical practice yet. Therewith, the polyphenols as well as the amino acids possess the antioxidant, anti-radical, hepato- protective and radio-protective activity, and besides, they strengthen the regenerative processes. The pectins exhibit the enterosorption properties with lipid lowering activity.

Our research was aimed at study of the hydrophilic compounds production process from the copton of apple for the purpose of its further optimization.

In order to produce the copton of apple the biologically active fraction we were preliminarily drying until air-dried state (with humidity no more than 15%) and then disintegrating them to 2-4 mm fractions. The extraction process of this raw material with water there reveals the swelling that is accompanied with destruction of herbal raw material particles and uniform moistening. Disintegration until much finer particle leads us to excessive swelling and increasing in hydraulic resistance in the extraction process.

For the study of the extraction process we decided to consider as an optimization criterion the gross productivity ($Y_1$%) of hydrophilic biologically active substances from per raw material, which is determined in compliance with ISO 9768:1994. This standard envisages as follows: extraction in the reflux conditions as well as the filtration of compound, drying of undissolved waste and then weighing with computing of extractive substances; gross productivity of the phenol compounds ($Y_2$ %) we determined in compliance with ISO 14502-1 standard. It is based on the method of colorimetric analysis by using the Folin-Ciocalteu reagent; gross productivity of the amino acids ($Y_3$ %) we determined by using the spectrophotometric method; for gross productivity of the pectin substances ($Y_4$ %) as the major factors effected on the parameters we have selected the temperature of extraction ($X_3$ 75-95°C), extraction duration ($X_2$ 90-150 minutes), the module: water/raw material ($X_3$ 6-10 l/kg) and the vibration frequency of the extractive mass ($X_4$ 1-5 1/sec). There has been realized the central composition rotatable arrangement matrix of the experiment, which comprises 31 tests, including the following ones: the complete factorial – 16 tests, the tests at the star points with

the side ± 2 – 8 tests and tests in the center of experiment – 7 tests. After each test the obtained extracts were kept until temperature 3-5 °C within 8-10 hours, and then we were removing the sediment by filtration. The extraction was carried out in the extractor of sampling action.

The realization of the rotatable arrangement matrix led us to the following equations of the adequate regression (in encoded scale), wherein an essentiality of the regression coefficients was verified for 0,95 accuracy by using the Student's test, and the adequacy of the equations – by using the Fisher's test:

$$Y_1 = 34{,}0 + 1{,}8x_1 + 1{,}6x_2 + 2{,}1x_3 + x_4 - 0{,}5x_1x_2 - 0{,}6x_1^2 - 0{,}5x_2^2 - 0{,}6x_3^2 - 0{,}6x_4^2 \ [\%];$$

$$Y_2 = 10{,}5 + 0{,}7x_1 + 0{,}6x_2 + 0{,}9x_3 + 0{,}3x_4 - 0{,}2x_1x_2 - 0{,}2x_1^2 - 0{,}3x_3^2 - 0{,}2x_4^2 \%]$$

$$Y_3 = 3{,}20 + 0{,}26x_1 + 0{,}24x_2 + 0{,}36x_3 + 0{,}15x_4 - 0{,}08x_1x_2 - 0{,}1x_1^2 - 0{,}1x_4^2 \ [\%];$$

$$Y_4 = 18{,}5 + 0{,}9x_1 + 0{,}8x_2 + 1{,}2x_3 + 0.5x_4 - 0{,}3x_1x_2 - 0{,}3x_1^2 - 0{,}3x_2^2 - 0{,}4x_3^2 - 0{,}2x_4^2 [\%];$$

For implementation of the proposed research we are intended to define the optimization strategy of the extraction production process; to determine the optimal regimes for the process and then on the basis of biologically active hydrophilic compounds complex we will develop the rational technology for production of appropriate medical preparation.

**References**


[1] V. Khvedelidze, B. Butskhrikidze. The Vegetable Extracts Technology - Kutaisi; ATSU, 2011;

[2] V. Khvedelidze. Mathematical Support of the Chemical-Technological Experiment - Kutaisi; ATSU, 2011

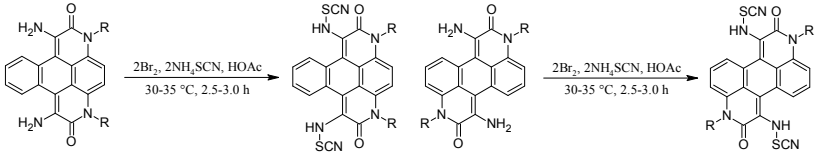
## THE NOVEL *BIS*-PYRIDONE CONTAINING FLUORESCENT PROBES WITH ACTIVE THIOCYANATE GROUPS

**N. Obolashvili, A. Avakyan, M. Kharadze, Sh.Kenchadze, I. Lagvilava**

Georgian Technical University
n_obolashvili@yahoo.com

The application of fluorescent probes in microbiology and histology is very important. The one type of important molecular probes are reactive dyes with thiocyanate groups widely used in pathogenic cells diagnostic [1-2].

In the present work we offered convenient methods of one-pot-synthesis of thiocyanate moiety containing bis-pyridone active dyes and displayed application possibility of the obtained compounds. The physical, optical and chemical properties of resulting products have been also studied [3-5].




**R=H, iPr, iBu, Hep, $CH_3(CH_2)_9CH_2$-, Bn ...**

**Scheme 1. Synthesis of desired active fluorescent dyes**

Unlike the monopyridone moiety containing compounds the synthesis of desired active dyes requires the reaction between a solution of pyridone compound and ammonium thiocyanate in the glacial acetic acid and bromine at 30-35 °C for a period of 2.5-3.0 h under the mechanical stirring. The reaction mixture was poured into water and precipitated light brown crystals were separated via filtration [3-5].

The synthesized thiocyanate derivatives may be used as fluorescent probes. Due to the presence of two active thiocyanate groups in molecule they can be recommended as an effective homobifunctional crosslinkers and precursors of the secondary immunoreagents [6]. The conjugation process with proteins runs in the water-acetone solution in alkali media (pH 9.0) at the room temperature. The labeled proteins, obtained according to above mentioned method, have yellow color with green luminescence [3-5].

### References

[1] O.I. Oyewole, S.O. Malomo, J.O. Adebayo, Pak. J. Med. Sci. Vol. 24, No.1 (2008), 18-22;
[2] S.M. Zingde, P.N. Anklesaria, S.H. Advani, A.N. Bhisey, B.P. Gothoskar, Blut. 55(2) (1987), 81-85;

[3] N.Z. Obolashvili, E.N. Elizbarashvili, I.V. Lagvilava, Kh.D. Topuria, Georgian Engineering News. No. 4, Vol. 52 (2009) 103-106;
[4] N. Obolashvili, I. Lagvilava, E. Elizbarashvili, Georgia Chemical Journal. 7, 4 (2007) 365-367;
[5] N. Obolashvili, I. Lagvilava, E. Elizbarashvili, Republic Conference of Young Scientists “Chemistry Today -2011”, 26th February (2011) Tbilisi, 67-68;
[6] H.G. Bäumert, H. Fasold, Methods Enzymol 172 (1989) 584-609.

# Authors Index

## R



## S



## T



## V



## Y



## Z

NoteBook