

Information about both local and international scientific grant projects implemented by scientific staff during the last 20 years

Project number / ID number	Project title	Name of the grant call	Funding organization	Grant budget (total)	Start and end dates	Principal investigator	Key personnel	Project Summary	Detailed description (for the completed project)	Achieved results
GE-2506	Scientific substantiation of the possibility of creating new bactericidal zeolite filter materials for purification-decontamination of water from various sources	Applied grant	International Science and Technology Center ISTC	210 130 USD	1.05.2022 - 30.04.2025	Vladimer Tsitsishvili	Nato Mirdzveli, Nanuli Dolaberidze, Manana Nijaradze, Zurab Amiridze, Bela Khutishvili, Tekla Kapanadze	The goal of the project is to create methods of chemical modification and transformation of clinoptilolite and other natural zeolites for the production of bactericidal filter materials suitable for water purification and decontamination		
FR-21-4196	Obtaining ursolic, oleanolic, betulinic acids from agro-industrial wastes, synthesis of their derivatives and evaluation of biological activity	Fundamental Research Grants	Shota Rustaveli National Science Foundation (SRNSF)	233 000 GEL	14.03.2022 - 14.03.2025	Imeda Rubashvili	K.Ebraldize, M.Tsitsagi, M.Chkhaidze, M.Alibegashvili, R.Kakava, T.Bukia	We are investigating sequential extraction of pentacyclic triterpenoids, derivatization. We are also working on the elaboration of analytical methods of target products and study of bioactivity		
CARY3-19-442	Bactericidal zeolite fillers for paper production	Applied grant (IBRD)	Development Bank for Reconstruction and	249 000 GEL	29.07.2020 - 29.07.2021	Vladimer Tsitsishvili	N.Mirdzveli, Z.Amiridze, A.Tsertsvadze, G.Khutishvili, K.Virsaladze, T.Kapanadze, B.Khutishvili, N.Chalidze, M.Panayotova, N.Dolaberidze, M.Nijaradze	The goal of the project was to obtain bactericidal materials using heulandite-clinoptilolite from Georgia, study their properties and use them as a filler for the production of bactericidal paper	Microporous materials containing silver, copper and zinc were prepared using a new environmentally acceptable ion exchange method. The synthesized materials retained the crystal structure of zeolite, contained a sufficient amount of biocidal metals, and exhibited bacteriostatic activity against gram-negative bacteria <i>Escherichia coli</i> , gram-positive bacteria <i>Staphylococcus aureus</i> and <i>Bacillus subtilis</i> , fungal pathogenic yeast <i>Candida albicans</i> , and fungus <i>Aspergillus niger</i> , and the mixtures of different forms were synergistic and had higher activity than individual materials. Filled papers were produced in the paper factory of the company "Paper-" and their general mechanical properties (basis weight, thickness, durability, etc.) were investigated. The introduction of zinc-containing zeolitic fillers gave the paper bacteriostatic action against <i>Escherichia coli</i> , and these two fillers are recommended for use in the production of bactericidal paper.	The results obtained in the process of cooperation between Georgian scientists of Tbilisi State University and Bulgarian scientists of Sofia University of Mining and Geology are interesting and important for such disciplines as physical chemistry (ion exchange in the 'solid' state), materials science and medicine (bactericidal adsorbent-ion exchangers), bacteriology (silver, zinc and the effect of the synergistic action of copper), as well as from an economic point of view (possibility of replacing expensive silver with cheap copper and zinc)
FR-18-2600	Scientific feasibility of creating nanocrystalline bactericidal sorbents on the basis of Georgian natural zeolites and the study of corresponding mechanisms	Fundamental Research State Grants	Shota Rustaveli National Science Foundation (SRNSF)	128 000 GEL	27.02.2019 - 27.02.2021	Nato Mirdzveli	Manana Nijaradze, Nanuli Dolaberidze, Zurab Amiridze, Nino Sinauridze, Ketevan Virsaladze, Tekla Kapanadze	The main direction and the research goal of the work is the investigation of mechanisms of nanocrystalline bactericidal material formation, including determination of regularities of hydrothermal crystallization and ion exchange processes, as well as development of optimal conditions to prepare zeolite sorbent with high sorption and detoxifying properties, which will be widely used in medicinal practice since it is highly demanded.	The sphere of application of the results of the project is medical practice, including the creation of new medical preparations. New methods expand the assortment of bactericidal preparations, and the sorbents with high capacities and antitoxic properties are interesting from a commercial point of view in accordance with the sales of similar products, price-forming factors, etc. Assessment of production costs both for pilot and large-scale technologies, as well as consideration of environmental aspects of production and application of new zeolite products is planned.	In order to obtain nanocrystalline bactericidal sorbents, the solid-phase method of chemical treatment of zeolitic adsorbents - ion exchange was used for the first time, which allows to increase the assortment of similar materials in a short time with lower costs. Many researchers were interested in the results of the project, both in Georgia and abroad, because an important task in this field is to create a theoretical and experimental basis for researching the properties of zeolitic sorbents, which is indicated by the dynamics of the increase in the number of open publications and patents. Application of nanocrystalline sorbents with high content of antibacterial metals can solve many problems in medical practice.
AR-18-741	Obtaining of hydroinsulation materials, highly effective penetrant and other products by wasteless processing of several industrial and petroleum deposits	Applied Research State Grants	Shota Rustaveli National Science Foundation (SRNSF)	390 000 GEL	2019-2021 (prolonged to the end of 2022)	Guram Khitiri	Ioseb Chikvaizde, Raul Kokilashvili, Tinatin Gabunia, Nino Samsonia, Nino Zviadadze, Givi Bazghadze	The issue of waterproofing of building constructions, various purpose buildings and structures is one of the urgent problems of modern times. Currently, concrete, reinforced concrete, metal materials are used for this purpose, which are quite expensive and are not produced in the region of Georgia. Importation, transportation and customs clearance of waterproofing materials seriously increases the builders' costs of and increases the cost of the building as well. Our goal is to obtain high-quality waterproofing material based on our own resources, creation of methodology for obtaining of highly effective insulation (waterproofing) materials for use in the following directions: waterproofing of concrete, reinforced concrete, metal, wood and other building structures, flat roofing, filling and gluing of cracks, spraying solutions and emulsions, spreadable mastics and adhesive layered materials; hydro- and anti-corrosive insulation of pipelines, including the oil and gas pipelines; modernized asphalt material; hard and flexible tiles and etc., drawing up specific proposals and working methods to get the planned products.		Up to 50 samples of insulating materials of different composition (including sand-based) and initial used tyre powder have been prepared. The process of observing is in progress.

AR-18-601

Complex, prolong-acting zeolitic fertilizer obtained by nanotechnology	Applied Research State Grants	Science Foundation (SRNSF)	420000 GEL	17.12.2018 - 17.12.2021	Giorgi Tsintskaldze	Marina Zautashvili, Tinatin Sharashenidze, Nina Mumladze, Manana Burdjanadze, Giorgi Iluridze, Giorgi Antia
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The effective way to achieve the nutrition regime of plants is to use mineral and organic fertilizers. Effect of using mineral fertilizers is very low, as after being introduced in soil, part of nitrogen fertilizers are either washed out or evaporated, and part of phosphate fertilizers are absorbed by the soil and turn into an sparingly soluble form. Use factor of this kind of fertilizer is only 15-25%. Natural zeolites are widely used in agriculture. Introduction of mineral fertilizers and zeolites in the soil allows us to guarantee the long-term effect of fertilizers and washing out of nutrition elements from the soil. We propose new nano technological method to receive anionic substitute. This method is based on introduction of ammonium dihydrophosphate and some cations in zeolite structure without changing its structure, by the formation of the anion substitutional phase. Due to the molecular sieve properties of the zeolite, ammonia cations, anions of phosphoric acid and other micro elements introduced into the zeolite structure, gradually pass into the soil. The interaction of phosphoric acid with soil ions is minimal, which maximizes the efficiency of fertilizer use. Enriched at nano-level with phosphorous, ammonia, potassium, calcium, iron, magnesium and microelements (boron, zinc, manganese, molybdenum, copper and sulfur) fertilizer obtained, due to its multifunctional universal properties may be used in open field for almost all types of agricultural crops, greenhouses, as well as for decorative plants. The resulted fertilizer due to its multifunctional universal characteristics can be used in open field for almost all types of agricultural crops, sapling farming, greenhouses, as well as on decorative plants.

Using natural zeolites from local raw materials, a zeolitic material is obtained by nanotechnological methods, which includes nitrogen, phosphorus, potassium, calcium, iron, magnesium, boron, zinc, copper, molybdenum, manganese; The proposed zeolite nanoporous material is an "inorganic capsule - molecular sieve", the operation of which is mainly based on the principle of anion exchange - the gradual transfer of phosphoric acid anions in the soil, which is well supported by the molecular-sieve properties of zeolite. Due to this, the contact of phosphoric acid anions in the soil and, accordingly, the formation of calcium, magnesium, iron and aluminum phosphates, which are insoluble or difficult to dissolve in water, are minimized. Also, the ecological danger that can occur by soil cultivation and changing its structure is reduced to a minimum; Phosphorus utilization rate increases; The fertilizer is of prolonged (long-term) action; improves soil aeration; it keeps moisture in the soil for a long time and continuously supplies it to the plant; works as a storage reservoir of elements necessary for plant life and growth; is a source of trace elements and thermoregulators; minimizes phosphorus loss; It is an environmentally efficient product; makes it possible to reduce plant maintenance costs; Fertilizers with similar properties and composition are almost not found on the market in our country, or if they are quite expensive or of low quality, therefore, the production of such a universal fertilizer obtained using local natural raw materials creates great prospects for its use. Considering the simplicity and low cost of fertilizer production, the prospect of using the proposed nanomaterial as a universal fertilizer will become more realistic. At present, there are mainly two types of phosphorus fertilizers sold in the market; These are simple phosphorus-containing fertilizers and complex phosphorus-, nitrogen-, and potassium-containing fertilizers. Applying simple fertilizer to the soil requires addition of nitrogenous and potassium fertilizers. Complex phosphorus fertilizers, such as the French-made "Everton" or "Europak" available on our market, are covered with a membrane made of organic substances, so that phosphates do not turn into insoluble forms that cannot be absorbed by plants when they come into contact with the soil. The total percentage of nitrogen, phosphorus and potassium in this fertilizer does not exceed 40%, and the rest of the fertilizer is organic ballast, which is another factor of soil pollution. The fertilizer offered by us is cheaper compared to the French fertilizer, the total percentage of nitrogen, phosphorus and potassium is more than 50%, and the most important thing is the zeolite containing the ballast. If we take into account that it is possible to adjust the amount of microelements and potassium in the proposed fertilizer, then once again we will be convinced of the superiority of the proposed fertilizer. Fertilizers of this type are practically not produced in Georgia, because the project is focused on the development of innovative and technological transfer with a perspective of commercialization, a small-scale enterprise was organized on the territory of P. Melikishvili Institute of Physical and

On the territory of P. Melikishvili Institute of Physical and Organic Chemistry, a small-scale enterprise was organized, where the proposed fertilizer is produced, which is competitive with the corresponding type of imported fertilizers; patent, scientific publication in a ranked journal, Participation in 2 scientific conferences.

<p>FR-18-3889</p> <p>Synthesis of coordination compounds of biomaterials with anesthetic substances and research of their physical-chemical properties</p>	<p>Shota Rustaveli National Science Foundation State Grants</p>	<p>222 000 GEL</p> <p>21.02.2019 - 21.02.2022</p>	<p>Nani Zhorzholani</p>	<p>Koba Amirkanashvili, Lela Metreveli, Aleqandre Dadianize, Ani Shubitidze</p>
<p>FR-17-187</p> <p>Investigation of formation of fine-dispersed zeolite crystals and the feasibility of creating new materials</p>	<p>Shota Rustaveli National Science Foundation State Grants</p>	<p>120 000 GEL</p> <p>20.12.2017 - 20.12.2019</p>	<p>Nanuli Dolaberidze</p>	<p>Manana Nijaradze, Vladimir Tsitsishvili, Nato Mirdzveli, Nino Sinauridze, Ketevan Virsaladze, Tekla Kapanadze</p>
<p>FR-17-381</p> <p>Development of a new technology for ways to overcome environmental problems caused by mineral fertilizers</p>	<p>Shota Rustaveli National Science Foundation State Grants</p>	<p>210 000 GEL</p> <p>20.12.2017– 19.12. 2020</p>	<p>Givi Papava</p>	<p>Riva Liparteliani, Eldar Gugava, Eer Gavashelidze, Nazi Gelashvili, Davit Kvaratskhelia, Ketevan Archvadze</p>
<p>STCU -2016-36</p> <p>The competition of state scientific grants was announced as part of the Program of Targeted Biodegradable polymers synthesis and application in environment protection from pollution</p>	<p>Shota Rustaveli National Science Foundation State Grants</p>	<p>70 000 USD</p> <p>2017 - 2019</p>	<p>Eldar Gugava</p>	<p>Marina Gurgenshivili, Nora Dokhturshvili, la Chitrekashvili, Nazi Gelashvili, Eter Gavashelidze</p>

Achievements in the field of researches in biotechnology and metabolic processes have led scientists to significant conclusions - microelements should enter the living organism only in the form of coordination compounds, since they give the body ability to absorb all vital microelements in a balanced and optimal way. Using simple, optimal methods, depending on the pH medium, 60 individual biocoordination compounds were obtained with the general formula (AnSH)₂[MX₄nH₂O] (type I) and [M(AnS)₂X₂](type II), where AnS is the main form of Lidocaine, Novocaine and Trimecaine; M=Ni(II), Zn(II), Mn(II), Cu(II), Fe(II), Fe(III), Sn(II), Co(II), Cd(II), Cr(III) (I); M=Co(II), Ni(II), Ni(II), Mn(II), Cu(II), (II) X=Cl-, NCS-. In the complexes, the order of metal-ligand coordination was established by IR spectroscopy. The process of complex formation in solutions and the thermal stability of the synthesized compounds have been studied. The molecular and spatial structure of the complexes (AnSH)₂[MX₄nH₂O], where Ni(II), Zn(II), Co(II), Cu(II), was solved by X-ray diffraction. Stereochemical aspects are discussed: the influence of the metal-complex and the organic ligand on the coordination process; The role of hydrogen bonds in the formation of structures; Influence of acid ligands on the internal coordination domain of the complexes. Relationship between structure and properties of the complexes. It is important that the biological activity of several coordination compounds against microorganisms (B. subtilis, S. Aureus, E. coli, C. albicans) is several times greater the bioactivity of the drugs themselves - Lidocaine and Novocaine.

Using simple methods, 60 coordination compounds containing biometals and anesthetic substances have been synthesized, the general formula of which is (AnSH)₂[MX₄nH₂O] and [M(AnS)₂X₂](II). The composition and individuality of the complexes were established by the methods of elemental analysis, IR spectroscopy, and X-ray diffraction analysis. Their solubility in water and various organic solvents was studied. To establish the nature of the ligand bond, the density, and the coordination properties of the acylaldehydes, the studied IR spectra of type I complexes do not allow one to establish the metal-ligand coordination bond, but broad bands are observed in the compounds in the region 2633–2885 cm⁻¹ indicate the existence of the cation (AnSH⁺). And also an absorption band is observed, which refers to the stretching vibrations of tetrahedral anions. In complexes of type II, the coordination bond between the metal and the ligand occurs through the oxygen atoms of the carbonyl group and the nitrogen atoms of the amino group. The specific properties of thermo-oxidative degradation were established from the heating curve, the rate of weight loss, and the temperature range of the decomposition process of the complexes. In compounds of type I and II, end-effects correspond to the oxidation of 2 moles of the ligand. Exo-effects correspond to the loss of acid ions. In all cases, the end product of thermolysis is metal oxide. Complex formation in Fe(III)-Lid-NCS- and Fe(III)-Tm-NCS- systems was studied. The complex is extracted with ether, isobutyl alcohol, chloroform. The best extractant is chloroform. Of the studied cations, the extract of Fe(III) complexes is the most sensitive and it is promising from the point of view of the spectrophotometric determination of Fe(III). Complete X-ray diffraction study of single crystals of the following chemical composition (LiH₂)₂[MeX₄nH₂O], where Me=Cu(II), Ni(II), Zn(II), Co(II); This method refined the molecular structure and spatial structure of the synthesized complexes. Single crystals mainly crystallize in synonies: monoclinic and centrosymmetric-triclinic. In the structures, metal ions coordinate with ligands in the form of two tetrahedral (ugly or regular) anions [Me(CN)₄]²⁻, [Me(NCS)₄]²⁻ or [Ni(NCS)₄H₂O]₂²⁻, while protonated cations remain in the outer coordination sphere. Anions and cations are linked by intermolecular hydrogen bonds. The Kirby-Bauer method revealed the antimicrobial activity of the Co(II), Ni(II), Zn(II), Cr(II), Cu(II) complexes. It has been established that the biological sensitivity of the compounds in relation to strains of staphylococcus (S. Aureus), Escherichia coli (E. coli), bacilli (B. Subtilis) significantly exceeds the sensitivity of pure Lidocaine or Novocaine. Of note are the thioyanate complexes Co(II) and Ni(II), whose bioactivity is quite impressive. The compounds can certainly be used to treat fungal (Candida albicans) disease.

According to the obtained results, it is determined that there are mesopores (hole-like, cylindrical) with average diameters of 22.4 nm in the arachite aggregates. 54.4 nm. Calculated by the Barrett-Joyner-Halenda method. The identity of the crystal structure of the sample is confirmed by X-ray diffractometric analysis method. Scanning electron microscope images show that the size of the largest crystallites is 50 µm. An ecologically profitable method of obtaining metal-containing sorbents with bactericidal properties has been developed. Bactericidal zeolitic adsorbents and ion exchangers have been obtained - with a high content of silver, copper and zinc, maintaining the crystal structure and other properties, which are promising materials for use in the medical field and for environmental measures (water purification, restoration of contaminated soils -disinfection). The chemical composition of the final products is studied, the specific surface area, pore size and volume are determined based on the adsorption measurements. X-ray diffractometric analysis and so-called The stability of their structure has been confirmed using the spectroscopy method. Electron microscopic images are shown. Ion exchange parameters are established: Static exchange capacity 3.5 meq/g, dynamic exchange capacity 2.7 meq/g, activation energy -4.6 for Ag; 42.3 - for Zn. Intense growth of the population requires continuous increase of food products - especially production of cereal crops. But agricultural designation lands suffer constant decrease thanks to the increased urbanization and intensification of industry. One of the ways to resolve the problem is significant increase of hectare norms of mineral, in particular nitrogenous fertilizers, which results in environment pollution, since, as is known, nitrogenous fertilizers are well soluble in water, are easily washed off and lost in soil uselessly, which results in tremendous economic loss and global environmental contamination. This is why development of innovation technologies to produce ecologically safe and profitable mineral fertilizers has a decisive significance for our further survival, and hence it is the urgent problem. Such technology enables us to replace easily washed-off nitrogenous fertilizers by polymerized ones, which are not easily washed-off and in vegetation period provide plants with dosed, regulated, controlled nutrition and harmonious development. The aim of the present Project was to develop an innovative technology to create by targeted polycondensation the biodegradable polymer nitrogenous fertilizers acting with prolongation mechanism, to prevent environment pollution and to eliminate the economic losses caused by leaching and evaporation. Therefore it is a scientific and innovative technological novelty. Polymer compositions were developed, containing modified, adapted microorganisms able to destruct polymer fertilizers and polymerized nitrogenous fertilizers, practical implementation of which allows to solve the following problems: -for the first time, targeted synthesis to obtain a new generation polymerized fertilizers using a modernized polycondensation method and a process mechanism has been implemented; -The method of synthesis of polymers with peptide groups in the main polymer chain was first developed; -Modification and stage-wise adaptation of microorganisms able to destruct polymers was first implemented; -Innovative technology has been developed to obtain cereal crops palletted-capsulated composites containing destructive microorganisms. Application of polymerized nitrogenous fertilizers enables us to extirpate tremendous economic losses due to their washing-off to the soil, to provide environment protection from global pollution by nitrogenous fertilizers, to reduce significantly hectare norms of nitrogenous fertilizers, to ensure dosed, controlled nutrition of plants, their harmonious development in vegetation period and to obtain ecologically safe products, to elevate productivity and labor efficiency and others. Results of Project implementation will give stimulus to the progress of researches in advanced agrarian countries to obtain ecologically friendly, economically profitable new generation polymer fertilizers by application of targeted polycondensation synthesis. - A method based on monomers containing reaction-capable multigroup monomers by pilcondensation has been developed for the synthesis of linear heterozygous polymers, prolonged polymerized nitrogenous fertilizers. - The mechanism of the polycondensation reaction and the main regularities of the process are studied. It is shown that by changing the molar ratio of the initial components and other parameters, it is possible to change the composition and chemical structure of polymers. - Using this method will give us a wide opportunity to obtain various types of prolonged fertilizers. - A technology has been developed for producing multicomponent compositions in which polymerized, biodegradable nitrogen fertilizers with a prolongation mechanism are used

The interaction of carbamide and formaldehyde was studied both in aqueous solutions and in the pores of the sorbent. Carbamide-formaldehyde oligomers were obtained by us in an aqueous medium. The reaction was carried out in a neutral, slightly acidic or slightly alkaline medium. A neutral or slightly alkaline medium creates favorable conditions for the production of carbamide methylene derivatives, further structuring was carried out in an acidic medium. During the reaction in the pores of the diatomite at the first stage, the formation of carbamide methylene derivatives, the subsequent transformation of methyl groups and the formation of methylene and dimethylene ether bonds occurs, which is confirmed by infrared spectroscopic examination. The process of carbamide sorption in diatomite vapors was studied. It was found that the amount of sorbed urea in the pores of diatomite increases with increasing temperature, which is explained by a decrease in the viscosity of molten urea, which facilitates the penetration of urea molecules into the pores of diatomite. At a temperature of 150-155°C, the degree of sorption reaches 23-25%. The influence of duration and temperature on the sorption process was studied. The process of carbamide desorption from sorbate was also studied. Natural and thermally activated diatomite were used as a sorbent. The pores were saturated with molten urea. In the case of natural sorbents, the sorbate contains 20% carbamide, and in the case of activated diatomite - 25-35%, which is explained by the increase in porosity and pore size of the diatomite as a result of heat treatment. Studies have proved that with an increase in the duration of polycondensation, with an increase in the degree of structuring, the desorption of urea from diatomite pores decreases with a decrease in the amount of free (non-reacting) urea, and after the completion of polycondensation, the desorption of urea practically no longer occurs. The process of structuring sorbed urea in the pores of diatomite in the range of 135-155°C has been studied. The rate of structuring at this time is somewhat reduced compared to the case when structuring is carried out under normal conditions, in a reaction vessel, without the participation of diatomite. To develop a method for obtaining multicomponent draped compositions, the components of the composition: Polymerized carbamide, diatomite, superphosphate, potassium chloride, trace elements (magnesium, boron, zinc, manganese, copper, cobalt) in the form of salts were previously dispersed in a porcelain mortar. Then each piece was individually placed in a rod-shaped mold. Multicomponent dredged compositions were obtained by pressing them under pressure of 25, 50, 100 and 150 Pascal. The temperature varied from 25 to 80°C. Carbamide and superphosphate under pressure of 50 Pascal are formed in the form of a rod at room temperature. With increasing pressure and temperature, the mechanical strength of the molded rod increases. Tests have shown that the multicomponent mixture under pressure is formed well enough at room temperature and the resulting rod has a sufficiently high mechanical strength, which is quite sufficient for its use in soil. Based on the data of the method for obtaining multicomponent drained compositions, the technology for obtaining the composition was developed, the main technological parameters were determined.

- Using simple optimal methods, depending on the pH of the medium, 60 individual biocoordination compounds were obtained.
- Method of metal-ligand coordination established
- The thermal stability of the compounds has been studied.
- The process of complex formation in solutions is considered, and the conclusions obtained are generalized in the direction of analytical chemistry.
- The molecular and spatial structure of the synthesized compounds has been established. Stereochemical aspects are considered; influence on the process of coordination of a metal and an organic ligand, the role of hydrogen bonds in the formation of structures; the effect of acid ligands on the inner sphere of the complexes; Structure and bioactivity.
- Several coordination compounds Co(II), Ni(II), Zn(II), Cu(II), have been identified, the biological activity of which against microorganisms significantly exceeds the activity of Novocaine or Lidocaine.

- The implementation of the project will result in:
- Enrichment and development of Inorganic and Coordination Chemistry as a science with new data;
 - Expansion of the range of biologically active substances with the prospect of their further use in pharmacology.
 - The data obtained during the study are necessary not only for the development of coordination and analytical chemistry, but also promising for the treatment of metal deficiency pathology.
 - The creation of a theoretical and experimental base for the synthesis and study of coordination compounds makes a significant contribution and promotes the development of this direction. Especially since the development of coordination

- The possibility of formation of fine-dispersed, transitional porous analcime, as well as the optimal ratios of mineral-forming suspensions and gels, which participate in the crystallization process and are important for the formation of zeolitic crystals, have been established.
- A method based on monomers containing reaction-capable multigroup monomers by pilcondensation has been developed for the synthesis of linear heterozygous polymers, prolonged polymerized nitrogenous fertilizers.
 - The mechanism of the polycondensation reaction and the main regularities of the process are studied. It is shown that by changing the molar ratio of the initial components and other parameters, it is possible to change the composition and chemical structure of polymers.
 - Using this method will give us a wide opportunity to obtain various types of prolonged fertilizers.
 - A technology has been developed for producing multicomponent compositions in which polymerized, biodegradable nitrogen fertilizers with a prolongation mechanism are used together with other necessary elements necessary for plant nutrition.
 - The use of multicomponent dredged-encapsulated compositions ensures autonomous, dosed nutrition of the plant and its normal development during the growing season, obtaining environmentally friendly products. The research results are widely used in developed agricultural regions and countries.
 - Multicomponent dredged compositions are controlled-release fertilizers that protect the environment from pollution.
 - The use of prolonged nitrogen fertilizer in the composition allows to reduce agrotechnical norms of nitrogen fertilizers by ~50% and increase yields by 15-39%.
 - The use of polymerized nitrogen fertilizer will avoid flushing and dumping, and consequently economic losses; the consumption of seed material will be reduced to 30-40 kg / ha.
 - The coefficient of nitrogen absorption by the plant increases significantly.
 - The tenth Complex fertilizer will be applied to the soil once, which will provide significant savings in labor resources, fuels and lubricants, extend the service life of technical means, preserve the structure of the soil, etc. Sh. The grain in the crushed composition of the seed material is protected from rodents, birds.
 - The interaction of carbamide and formaldehyde in aqueous solutions, pores of a natural sorbent has been studied.
 - At the initial stage of the aqueous solution, methylene derivatives are formed, and the reaction is bimolecular.
 - The stability of methyl groups depending on pH has been studied. It has been shown that the stability of the methyl groups is high in the neutral and slightly alkaline regions.
 - Both the formaldehyde binding reaction and the condensation of methyl groups depend on the concentration of reagents, depend on pH and temperature.
 - At high concentrations, bimolecular reactions prevail, and the equilibrium shifts towards polymer formation.
 - In the neutral or alkaline region, dimethyl ether bonds are mainly formed.
 - When the temperature rises or the temperature changes, the oligomers undergo further polycondensation.
 - polycondensation of carbamide and formaldehyde was carried out in the pores of the sorbent. Some kinetic regularities of this process have been studied. It is shown that the reaction has a second order.
 - First of all, polycondensation of carbamide was carried out in the pores of a natural sorbent - diatomite.
 - A technology for obtaining a long-acting fertilizer based on carbamide has been developed.
 - The technology of obtaining multicomponent dredged compositions from polymerized carbamide has been developed and the main technological parameters have been established.
 - It has been established that agrotechnical standards for the use of prolonged nitrogen fertilizers are reduced to 50-60% with a corresponding economic effect. Grain yield increases to 15-30%.
 - The use of polymerized nitrogen fertilizer practically eliminates its washing and spending, the seeding rate is reduced by 45-50 kg, the nitrogen absorption coefficient increases. During the growing season, the plant is provided with dosed nutrition, which contributes to its normal growth and development, increasing yields and obtaining

	Synthesis and study of prolonged effect and degradable polymer nitre; Development of innovative technology for multi-component pellet composites on its base	Fundamental Science	Research Foundation (SRNSF)	150 000 GEL	05.05.2015 – 04.05.2018	Marina Gurgenishvili	Zaur Lomtadze, Nora Dokhturishvili, Ketevan Papava
FR/38/10-16Q/4							
S-GE800-15-GR-126	Development of Biofuel in Georgia – project Ecosub	Democracy Commission small grants program	USA Embassy,	19 250 USD	2015-2016	Kakha Kharchkhadze	Natela Khetsuriani
	Complex protection of vineyard and fruit by harmless and accessible local means	Applied Science	Research Foundation (SRNSF)	198 768 GEL	02.04.2014 – 02.04.2016	Avtandil Dolidze	A.Dolidze, O.Lomtadze, N.Kavtaradze, D.Kakashvili
AR/116/10 - 101/13							
FR/322/10-100/13	Synthesis of nitrogenous fertilizers and studi of physiological-biochemical aspects of their microbial degradation.	Fundamental Science	Research Foundation (SRNSF)	150 000 GEL	02.04.2014- 02.04.2017	Givi Papava	Eldar Gugava, Nanuli Khotenashvili, Riva Lipartelani

Intense growth of the population calls for incessant increase of production of farm produce which can be achieved by assimilation of new areas. But arable lands are decreasing annually because of progressing urbanization and intensification of industry. One of the ways to provide population with foodstuff, is inoculation of intense advanced technologies in agriculture, in particular, application of nitrogen-containing chemical fertilizers in increased dose. According to available data, annually more than 200 million ton nitrogenous fertilizers are introduced into soil in the whole world. Because of their especially good water solubility, the main part of fertilizers (up to 100 million ton) is lost due to their evaporation and washing off, which alongside with tremendous economic losses results in global environmental pollution (water reservoirs, rivers, ground waters, ponds, lakes, seas, wells and others). Nitrogenous fertilizers, as a result of evaporation, reach high atmospheric strata, destruct ozone layer, which becomes a reason of many heavy diseases (metahemoglobinemia et al). The project goal is realization of synthesis of hardly soluble in water polymer nitre, which at introduction into soil suffers degradation at the impact of soil degradation microorganisms and transforms into easily assimilable form. Research novelty is that the synthesis of prolonged effect polymer nitre (polymerization and polycondensation reactions) is realized for the first time. Synthesis is carried out in the pores of natural zeolite. The present project offers development of innovative technology for obtaining multi-component pellet polymer nitre-containing composition, which will enable to decrease substantially agrochemical norms of nitrogenous fertilizers (by 50-60%). Introduction of prolonged effect nitre, as well as natural sorbents (zeolite, diatomite), in the pores of which polymer nitre is formed, simultaneously creates favorable terms for propagation of microorganisms which degrade polymer nitre. Among all type nitrogenous fertilizers used in practice, unconditional leaders are nitrates – nitric

The production technology of alternative renewable fuel – Biodiesel – was developed and introduced. Several tons of biofuel were produced at the Ila's University on the biofuel pilot plant. Chemical and spectral analysis of biofuel was performed, parameters of biofuel were optimized according to the international standards, and for the first time in the history of Georgia, cars started to run on biofuel. In addition, a website www.biodiesel.ge was created, brochures were printed, a documentary educational film was shot and a conference was held. As part of the grant, the following safe and less dangerous means against pests and diseases of grapes have been developed and tested (in real conditions - in the vineyard):

- Pheromone traps prepared according to a new synthesis scheme to predict the spread of grape worm;
- New insecticide-scaricidal drug "Antipes" against scale insects and mites;
- oil-emulsion preparation of a new prescription composition against the hibernating phase of pests;
- New fungicidal drug "Dihydrophosphate" against powdery mildew and rot;
- Micronutrient-enriched humic nutritional preparation prepared on the basis of local natural raw materials – peat, to improve the growth and development of grapes and increase immunity to diseases.

The aim of the project was to conduct field trials of the developed preparations against pests and diseases of various agricultural crops, especially grapes and fruit trees (apples, peaches), which are priority for Georgian agriculture. If the positive results and effectiveness are confirmed, the basis for their successful commercialization will be created.

In the case of the production and sale on the market of cheap and highly effective insectacaricides, fungicides and nutrients with a low environmental impact, the costs of farmers for the maintenance and care of crops will be significantly reduced. Their products will become competitive. Accordingly, their incomes and social conditions will increase.

The development of environmentally friendly and profitable fertilizers is of paramount importance for our existence. This technology will allow us to replace soluble nitrogen fertilizers with polymerized ones and use biological nitrogen together with them. The presented project will allow us to research and develop such technologies by creating multicomponent compositions containing nitrogenous bacteria and polymerized fertilizers. Such fertilizers significantly (up to 50-60%) reduce the need for nitrogen fertilizers necessary for optimal plant growth and development. The proposed long-acting nitrogenous fertilizers also contain natural sorbents (zeolite, diatomite), where nitrogenous fertilizers can be released in the pores of these sorbents, which at the same time create favorable conditions for the reproduction of bacteria. The creation of stable and stable structured forms of urea based on studies in which the transition of ammonium ions occurs slowly, in parts, is an absolutely necessary condition for increasing the efficiency of fertilizers and reducing the dependence of plants on biogenic processes of their assimilation. For structural degradation of carbamide, we modernize the enzymatic structure of microorganisms, its modification and adaptation to a new nutrient substrate. Nitrogen-fixing bacteria and structured nitrogen fertilizers used in the composition will allow us to reduce the agrochemical norms of nitrogen fertilizers by 50-60%

According to modern data, a significant part of nitrogen fertilizers, due to their good solubility in water, is lost as a result of their decomposition and washing, which, in addition to huge economic losses, leads to global environmental pollution. At the same time, nitrogen fertilizers as a result of melting, getting into higher layers of the atmosphere, cause the destruction of the ozone layer, which is the cause of many serious diseases on Earth. Therefore, the development of environmentally safe and cost-effective new technologies for the production of safe long-acting mineral fertilizers is of great importance. Based on the above, the aim of the research was the synthesis of a nitrogen fertilizer of prolonged action based on a nitrogen fertilizer, which can be carried out in the pores of natural sorbents. For this purpose, a polymer adductor obtained as a result of polymericol transformation of polyvinyl chloride from polyethylene polyamine was studied. In the case of the use of low-molecular polyvinyl chloride for polymer transformation, the structure of polyethylene polyamine and the subsequent synthesis of polymer adductor are carried out. The final product of the reaction is an sorbent mass that is poorly soluble in water and is a nitrogen fertilizer acting by a prolonged mechanism. A chlorinated polymer was selected and studied. Its fractionation by molecular weight was carried out. Low-molecular and high-molecular fractions were selected, in which nitrogen-containing monomers will be replaced in the future. Studies have been conducted on the synthesis of polymer nitrate for the production of polymers and oligomers containing functional groups. - Experiments have been carried out to replace chlorine atoms in polyvinyl chloride with amino groups. - It is established that the variable parameters of the process are: temperature, duration and molar ratio of the initial components. The optimal conditions for the reaction are: temperature 1650C, reaction duration 8 hours, molar ratio of polyvinyl chloride and ammonia, respectively, 1:4. The polymer adductor is synthesized on the basis of polyethylene polyamine obtained as a result of the polymer analogous transformation of polyvinyl chloride. The reaction of polyamine interaction with nitric acid was studied. The main variable parameters of the process are temperature, molar ratio of reagent components, concentration and duration of the reaction. - A technology has been developed for the production of multicomponent drained encapsulated composites of basic food elements (NPK) based on polymer nitrate, where 50% urea-formaldehyde oligomer and 4% aqueous starch solution were used as fixators. - Practical recommendations and a production scheme for obtaining multicomponent draped compositions have been developed. For the biodegradation of the long-acting fertilizer, the enzymatic mechanism of microorganisms decomposing polymers, its modification and adaptation to a new nutrient substrate were modernized. Active strains of oxidizing microorganisms were obtained. The gradual adaptation of microorganisms decomposing polymers and the process of decomposition of fertilizers of prolonged action have been studied. When using seed material processed using a new technology, in parallel with productivity and quality indicators, special attention is paid to the cost of production, the level of which is determined by the amount of costs that were spent on obtaining these products. The use of our expanded fertilizer will be possible both in Georgia and in any agricultural country in the world, which will provide a great economic and environmental effect. The social effect is manifested in the protection of the population from various serious diseases.

The physical and chemical characteristics of biodiesel and petroleum diesel were studied. Different mixtures of biodiesel and petroleum diesel fuel were produced. An optimal mixture of biodiesel and petroleum diesel was selected, which ensures the development of diesel fuel technology and its use in internal combustion engines without their modification. Physical and chemical analysis of biodiesel and petroleum diesel B20 blend was carried out. Standard characteristics of studied fuels are the following: density at 150C, explosion temperature, 0C; kinematic viscosity, mm2/sec; cetane number, acid number mg KOH/g of fuel; sulfur content, mg/kg; content of polycyclic aromatic hydrocarbons,%; explosion temperature, 0C; total pollution, mg/kg; cokeability (in 10% of sediment),%; corrosion on a copper plate (3 hours at 500C); content of fatty acids and methyl ether, %; resistance to oxidation, n/l g/m3; fractional composition; 90% distillation temperature 0C; ash content, %.

In early spring (the first decade of March), the trees of the apple orchard of farmer Vano Kakashvili (Golden variety) were treated with an oil-emulsion preparation of an experimental batch. The oil preparation of the Italian company (Sipkam) – "Sipkamol" was used as a reference. Unsprayed plants were taken as control. According to the census conducted in late spring, the oil preparation of the experimental batch is more effective than the preparation "Sipkamol", chosen as a reference. Pheromone traps were used to predict the spread of pests (grape mealybug, eastern codling moth) and determine the exact timing of the use of pyrethroid preparations against them. It has been established that with the help of pheromone traps it is possible to predict the spread of the pest, as well as determine the exact timing of the chemical control of the caterpillar phase of all three generations. On the experimental plot of the apple orchard of farmer Vano Kakashvili (Skra village), a trial batch of the Antipes insect-scaricidal preparation was tested against aphids, codling moth and hawthorn ring moth. The effectiveness of the drug "Antipes" in the fight against pests of grapes and fruit trees was compared with the best imported insecticidal drugs used in production. In the fight against aphids, the drug "Decis Prof" (Bayer's company) and the drug "Aktelik" (Syngenta's company) were taken as standards, and in the fight against apple fruit moth and hawthorn moth, insect-scaricides "Koragan" and "Avant" (DuPont's company). On the basis of zinc hydro- and dihydrophosphates (Zn(H2PO4), ZnHPO4), a practically environmentally friendly fungicidal preparation "Antifungal" has been developed to replace moderately toxic preparations containing copper. Field trials were carried out on trial plots of the peach orchard and vineyard of farmer Zurab Tolashvili. The effectiveness of the drug for the prevention of grape rot and peach leaf curl has been tested. Bordeaux liquid (copper sulfate – lime) was used as a reference. Nutrient preparations prepared on the basis of humins extracted from peat and coal, containing, along with the main trace elements (Fe, B, Mn, Cu, Co, Zn, Mo), as well as Si, were used in the form of combined mixtures with insectoacaricidal and fungicidal preparations.

Intensive population growth requires an increase in food production. One of the ways to solve this problem is the use of intensive agricultural technologies, which is associated with the use of mineral fertilizers, especially nitrogen-containing (saltpeter and urea) fertilizers in increased doses. Due to the extremely good solubility of nitrogen fertilizers in water, a significant part of them is lost as a result of washing and evaporation. These economic losses are accompanied by pollution of the environment – soil, water and atmosphere, which creates dangerous environmental conditions. Therefore, the development of environmentally friendly and profitable fertilizers is crucial for our existence. In order to avoid environmental pollution with nitrogen fertilizers, a new method for obtaining polymerized nitrogen fertilizers based on urea by polycondensation has been developed, the reaction mechanism and the regularities of the processes, the influence of various factors on the course of the reaction have been studied, and optimal conditions for the reaction have been determined. The interaction of urea and formaldehyde has been studied in aqueous solutions and melts. In an aqueous solution, methylene derivatives are formed at the initial stage. The reaction is bimolecular, and dissociation reactions are monomolecular. Depending on the pH, the stability of the methyl groups is high in neutral and slightly alkaline regions. When the pH is less than 7, an esterification reaction occurs. When pH = 4-7, dimethylester bonds are formed and the reaction is bimolecular. When the pH changes in the range of 3.7 – 5.5, the reaction of the interaction of the methyl group with imine groups is mainly carried out, followed by the formation of methylene bonds. Both the formaldehyde binding reaction and the condensation of methyl groups depend on the concentration of reagents, on the pH of the medium and temperature. At high concentrations, bimolecular reactions prevail and the equilibrium shifts to the right, towards polymer formation. In neutral or alkaline media, dimethylene ether bonds are mainly formed when the temperature rises or when the pH changes, the oligomers undergo further polycondensation, which leads to the structuring of the polymer. If the molar ratio of formaldehyde and urea is less than 1:1, then there is no place for structuring. The activation energy of the condensation process is equal to 14.5-15.9 kcal/mol. The synthesis of carbamide-formaldehyde oligomers in the alloy was carried out. Some kinetic regularities of the process in the temperature range 110-125°C, the molar ratio of urea and formaldehyde 1:2 have been studied. The reaction rate constants retain constant values during the reaction when they are calculated according to the second-row equation. The linear dependence of the change in the logarithm of the reaction rate constant on the inverse absolute temperature also indicates the second order. The linear dependence on the duration of $1/\lambda \times t$ is also preserved. The activation energy is equal to 15.4 kcal/mol. Multicomponent compositions containing nitrogen-fixing microorganisms and polymerized fertilizers have been developed. Nitrogen fertilizers of prolonged action also contain natural sorbents (zeolite, diatomite), in the pores of which the synthesis of polymer fertilizers by polycondensation was carried out for the first time. The enzymatic generation of microorganisms decomposing polymers has been modernized, its modification and adaptation to a new nutrient substrate has been carried out. Active strains of nitrogenous microorganisms were obtained and propagated, as well as step-by-step adaptation of microorganisms decomposing polymers and initiation of decomposition of

1. To obtain polymer nitrate, polyethylene polyamine, obtained as a result of polymeralergical conversion of polyvinyl chloride, was used to obtain a polymer adductor. Studies were conducted to study the process of its interaction with nitric acid. 2. A technology has been developed for obtaining multicomponent compositions of the necessary nutrients (NPK) for plants based on polymer nitrate, polystyrene and polyvinyl polymers were used for encapsulation. 3. Practical recommendations and a production scheme for obtaining multicomponent draped compositions have been developed. 4. The prolonging effect of polymer nitrate has been studied, the process of transition into the soil and into the plant after fertilization has been determined. Studies have shown that prolonged nitrogen fertilizer (polymerized saltpeter) slowly dissolves after application to the soil, therefore, the plant uses it throughout the growing season, evaporation and leaching of fertilizer decreases sharply, the coefficient of nitrogen assimilation by the plant increases by 10-12%. 5. The qualitative and quantitative composition of microflora (microorganisms) of bureau-carbonate, chestnut and alluvial soils of Georgia for agricultural purposes has been studied in order to isolate microorganisms that decompose (decompose) polymer clay. 7. Physiological groups of microorganisms – 80 strains were isolated. 6. The saprophytic microflora of the soils of the Kakheti region has been studied, which is qualitatively more or less similar in names, but sharply differs in species and quantitative indicators. 7. The type of soil and, consequently, its microflora differ as qualitative. And the quantitative composition. Consequently, the biodegradation of fertilizer probably occurs with different intensity in the soil, which is due to the difference in the number of urobacteria present in the microflora. Therefore, when using fertilizers, a qualitative and quantitative analysis of the soil microflora is necessary. 8.

An alternative renewable fuel – Biodiesel – production technology was developed and introduced. Based on the institute's laboratory research, several tons of biofuel were produced on the pilot plant located in the Ila's University. Chemical and spectral analysis of biofuel was performed, parameters of biofuel were optimized according to international standards, and cars started to run on biofuel for the first time in Georgia. The website www.biodiesel.ge was created, brochures were printed, a documentary educational film was shot and a conference was held.

The oil-emulsion preparation of a new formulation, developed to control pests of the wintering stage of the period, is more effective than the oil preparation of the Italian company Sipkam – Sipkamol. Entomological glue of a new composition, of trapping tapes and pheromone traps, installed on fruit trees and vineyards, do not soften or drip in hot summer conditions. The light color of the glue ensures good visibility of butterflies caught in pheromone traps. The content of turpentine oil in the composition of the preparation "Antipes" leads to a prolongation of the insectoacaricidal action up to 22-25 days. As a result, the low concentration of pyrethroid is sufficient to cover the duration of the development cycle and destruction of the pest. The effectiveness of "Antipes" is at the level of expensive imported insecticides used as standards. On the basis of zinc hydro- and dihydrophosphates [Zn(H2PO4), ZnHPO4], the fungicidal preparation "Antifungal" was developed to prevent grape rot and peach leaf curl.

When preparing combined mixtures of humic preparations with insectoacaricidal and fungicidal preparations, homogeneous non-separating solutions are obtained. When processing plants, phytotoxicity (burning) of green organs does not develop. The effect of humic preparations on increasing the resistance of grapes to drought, as well as the effect of silicon on the growth and development of apple and peach seedlings, is noticeable.

1. The interaction of urea and formaldehyde in aqueous solutions and alloys has been studied. 2. At the initial stage, methylene derivatives are formed in an aqueous solution and the reaction is bimolecular, while dissociation reactions are monomolecular. 3. Depending on the pH, the stability of the methyl groups is high in neutral and slightly alkaline media. When the pH is less than 7, an esterification reaction occurs. Both the formaldehyde addition reaction and the condensation of methyl groups depend on the concentration of reagents, on the pH of the medium and temperature. At high concentrations, bimolecular reactions prevail, and the equilibrium shifts towards polymer formation. In a neutral or alkaline medium, dimethylester bonds are mainly formed. When the temperature rises or the pH changes, the oligomers undergo further polycondensation, which leads to polymer structuring. 4. It is shown that when the molar ratio of formaldehyde and urea is less than 1:1, there is no place for structuring. 5. The synthesis of carbamide-formaldehyde oligomers in the alloy was carried out. Some kinetic regularities of the process have been studied at a temperature range of 110-125°C, the molar ratio of carbamide and formaldehyde is 1:2. It is shown that the reaction has a second order. 6. Polycondensation of carbamide in the pores of a natural sorbent – diatomite was carried out for the first time. In order to study the effect of long-term application of nitrogenous fertilizers on the soil microflora, a qualitative and quantitative analysis of various types of soil microflora was carried out. A number of physiological groups of microorganisms have been isolated and identified. 8. In vitro tests have shown that prolonged nitrogen fertilizer does not exhibit biocidal properties on the soil microflora. 9. The conditions for the growth/development/cultivation of microorganisms of prolonged fertilizer of destructive action have been determined. The optimal pH for the cultivation of

Stude of impact of modification process on polyphenylene oxide and graphite structure, tribochemical and tribo-technical properties to receive antifriction material of improved properties	Fundamental Research State Grants	Science Foundation (SRNSF)	150 000 GEL	02.04.2014-02.04.2017	Ia	Vitali Sherozia, Nunu Chitrekashvili	Maisaradze, Shalva Papava
Development of scientific bases for obtaining nano-zelite sorbents	Fundamental Research State Grants	Science Foundation (SRNSF)	99 000 GEL	31.03.2014-31.03.2016	Nanuli Dolaberidze	Manana Nijaradze, Nato Mirdzveli	

FR/237/8-121/13	Fundamental Research State Grants	Science Foundation (SRNSF)	150 000 GEL	02.04.2014-02.04.2017	Ia	Vitali Sherozia, Nunu Chitrekashvili	Maisaradze, Shalva Papava
FR/117/6-480/13	Fundamental Research State Grants	Science Foundation (SRNSF)	99 000 GEL	31.03.2014-31.03.2016	Nanuli Dolaberidze	Manana Nijaradze, Nato Mirdzveli	

Giometrin - a drug against the parasitic mites of animals	Applied Research State Grants	National Science Foundation	38,100 GEL	01.04.2013-30.09.2013	Omar Lomtadze	O.Lomtadze, G.Chimakadze, N.Shalvashvili, K.Chimakadze	
№ 04/13 (29/01)	Applied Research State Grants	National Science Foundation	38,100 GEL	01.04.2013-30.09.2013	Omar Lomtadze	O.Lomtadze, G.Chimakadze, N.Shalvashvili, K.Chimakadze	

Development and research of ecologically safe system of protection of peach from pests and diseases	Fundamental Research State Grants	Science Foundation (SRNSF)	99,000 GEL	25.04.2013-25.04.2015	Ludmila Tskhvadadze	L.Tskhvadadze, N.Lomtadze (A.Dolidze)	
FR/576/10-101/12	Fundamental Research State Grants	Science Foundation (SRNSF)	99,000 GEL	25.04.2013-25.04.2015	Ludmila Tskhvadadze	L.Tskhvadadze, N.Lomtadze (A.Dolidze)	

The creation of a multicomponent self-lubricating antifriction material is a complex scientific problem that requires in-depth research of the processes occurring during their processing and friction. To overcome this problem, first of all, it is necessary to choose a binder polymer with high mechanical properties. In order to overcome the disadvantages and partially improve wear resistance and thermal stability, it is necessary to choose as a filler a material that has high thermal conductivity and is anionification. Of the fillers known in the literature, only graphite satisfies these conditions. Analysis of fish products revealed that the reason for insufficient wear resistance and heat resistance in the polyphenylene oxide-graphite system is the presence of tribo- and thermal oxidation of the lateral methyl (CH₃) group of the polymer during friction. To solve this problem, the idea arose to select the appropriate material and modify polyphenylene oxide and graphite in such a way as to individually reduce their friction coefficients with steel, eliminate polymer destruction and, at the same time, increase wear resistance. In this regard, the fluorine-containing oligomer - fluoroalkane, which in polyphenylene oxide causes the necessary structural changes necessary for the antifriction material, and is characterized by high thermal stability and manufacturability, turned out to be acceptable. In graphite, it does not cause structural changes, but forms a binding layer with it on its surface, which reduces the coefficient of friction of graphite and the system as a whole several times. The structure and properties of modified polyphenylene oxide samples were studied by chemical, IR spectroscopic, mass spectral, thermogravimetric analysis and determination of thermal friction properties. The structure and properties of modified graphite samples were studied by X-ray diffraction and chemical analysis and determination of friction properties at various speeds. The study of the properties of samples obtained by the joint processing of modified polyphenylene oxide and modified graphite was mainly

The project aimed to create a theoretical and experimental basis for obtaining fine-dispersed samples of natural zeolites by an alternative method, in particular, by chemical treatment. Nano-sized zeolite crystals were obtained by recrystallization of Georgian natural zeolites under hydrothermal conditions.

Grant project "Giometrin" - a drug against parasitic mites of animals, which was jointly funded by the US Civilian Research and Development Fund (CRDF-Globa) and the National Science Foundation Shota Rustaveli, provided for the conduct of this kind of research, which will create a real prerequisite for the commercialization of this drug. The preparation against parasitic animal mites "Giometrin" is a composition of prolonged acaricidal action, which was developed within the framework of the grant No. GNST/ST07/8-272 Parasitic animal mites and their control in Georgia. The acaricidal activity of the drug "Giometrin" is 22-25 days instead of 12-15 days of imported drugs. The prolonged acaricidal effect of the drug "Giometrin" and the safety used of the components on humans and animals are important prerequisites for their establishment in the veterinary market. The drug will be attractive to potential users, since when it is used, during the period of activity of parasitic mites, the number of measures necessary to protect animals will be significantly reduced and accordingly, the costs of their implementation will be reduced by almost 2 times.

In order to restore the prestige of one of the traditional export crops of Georgia - peaches, and regain export value, it is necessary to improve the quality indicators of the peach harvest, taking into account modern environmental requirements. The misuse of pesticides against pests and diseases has catastrophically changed the biosystem. Along with pests, their natural enemies are also affected. Most of the pesticides used are lost to the environment, polluting the air, water and soil. Residual pesticides and their metabolites enter the human body along with plant and animal food. In such an ecological environment, human health deteriorates, diseases increase. Based on the foregoing, the creation in Georgia of a system for the safe production of environmentally friendly products, including fruits, is relevant both from a scientific and practical point of view. During the implementation of the grant project, the possibility of protecting peaches from pests and diseases using a mixture of fungicidal and insectoacaricidal preparations with humic preparations containing essential trace elements was studied. With the development of effective mixtures of such a complex action, the frequency of spraying plants with preparations has been reduced, at the same time there is no place for losses, since the working solution, falling on the soil (with foliar feeding), will be absorbed by the root system of the plant. This circumstance will significantly affect the cost of plant protection measures.

The creation of a multicomponent self-lubricating antifriction material is a complex scientific problem that requires in-depth research of the processes occurring during their processing and friction. To overcome this problem, first of all, it is necessary to choose a binder polymer with high mechanical properties. In order to overcome the disadvantages and partially improve wear resistance and thermal stability, it is necessary to choose as a filler a material that has high thermal conductivity and is anionification. Of the fillers known in the literature, only graphite satisfies these conditions. Analysis of fish products revealed that the reason for insufficient wear resistance and heat resistance in the polyphenylene oxide-graphite system is the presence of tribo- and thermal oxidation of the lateral methyl (CH₃) group of the polymer during friction. To solve this problem, the idea arose to select the appropriate material and modify polyphenylene oxide and graphite in such a way as to individually reduce their friction coefficients with steel, eliminate polymer destruction and, at the same time, increase wear resistance. In this regard, the fluorine-containing oligomer - fluoroalkane, which in polyphenylene oxide causes the necessary structural changes necessary for the antifriction material, and is characterized by high thermal stability and manufacturability, turned out to be acceptable. In graphite, it does not cause structural changes, but forms a binding layer with it on its surface, which reduces the coefficient of friction of graphite and the system as a whole several times. The structure and properties of modified polyphenylene oxide samples were studied by chemical, IR spectroscopic, mass spectral, thermogravimetric analysis and determination of thermal friction properties. The structure and properties of modified graphite samples were studied by X-ray diffraction and chemical analysis and determination of friction properties at various speeds. The study of the properties of samples obtained by the joint processing of modified polyphenylene oxide and modified graphite was mainly carried out by the same methods; additionally, density, toughness and thermal conductivity were determined. At the initial stage, the structure of the modified fluoroalkane polyphenylene oxide was studied and the tribochemical processes occurring during friction in polyphenylene oxide filled with graphite nanopowder were studied. It was found that fluoroalkane is an active modifier of polyphenylene oxide, converts 70% of it into an insoluble state. Also, the heat resistance of such a modified polyphenylene oxide improves by 2 times and significantly increases wear resistance, reduces the coefficient of friction and increases its stability to a temperature of 250°C. This increases the prospects not only of this material, but also of polymers similar in chemical structure for obtaining new, improved antifriction properties of various filler composites. Modification of graphite with fluoroalkane has been studied. Modification of graphite with fluoroalkane will be studied for the first time. It is shown that fluoroalkane does not cause structural changes in graphite. But on the surface of the graphite nanopowder, an embedded layer of fluoroalkane with a thickness of 2-5 microns forms, in which fluorine atoms are located along the periphery. This layer protects graphite grains from destruction by friction and, at the same time, significantly improves the self-lubricating ability of graphite. As a result, the friction coefficient of graphite can be reduced by almost 3-4 times. These results are important for the tribochemical direction, since it can be used as a filler in other types of antifriction plastics, as well as separately as greases.

Through the direct chemical treatment of natural phillipsite (ion exchange, thermal and acid treatment), finely dispersed, high ion exchange capacity anti-toxic and antiviral properties containing silver, copper, zinc sorbents with prolonged action were obtained, which provides for the determination of some regularities of gel formation, hydrothermal crystallization and chemical modification in aluminosilicate systems, which ensures the creation of highly efficient, pure zeolite nanomaterials.

The aim of the project - "Giometrin - a drug against parasitic mites of animals" jointly funded by the Shota Rustaveli National Science Foundation and the US Civilian Research and Development Foundation (CRDF-Globa), is to obtain a commercial prototype of the drug and prepare the necessary documentation for obtaining a license for state registration. To achieve this goal, it was necessary to perform the following tasks:

- development of technology for the industrial production of the drug;
- Production of an experimental batch of a commercial prototype of the drug "Giometrin";
- Study of the toxicological and allergic effects of the drug, by an organization of relevant competence;
- Carrying out large-scale field trials to confirm the effectiveness and safety of the drug "Giometrin" in the regions of Georgia with different climatic conditions;
- Preparation of documentation (safety report, instructions for use, production regulatory document, technological procedure for obtaining) that meets the requirements of the state registration of the drug "Giometrin" for veterinary drugs.

Field tests of the commercial prototype of the drug "Giometrin" were carried out in farms in various regions (Kakheti, Kvemo Kartli, Samegrelo, Tsalka upland zone and suburbs of Tbilisi). The degree of infection of animals with ticks was determined. Ticks were collected from the skin of animals for their subsequent identification and study of the effect on them of the commercial prototype of the drug "Giometrin". On the skin of animals treated with Hyometrin, single specimens of parasitic mites were observed on the 25-28th day after treatment. The drug protected cattle from the attack of blood-sucking zoophilous flies for 16-18 days. In the case of widely used imported acaricidal preparations, the presence of a parasitic mite on the skin of animals was observed on the 10-12th day, and the attack of flies - on the 5-7th day.

To carry out the work of the grant project, two peach orchards were selected in the village of Skra (Gori region), where they grew different varieties of peach ("Elberta", "Krimchak", "Tsedisuri", "Nectarine", "Start Red Golden", "Upepha", "Georgian peach"). Trial, standard and control plots were planned in selected orchards. The type and amount of preparations used were selected based on the number of plants in the provided plots. Measures were taken against the wintering stages of widespread pests (eastern codling moth, mites, aphids, California scale insects) - spraying peach trees with a water-oil emulsion and equipping trees with entomological glue belts. Pheromone sexual traps of the pest were used for complex control (prediction of distribution and population reduction) of the eastern codling moth (one of the main pests of peach fruits). Against peach pests, a composite preparation with a low ecological impact on the environment has been developed and applied, which includes turpentine oil obtained from pine resin, interacting synergistically with synthetic pyrethroids. The effectiveness of the developed composition is at the level of existing imported pyrethroid preparations with a significantly low (almost 2 times) content of the main active ingredient. On the basis of water-soluble zinc salts (hydro- and dihydrophosphate), a preparation against fruit rot disease of peach - Monilia fructigena (moniliasis) was developed and tested. Nutrient preparation "Humafid" was prepared and used on the basis of humins isolated from peat with potassium hydroxide, where Mg, Fe and Mn were mainly used as essential elements. The supply of the plant with the Mg²⁺ cation is carried out both by adding Mg salts to the humic preparation and by means of a granulated nutrient preparation. A granulated preparation was obtained from peat by adding to the sediment remaining after the extraction of humates, the calculated amount of magnesium sulfate (kieserite) and dolomite flour. The effectiveness of developed environmentally less dangerous insect-acaricidal, fungicidal and nutritional preparations (Antipestit, phosphate solution, Gumafid) was compared with preparations traditionally used to protect peaches from pests and diseases (Antrakol, Aktara, Bordeaux solution, etc.). According to the test results, the developed drugs are not inferior in efficiency to imported drugs. At the same time, their use is less dangerous from an environmental point of view and beneficial in terms of consumption, since they are locally produced and cost significantly (almost 40%) less than imported drugs.

1. A study of the structure of polyphenylene oxide modified with fluoroalkane and the study of tribochemical processes occurring during friction in polyphenylene oxide filled with graphite nanopowder was carried out. It turned out that fluoroalkane is an active modifier of polyphenylene oxide. 2. Modification of graphite with fluoroalkane was studied for the first time. It is shown that fluoroalkane does not cause structural changes in graphite. But on the surface of the graphite nanopowder, an embedded layer of fluoroalkane with a thickness of 2-5 microns forms, in which fluorine atoms are located along the periphery. This layer protects graphite grains from destruction by friction and, at the same time, significantly improves their self-lubricating ability of graphite. 3. Thermal conductivity, coefficient of friction, wear and thermal stability of polyphenylene oxide with various fillers with graphite nanopowder (EUT-1) were studied. tribochemical processes during friction in polyphenylene oxide filled with graphite nanopowder were also studied. 4. The influence of the processing process on the structure of modified polyphenylene oxide filled with 30 wt%, 45 wt% and 60 wt% modified graphite by static and dynamic methods was studied. 5. Based on our studies, we obtained an antifriction self-lubricating polymer composition of poly-2,6-dimethylparaphenylene oxide (polyphenylene oxide) -[C₆H₄(CH₃)₂O]_n, n=250-450, nanostructured graphite (particle size 80-120 Nm) and fluorinated oligomer R(CF₂)_nCl, where n=7-14, R = H, by COOH interaction, this ensures high thermal conductivity and heat resistance of antifriction self-lubricating polymer composites with a low coefficient of friction, high mechanical strength, resistance to water and increased wear resistance. 6. The results obtained may be important for progress in this area of technology - to lead to the introduction of highly efficient, new generation, antifriction self-assembled

aluminosilicate systems and Laws of chemical processing and ways of making new nanoscale zeolite materials on this basis. a) The method of obtaining nano-sized zeolite crystals by recrystallization of natural zeolites in hydrothermal conditions; b) Method of obtaining nano-sized zeolite crystals by chemical modification; Using the results of the project will contribute to the development of the technology of nano-dimensional materials, Expanding the field of practical use, environmental safety, high yield and quality of the target product.

Documentation has been prepared for the Giometrin drug that meets the requirements for state registration of veterinary drugs:

1. Conclusion of the G. Natadze Research Institute of Hygiene and Medical Ecology that the drug "Giometrin" is non-toxic, does not cause allergic manifestations and can be used to protect animals from parasitic mites;
2. - Instructions for the use of "Giometrin" in the form of a suspension with acaricidal properties against parasitic mites of animals;
3. - Regulatory document for the drug "Giometrin" - MST 001.2014 "Water-oil emulsion, with insecticidal properties, concentrated;
4. - Technological regulations for the use of an oil-in-oil-emulsion concentrate with insecticidal properties (Giometrin preparation).

The work envisaged by the grant project was completed in full. After the completion of the project, state registration and permission for the production of the drug "Giometrin" can be obtained after finding the area required for the production of the drug and equipping it in accordance with existing requirements.

organophilic surfactants) against widespread peach pests in the wintering phase has been developed and tested. In the traditional formulation of a non-drying adhesive prepared on a polyisobutylene basis, aviation oil was replaced by industrial oil, aluminum oxide was replaced by montmorillonite clay from the Askan deposit, and paraffin was removed from the formulation. Glue, a non-foaming, light color oil, retains good adhesion for a long time and does not peel off in hot summer conditions. Synthesis of the sex pheromone of the oriental codling moth was carried out by a simplified method using plant blockyns instead of the traditional classical method for obtaining sex pheromones. In addition, in addition to the rubber dispensers traditionally used in pheromone traps, cubes made from natural zeolite (clinoptilolite) were used. Designed by:

- Composite preparation against peach pests, with a small environmental impact, the effectiveness of which is at the level of existing imported pyrethroid preparations, in conditions of 2 times less content of the main active substance.
- Drug against peach disease - Monilia fructigena - peach fruit rot.
- Liquid and granular nutritional preparations based on humins extracted from peat. Mg, Fe, and Mn salts were used to prepare liquid preparations, and magnesium sulfate (kieserite) and dolomite flour were used to prepare granular preparations.
- An environmentally safe system for the complex protection of peach culture based on the obtained insecto acaricidal, fungicidal and nutritional preparations has been developed.

Development technologies to obtain new generation nitrogenous fertilizers of prolonged effect with the purpose of environment protection and application in viticulture	Applied Research	National Science Foundation (SRNSF)	216 944 GEL	2013-2015	Eldar Gugava	Shota Rustaveli
						Givi Papava, Zaur Lomatidze, Riva Liparteliani, Nazi Gelashvili, Namuli Khotenshvili

The presented project is a completely different, new technology at the present stage, which has no analogues in the world. The aim of the project is to develop innovative technology for the production of nitrogen fertilizers, increase yields and quality indicators of grape crops and protect the environment from global pollution. For the first time, nitrogen fertilizer will be obtained using innovative technology, which will reduce the norms of grape vegetation by 50-60%, which will give a great economic and environmental effect. For grape crops, 2 types of nitrogen fertilizers of prolonged action will be synthesized: a linear structure fertilizer for application during the initial growing season and a spatial structure fertilizer (for simultaneous application), which will operate throughout the growing season. Such nitrogen fertilizers can be successfully used for other perennial crops. Therefore, the product obtained as a result of the project can have a very wide consumer not only in Georgia, but also in many countries of the world where viticulture is developed. Development of natural energy resources and energy saving technology is an issue of great importance in the modern world. Development of technology for utilization of solid fuel wastes accumulated in the environment to obtain alternative fuel is an important direction, which in itself will lead to the saving of traditional energy resources and to the reduction of environmental pollution. Finding alternative sources of energy and creating energy saving technologies is one of the main problems of the developed countries. Mining residues of coal (dust, sludge, fragments), which are secondary energy raw materials, are widely used for production of briquetted fuel. Production of combustible briquettes based on the utilization of these raw materials is a highly efficient and cost-effective means for obtaining alternative fuel, and it is widespread throughout the world. The world production of briquettes made on the basis of coal is more than 110 million tons. The possibility of making briquette fuel based on the wastes of various carbon-containing combustible raw materials on the territory of Georgia was studied. Local materials were used as binders, combustion activators and modifiers in fuel briquettes. We studied locations of the materials used in Georgia and the estimated resources of the supplies. From the carbon-containing wastes we focused our attention on coal piles, wood sawdust and wood chippings. A high-calorific, alternative briquette fuel based on the utilization of secondary carbon-containing wastes was developed and studied. Three bio- and four coal-residue-containing fuel briquettes were produced. The physical-chemical and technological characteristics of the obtained test samples were studied. The test samples correspond to the standard requirements both from the economic and ecological point of view. By using of fuel briquettes, it is possible to obtain additional thermal energy, which ensures the saving of traditional energy resources. This will make a certain contribution to the development of briquette fuel production in Georgia.

Development of fuel briquette compositions and determination of technological modes of their receipt based on the utilization of carbonaceous wastes.	Applied Research	National Science Foundation (SRNSF)	198,898 GEL	15.04.2013 – 15.04.2015	Natela Khetsuriani	Elaa Topuria, Esma Usharauli, Zurab Gonglashvili, Ketevan Goderdzishvili, Irina Mchedlishvili, Madlena Chkhaidze
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Methods for rational processing of petroleum pipeline residues	Applied Research	National Science Foundation (SRNSF)	134,700 GEL	25.04.2013-24.04.2015	Guram Khitiri	Shota Rustaveli
						Ioseb Chikvaizde, Tinatin Gabunia, Madona Tsursumia

Among the nitrogen fertilizers used in agriculture, the products with the largest tonnage of production are ammonium nitrate and carbamide. In accordance with the plan provided for by the grant project, an innovative technology for obtaining a long-acting fertilizer has been developed, which is implemented for the first time and has no analogues. The synthesis of prolonged fertilizer is carried out in the pores of a natural sorbent, also without the use of a sorbent, by a polycondensation reaction. Two methods of obtaining a prolonged fertilizer have been developed: by carrying out the process both in alloy and in solution. During the polycondensation reaction, a monomer - carbamide and a polymerized aldehyde - paraform were used in the alloy. At the first stage, paraforms are depolymerized to 135 degrees. The resulting formaldehyde at the time of release is highly reactive. It interacts with carbamide to form functional methyl groups capable of reacting. When methylene groups interact or when they interact with carbamide, dimethylene ether and methylene group-containing oligomers are formed, respectively. Accordingly, a technology for obtaining a prolonged-acting fertilizer has been developed. Depending on the molar ratio of the initial components, macromolecules with a linear or spatial structure are formed. The first stage of the reaction proceeds at a temperature of 135-145 degrees, and at 150-155 degrees macromolecules are formed. The technical conditions for obtaining a prolonged fertilizer are as follows: in the case of fertilizers with a linear structure, the molar ratio of the initial components - carbamide and paraform is 1:0.9-1.2, respectively. In the synthesis of fertilizers with a spatial structure - 1: 1.3-2.5 mol. The reaction temperature is 135-155 degrees. During the reaction in solution, the reaction temperature is 95-98 degrees. The pH of the solution at the end of the reaction, when precipitated in water - 3 hours. The duration of the reaction is 2-2.5 hours. To obtain a fertilizer with a spatial structure of prolonged action, the molar ratio of the initial components - carbamide and formaldehyde is 1:1.7, respectively. When the reaction mixture is deposited in water, pH = 3. The effect of the reaction duration, temperature, molar ratio of the initial components, reaction medium, concentration of the initial components, catalyst, nature of the solvent and other factors on the course of the reaction was studied. Optimal reaction conditions have been established: a high-molecular nitrogen fertilizer with a linear structure of prolonged action has been synthesized both in alloy and in solution. The molar ratio of the initial components - carbamide and aldehyde - changed to 1: 0.8-1.2, respectively. The reaction temperature varied from 60 to 95 degrees during the reaction in solution. The duration of the reaction is from 1 to 16 hours. The pH of the reaction medium is from 8 to 3. The concentration of the initial components is from 0.6 to 2 mol/l. During the reaction in the alloy, the reaction temperature varied from 70 to 155 degrees. The duration of the reaction at the initial stage was 2 hours, at 155 degrees it was 12 hours. The molar concentration of the initial components varied from 0.8 to 1.1 mol/l. The simplified structural formula of the formed polymer having a linear structure looks like this: -HNCONHCH2[NHCONHCH2]n - HNCONHCH2. Optimal reaction conditions have been established.

The current shortage of thermal energy in Georgia is caused by limited amount of natural energy resources in the country. The production of combustible briquettes has a practical perspective of solving the problem of thermal energy, both in the central and mountainous regions of the country. The alternative thermal energy produced by the utilization of secondary raw materials will be used in household-utility, small enterprises and energetics. Production of briquette fuel based on local secondary raw materials is a rational, highly efficient and profitable means to an end. Utilization of wastes also ensures the improvement of the ecological condition of the environment. Our goal was the production of fuel briquettes with different compositions using wastes of energy-bearing raw materials present in Georgia, evaluation of physical-chemical, mechanical-technical characteristics, commodity properties of secondary raw materials and of the obtained briquettes, selection of the optimal technological scheme, determination of the ecological effect obtained by their use and saved energy resources, creation of the prerequisites for their introduction into production in the form of a recommendation. The stocks of combustible residues to be used on the territory of Georgia was studied and specified, namely: coal (wood), wood (sawdust, "DSP"), corn (roots and part of the stem). Binders and materials necessary for their modification were selected taking into account the data of local resources: bitumens, polyethylene, oil sludge, heavy oil, bituminous rocks, clays. Their location and stocks were determined. The secondary raw materials map of Georgia was compiled. From the carbonaceous wastes bulk piles of coal, wood sawdust and wood chippings were used. A mixture of two fine-grained fractions was prepared as briquetting compositions. As a binding material the oil sludge was selected from local, cheap and available organic compounds, and various clays - from inorganic compounds. Urotropin and other compounds were used as combustion activators. As modifiers were used tar, foam, geological material containing magnesium, magnesite, calcium carbonate and others. A high-calorific, alternative briquette fuel based on the utilization of secondary carbon-bearing wastes has been developed and studied. Three bio- and four coal-residue-containing fuel briquettes were produced. The obtained samples correspond to the standard requirements both from the economic and ecological point of view. By using of fuel briquettes it is possible to obtain additional thermal energy, which ensures the saving of traditional energy resources. This will make a certain contribution to the development of briquette production in Georgia.

During the operation of the oil pipeline, a considerable amount of heavy components are deposited in it in the form of a semi-solid, viscous mass. This waste blocks the permeability of oil pipelines and causes various types of disruptions, which can lead to serious accidents and severe environmental consequences. The main task of our work was the study of this residue. The main components of the residue are relatively high molecular weight naphthenic, aromatic and other hydrocarbons and heteroatomic compounds. These compounds are present in the waste in a native form, that is, its composition is very different from the oil wastes (manur, tar). The use of these wastes compared to oil and tar is much more promising for obtaining deficient, low-tonnage products. It contains mechanical impurities (sand). The latter increases the interest in it from the point of view of asphalt bitumen production. The problem is that the amount of wastes is increasing every year, and its non-use leads to environmental pollution and loss of cheap raw material. Due to the high cost of natural resources and strict requirements for protection of the environment, it is necessary to develop new effective methods of utilization and use of oil wastes. Fractions boiling at 350-450°C and >450°C are separated by method of molecular distillation. The low values of ash, coking and resin content of these fractions indicate a high content of paraffins and ceresins. Fractions distilled in temperature ranges of 50° were combined and four fractions were obtained: 80-1900C(1), 190-3000C(2), 300-3500C(3), 350-4500C(4), their characteristic constants were determined.

1. The synthesis of prolonged fertilizer is carried out in the pores of a natural sorbent, as well as without the use of a sorbent, with a polycondensation reaction. 2. Two methods of obtaining a prolonged fertilizer have been developed: by carrying out the process both in alloy and in solution. 3. The effects of the reaction duration, temperature, molar ratio of the reaction of the initial components, the reaction medium, the concentration of the initial components, the catalyst, the nature of the solvent and other factors on the course of the reaction were studied. Optimal reaction conditions have been established. 4. A high-molecular nitrogen fertilizer with a linear structure of prolonged action has been synthesized both in alloy and in solution. 5. The molar ratios of the initial components are established. The molar ratio of the initial components - carbamide and aldehyde - changed to 1: 0.8-1.2, respectively. The reaction temperature varied from 60 to 95 degrees during the reaction in solution. The duration of the reaction is from 1 to 16 hours. The pH of the reaction medium is from 8 to 3. The concentration of the initial components is from 0.6 to 2 mol/l. During the reaction in the alloy, the reaction temperature varied from 70 to 155 degrees. The duration of the reaction at the initial stage was 2 hours, at 155 degrees it was 12 hours. The molar concentration of the initial components varied from 0.8 to 1.1 mol/l. Optimal reaction conditions have been established. A monograph has been published as part of a grant project: G. Papava, E. Gugava, K. Ebralidze, M. Gurgenshvili, I. Chitrekashvili. Obtaining and application of Prolonged Nitrogen Fertilizers in Agriculture. Publishing house "polygraphmax" LLC. 17 Rokakidze Avenue, Tbilisi, 2014

- The corn roots, chipboards and Caucasian Fir cones (briquetting material), as well as polyethylene (binding material) were used in mixed briquettes for the first time. Only local secondary raw materials were used. The obtained fuel briquettes complied with the standards.
- Comparative characterization of combustible waste raw materials, bio and mixed briquettes, determination of ecological effects, heat capacity of briquettes and the amount of electricity saved according to the thermal energy released as a result of combustion were carried out. The estimated cost of the product and the profit data were determined.
- A map of the location and stocks of secondary raw materials in Georgia was drawn up.
- The optimal technological scheme module for obtaining of fuel briquettes was selected.
- Recommendations and recipes for their production and commercialization of briquette compositions were prepared.
- During the reporting period, 5 articles and 3 international conference theses were published. The database was compiled.
- From corn roots and chipboards were obtained combustible briquettes corresponding with the requirements of the existing standard both from the ecological and economic point of view. It is worth noting that corn roots and chipboards as a briquetting material, as well as polyethylene as a binding material were used in mixed briquettes for the first time.

Several methods were developed for the separation of ceresins and solid paraffins from the 350-450°C fraction, from the >450°C residue and oil pipeline sludge. The possibility of obtaining lubricants and insulating materials, as well as mastics and candles by mixing solid paraffins and ceresins was studied. The luminophore (20-22%) separated from the residue >450°C is the best raw material for obtaining electrode coke, insulating materials, bitumens and luminescent components. The patent P 2018 6831 B: Method of efficient utilization of oil pipeline sediment was received. It describes an environmentally safe method of efficient utilization of oil pipeline sediment, which allows high-quality, expensive products to be obtained by its rectification and molecular distillation, without cracking, with minimal operations, excluding usage of adsorbents and expensive stages. For the first time in Georgia it is possible to implement an effective scheme for rational processing of oil pipeline wastes in order to obtain low-tonnage, deficient products from it. 3 articles and 4 international and local conference theses were published

#5461	New generation premises containing bio-metals and natural zeolite	Grant competition of Science and Technology Center in Ukraine	Science and Technology Center in Ukraine	123 300 EUR	02.12.11-02.11.14	Spartak Urotadze	<p>The aim of the project is the creation of bio-coordination compounds containing bio-metals and organic substances and their combinations with Natural zeolite. They provide production of inexpensive, ecologically safe, wasteless, antibacterial antiseptic additives.</p> <p>Tasks to reach the goal:</p> <ul style="list-style-type: none"> Synthesis of coordination compounds containing essential bio-metals and organic substances (amino acids, oxo-acids and etc.); preparation of the optimal compositions on the bases of synthesized compounds and natural zeolites (clinoptilolite, laumontite and etc.); Preparation of the scientifically proved recipes for the inexpensive, ecologically safe, wasteless, additives containing effective doses and optimal composition of essential bio-metals, organic substances and zeolite. <p>Application of the prepared composites will provide:</p> <ul style="list-style-type: none"> Prolonged intake of the nutrients by poultry and animals; Maximal decrease in fall, increase in live mass (15-20%) and improve of the meat quality; Keeping of physiological and biochemical indices within the limited norms; decrease in food expenses. 	<p>The following conclusions are made on the bases of the works done within the scope of the project "Generation Premixes Containing Bio-metals and Natural Zeolites.</p> <ul style="list-style-type: none"> The conditions for the synthesis are established and the following types of coordination compounds are synthesized: M:L1.L2.nH2 O, where M=Mn, Zn, Fe, Co, Cu, L1= amino acid (glutamic acid or methionine), L2= anion of citric acid n=0-6. Composition of the synthesized compounds, their individuality, solubility and stability in water, type of the metal-ligand bond, and thermal stability have been studied. The test trials of the premises created on the basis of mixing the synthesized compounds and natural zeolites have been carried out on broiler, egg laying chickens and rabbits. The optimal recipes have been proposed on their bases taking into account soil-climate conditions of the local zones. <p>Application of the premises prepared according the recipes provides:</p> <ul style="list-style-type: none"> Prolonged intake of nutrients by poultry and animals Maximal decrease in fall Increase in the live mass by 10-12% Improvement of meat quality Keeping of physiological and biochemical indices within the limits of the norms Avoiding of different diseases Decrease in nutrient expenses while its intake because of the increase in its effectiveness Decrease in the prime cost of the nutrient
							<p>Spartak Urotadze, Iamze Beshkenadze, Apolon Kozmanishvili, Nani Zhorzholiani, Maia Gogladze, Givi Beghelari, Nana Osipova, Tamar Kvernadze, Nino Burkiashvili, Victoria Enukidze</p>	
GNSRF/ ST 09-153-7104 .	New Type Hybrid Porous Polymeric Insulation Material	State scientific grants	Georgian National Science Foundation	150 000 GEL	01.04.2010-01.04.2013	Givi Papava	<p>The Project pursues obtaining of new type hybrid porous polymers on the base of amide type oligomers and winemaking wastes (husk), which will have high sound- and heat-insulation properties, as well as high sorption capacity. Technology of obtaining the offered porous polymer materials is developed for the first time and it will enable one to solve the above listed problems. The offered project will enable one to organize wide scale enterprise for production of highly efficient porous polymers as well as their application for the provision of sound and heat insulation of buildings and communications, their application in environment protection from pollution due to oil products. Practical value of the Project is that we'll obtain new type highly efficient hybrid porous polymers, which are distinguished by high sound- and heat-insulation properties as well as by high sorption properties, fire resistance, by capacity to vary properties in wide range, according to the structure and ratio of initial components, by cheapness. The Project will be implemented by participation of scientists and specialists, highly experienced in the sphere of the submitted theme. The submitted Project provides also thermal modification of natural inorganic sorbents. We'll develop technology of rendering hydrophobic natural mineral sorbents, which is necessary for granting them selectivity. The Project provides obtaining of porous polymers filled highly with grape husk. It also provides study of the process of formation of hybrid porous polymers. Intensive growth of the population makes urgent the problem of heightening of production of major cereals. Increase of urban population and industry results in decrease of arable lands. Therefore the practically only means of problems resolution is application of intensive technologies, which in its turn is connected with the necessity of increasing agrochemical norms of mineral fertilizers, especially of nitrogenous fertilizers. But due to extremely high solubility of nitrogenous fertilizers its significant part (approximately 50%) is lost because of its washing down and evaporation. Alongside with the great economic losses, it conditions total contamination of environment – water reservoirs, rivers, wells, lakes, etc. When it reaches upper strata of the atmosphere it results its destruction and heavy ecological conditions for the population and fauna, it conditions various type heavy diseases. Therefore it becomes extremely urgent and actual to develop ecologically safe and profitable technology, which will enable to reduce significantly application of mineral nitrogenous fertilizers by means of drastic decrease of its solubility in soil. The submitted Project pursues creation of such technology by means of creation of multi-component pellet compositions, which contain structured nitrogenous fertilizer and zeolite in the pores of which nitrogenous fertilizer undergoes structuring. Simultaneously these pores create favorable medium for propagation of bacteria. In this way we achieve the prolongation effect of the structured nitrogenous fertilizers and it enables us to decrease the norm of nitrogenous fertilizers per ha to 50%. Thanks to this technology nutrients are delivered to plants according to need, by means of buffer effect of chemical reactions, taking place in soil. Resolution of the below listed objectives is necessary for implementation of the Project 1. Isolation and propagation of cultures corresponding to uro-bacteria 2. Development of a method of defining the rate of degradation of structured nitrogenous fertilizers by uro-bacteria. 3. Development of a technology of obtaining</p>	<p>The project provided for the development and research of innovative technology for obtaining new types of heat and sound insulation porous polymer materials. To obtain porous insulating materials proposed by the authors of the project, the main components are an amide-type monomer carbamide, formaldehyde and waste from the processing of grapes - chacha. Laboratory studies have studied the process of formation of an oligomer and a porous polymer material, the influence of various factors on its course. Hybrid porous plastic materials based on synthetic polymer and waste from the production of wine – chacha were obtained. Work was carried out to identify one of the main components – chacha. Various functional groups were identified in the samples. To obtain hybrid porous polymer materials, chacha was hydrophobized and sorption properties were studied. The main component for the production of porous materials is amide and mixed oligomers. An innovative technology has been developed, on the basis of which porous polymers are obtained both in powder form and in the form of granules. Work has been carried out to determine the main technological parameters of the process. The curing process of the polymer composition and the effect of changes in the content of chacha on the technological process have been studied. Perlite-containing porous polymer have been synthesized in a pair with a cup. A cheap natural mineral sorbent can also be included in the composition of porous polymers, which will significantly reduce the cost of products and at the same time increase its fire resistance. For this purpose, you can use a natural mineral - perlite. Granulometric analysis and fractionation of modified perlite were carried out in laboratory conditions. Several fractions were identified: 0.14, 0.63, 1.25 and 1.75 mm. Tests of porous polymers were carried out in laboratory conditions. The proposed project made it possible to obtain highly efficient porous hybrid polymers. Such polymers can be used for sound and thermal insulation, as well as for cleaning oil-contaminated waters and soil. The new technology will reduce the proportion of the amide oligomer in the polymer composition by using chacha up to 50 wt. %. The uniqueness of the project results lies in the fact that hybrid porous polymer materials based on chacha will be obtained for the first time by developing a new technology. The resulting hybrid porous plastic material is characterized by cheapness, selectivity, high sound and thermal insulation properties, as well as high sorption capacity and other properties. The real and potential consumers of porous polymers are the production of non-alcoholic and alcoholic beverages, construction organizations, oil producing and oil refineries, etc. There are practically no competing organizations in Georgia, as there are no production facilities for the production of amide polymers, and imports cannot be carried out. Because of its non-transportability (it requires compliance with a special regime and makes its import unprofitable). The creation in Georgia of the production of oligomers and porous polymer materials based on them provides it with a wide market.</p>
							<p>Gavashelidze Eter, Maisuradze Nunu, Khotenashvili Nanuli, Tabukashvili Zurab</p>	
GNSRF/ST09-220-8-100	the environment from pollution	State scientific grants	Georgian National Science Foundation	150 000 GEL	01.04.2010-01.04.2013	Gugava Eldar	<p>The process of urea structuring in zeolite pores has been studied. Natural unmodified analcime was used for this purpose. The grain size was 0.5 – 1 mm. Analcime was saturated with a mixture of carbamide and aldehyde components. Ammonium nitrate and ammonium chloride were used as catalysts. The content of carbamide in the secondary pores of analcime varied from 10 to 15%. The structuring process was studied at 1500C. It was found that during the process without a catalyst, low-molecular oligomers are formed, which, when treated with water, are completely washed out of the pores of the analcime. When using catalysts, a structured product is formed. The reaction takes place in two stages. At the first stage, oligomers are formed, which subsequently undergo structuring. As a result of the reaction, macromolecules are formed that cannot be extracted from the pores of the analcime. In this way, the effect of a chemical bond between analcime and structured carbamide molecules is created. Structured carbamide can be extracted from the pores of analcime only in the form of breaking chemical bonds and the formation of fragments of small molecules. When using structured urea as a chemical fertilizer, its gradual degradation occurs under the action of urease enzymes. In the initial mixture, the molar ratio of carbamide and aldehyde was 1:1.2 and 1:1.5, respectively. At a temperature of 1500C, with a duration of 1.5 hours, the process of structuring carbamide in the alloy was studied. The molar ratio of carbamide and aldehyde was 1:1 and 1:2, respectively. The temperature is 1350C and 1500C, the reaction duration is 2 hours. At a ratio of 1:1, linear molecules are formed, which are characterized by a prolonging effect. In this case, urease enzymes easily penetrate into the polymer mass, and degradation proceeds quickly. At a ratio of 1:2, a polymer with a high degree of crosslinking is formed. In this case, the penetration of enzymes into the polymer mass and the breaking of chemical bonds is difficult, and degradation requires a long time. Chemical fertilizer with the effect of prolonged action – structured carbamide, 200 g each, was produced for use in laboratory vegetation tests.</p>	<p>2 Patents; 10 Scientific articles (2-high-ranking journals, 2-thesis, 1 foreign journal; 5 local journals)</p> <ol style="list-style-type: none"> Hybrid porous plastic materials based on synthetic polymer and waste from the production of wine – chacha were obtained. Work was carried out to identify one of the main components – chacha. Various functional groups were identified in the samples. Hydrophobization of chacha was carried out and sorption properties were studied. An innovative technology has been developed, on the basis of which porous polymers are obtained, both in the form of powder and in the form of granules. Work has been carried out to determine the main technological parameters of the process. The curing process of the polymer composition and the effect of changes in the content of chacha on the technological process have been studied. Porous polymers containing perlite paired with a cup have been synthesized. Studies have been conducted to study the process of modification of perlite. Perlite is a rock of volcanic origin. It is not a fibrous material, does not burn or rot, is biostable and chemically inert (pH = 6.5). Optimal conditions for modification of perlite 950-1200°C have been determined. The sorption properties of modified perlite hydrophobized perlite were studied, in particular, the efficiency of removing oil from the water surface. Sorption properties of hydrophobized chacha were studied. Optimal conditions for the synthesis of homogeneous and mixed oligomers were established. The influence of the chemical structure of the amine component on the properties of the porous polymer was established. The properties of porous polymers were studied. The proposed project made it possible to obtain highly efficient porous hybrid polymers. The use of such polymers is possible for sound and thermal insulation, as well as for cleaning oil-contaminated waters and soil. The new technology will reduce the proportion of the amide oligomer in the polymer composition by using chacha up to 50 wt. %. The uniqueness of the project results lies in the fact that hybrid To obtain a structured prolonged fertilizer for the purpose of introducing carbamide into the pores of zeolite, a sample containing natural, unmodified zeolite-clinoptilolite of various deposits was selected. For chemical, X-ray phase and infrared spectral studies. In order to clarify the safety of structured urea for soil microflora, the effect of polymers on the qualitative and quantitative composition of some types of (brown-carbonate, brackish) microflora was studied. For the first time, multicomponent graded encapsulated fertilizer compositions for grain crops (wheat, rye, barley, triticale) were developed. When using the resulting prolonged fertilizer, the hectare rate of nitrogen fertilizers is reduced by 50%, and along with an increase in yield, it is given the greatest ecological and economic importance. Urobacteria strains were isolated from soils, active, new selective forms were obtained by their selection, which will be used to degrade structured urea, convert it into a form assimilated by plants, and then to carry out ion exchange processes of ratios, to convert insoluble calcium phosphate into a soluble form. The described process is carried out in the soil. The selected strains were tested on polymer nitrogen fertilizers and the presence of intermediate oligomers in them was checked. Samples containing natural, unmodified zeolite-clinoptilolite from various deposits were selected. The process of urea structuring in zeolite pores has been studied. Natural unmodified analcime was used for this purpose. The grain size was 0.5 – 1 mm. The process of structuring carbamide in the alloy was studied. The molar ratio of carbamide and aldehyde was 1:1 and 1:2, respectively. The temperature is 1350C and 1500C, the reaction duration is 2 hours. The influence of the molar ratio, the duration of the process and the temperature of the initial components on the structuring process of carbamide and aldehyde components has been studied. A chemical fertilizer with the
							<p>Gavashelidze Eter, Maisuradze Nunu, Gelashvili Nazi, Papava Ketevan, Lipartelianu Riva</p>	

Project ID	Project Title	Georgian National Science Foundation	State Scientific Grants	Start Date	End Date	Lead Scientist	Co-Lead Scientists
GNSF/ST09-152-5-250	Application of new types of hybrid porous polymers	150 000 GEL	01.04.2010-01.04.2013	Zaza Molodnashvili	Nazi Gelashvili, Ketevan Papava, Vitali Sherozia, Natela Khetsuriani		
GNSF/ST09-229-8-100	Development of new technologies for cereals with the purpose of decrease of the norm of nitrogenous fertilizers per ha and environment protection from pollution, by the use of nitrogen-fixing organisms	150 000 GEL	01.04.2010-01.04.2013	Marina Gurgenshvili	Eldar Gugava, Ia Chitrekashvili, Nora Dokhturishvili, Zaza Molodnashvili		
#4294	Controllable released fertilizers on the basis ion-exchanging and polymeric compositions	197 408 USD	01.02.2009-01.02.2012	Givi Papava	Maisradze Nunu, Dokhturishvili Nora, Gelashvili Nazi, Papava Ketevan, Gurgenshvili Marina, Andronikashvili Teimuraz, Eprikashvili Luba, Kordzaxia Teimuraz, Lomtadze Zaur, Gasviani Nodar, Gugava Eldar, Gvashelidze Eter, Molodnashvili Zaza, Ramishvili Meia, Chitrekashvili Ia, Tabukashvili Zurab, Lipartelani Riva, Khotenashvili Nanuli		

The purpose of the project is the development and studying of new organic and mineral hybrid foam-polymers on the basis of various classes of polymers and natural modified sorbents with high sorption ability and physical-mechanical properties. Every year all over the world the scales of oil extraction and processing increases, which causes a danger of environment pollution. Therefore, the measure directed on the development of efficient methods of removing of these substances from the polluted surface are of primary importance. There are numerous known methods applied for removal of oil and oil products from the water surface. The most widely spread among them is an absorption method. Non-organic sorbents sink into water together with absorbed products. This causes intensive pollution of the lake, sea, ocean bottoms. The proposed project aims to develop high-filled, high sorption ability foam-polymers of a new type on the basis of various classes of polymers and natural modified non-organic sorbents. Their removal from the water surface is possible in mechanical way, together with absorbed oil products. The proposed technology of foam-polymers generation is being developed for the first time and it will enable us to solve the above-mentioned problems. The proposed project enables large-scale production of highly efficient sorbents and their exploitation for protecting environment. The practical value of the project includes the following: the new type of highly efficient foam-polymers of different configurations will be created. These polymers will have floatability together with absorbed substances and will be distinguished with high sorption properties, fire resistance, the property variability in wide interval, dependence on base material structure and reliability. The project will be implemented by the scientist and specialist, which have large experience on the topic of the proposal. The present project proposes thermal and chemical modification of natural sorbents. Technology of hydrophobization of sorbents will be developed, which is necessary for granting selectivity to sorbents. Intensive growth of the population makes urgent the problem of increase of cereals production. Increase of urban population and industry result in the decrease of arable lands. Therefore, the practically only means of problem resolution is application of intensive technologies, which is connected with the necessity of increasing agrotechnical norms of mineral fertilizers, especially those of nitrogenous fertilizers. But due to extremely high solubility of nitrogenous fertilizers its significant part (approximately 50%) is lost because of its washing down and evaporation. Alongside with the great economic losses, it conditions total contamination of environment – water reservoirs, rivers, wells, lakes, etc. When it reaches upper strata of the atmosphere it results its destruction and heavy ecological conditions for the population and fauna, it contributes to various type heavy diseases. Therefore it becomes extremely urgent and actual to develop ecologically safe and profitable technology, which will enable to decrease significantly application of mineral nitrogenous fertilizers into soil by means of drastic decrease of its solubility in soil. The submitted Project pursues creation of such technology by means of creation of multi-component pellet compositions, which contain nitrogen-fixing bacteria and structured nitrogenous fertilizer, as well as zeolite, in the pores of which nitrogenous fertilizer undergoes structuring. Simultaneously it creates favorable medium for propagation of bacteria. Thus we achieve prolongation effect of the structured nitrogenous fertilizers and application of nitrogen-fixing bacteria jointly with this effect, will enable us to decrease the norm of nitrogenous fertilizers per ha by 50% and more. Thanks to this technology nutrients are delivered to plants according to need, by means of buffer effect of chemical reactions, taking place in soil. For Project implementation it is necessary to resolve the below listed objectives: 1. Isolation of nitrogen-fixing bacteria from the medium of various culture, selection and propagation of active cultures; 2. Development of technology of obtaining nense population growth requires increased food production. By contrast, farmlands are gradually disappearing due to growing urbanization and intensification of industry. One solution to this problem of a decreasing food supply is the use of intensive agricultural technologies such as chemical fertilizers, especially those containing nitrogen. However, due to the especially high solubility of nitrogen fertilizers, a large proportion of their application (at about 100 million tons) is lost to leaching and evaporation. This economic loss is accompanied by total environmental pollution, and by pollution of upper layers of the atmosphere where evaporated substances destroy the ozone layer, thus creating dangerous ecological conditions for human beings and fauna. The development of ecologically harmless and profitable fertilizers is crucial to our livelihood. The present Project will develop such a technology by creating multi-component compositions consisting of nitrogen-fixing bacteria. Such a fertilizer would decrease significantly (by 50-60%) the amount of nitrogen fertilizers required for optimal plant growth. The proposed nitrogen fertilizer would have a prolonged action and contain a natural sorbent (zeolite, diatomite) where nitrogen can be sequestered in mineral pores, thereby simultaneously creating a favorable medium for the propagation of bacteria. Main nutritive substances (NPK) for plants are released via ion-exchange reactions, in which the exchangers (previously exchanged natural zeolites) containing ammonium and potassium cations are mixed with phosphate rock. Calcium ions travel from phosphate rock through the soil solutions and exchange with nutrient cations held in the zeolite, thus releasing potassium and ammonium. To implement the Project the following tasks will be resolved: - obtaining and propagation of cultures of nitrogen-fixing bacteria; - development of technology for obtaining structured nitrogen fertilizers of prolonged action; - realization of step-wise adaptation of microorganisms possessing urease activity – to polymers; -

Studies were conducted on the selection of natural mineral sorbents. Natural sorbents have advantages over synthetic sorbents: cheapness, accessibility. However, in terms of efficiency, purity, and uniformity, natural sorbents lag behind synthetic sorbents. At the initial stage, a natural sorbent was chosen - zeolite, which is resistant to aggressive media (acids) and at the same time is thermally stable, which is an important factor in relation to export parameters. Research work was carried out to study the conditions of chemical modification of natural zeolites and to determine optimal conditions. Chemical modification was carried out to increase and activate the size of the zeolite pores. Optimal conditions of chemical modification of zeolite (temperature, time, concentration of solutions and ratio of components) were determined. Various methods of chemical modification have been established - in particular, with the help of acids, ammonium chloride (NH4Cl), potassium chloride (KCl) and other substances. Experiments on thermal modification of diatomite were carried out. To obtain polymer compositions, mixed oligomers of urea-formaldehyde, melamine-formaldehyde and urea-melamine-formaldehyde were synthesized, which are promising materials for their use as matrices in compositions. It was found that the properties of the formed porous hybrid polymer are greatly influenced by the ratio of the amide oligomer to the diatomite and the reaction area. Studies show that porous composites have much higher sorption properties than natural and modified diatomites. Porous hybrid polymers based on a carbamide-formaldehyde oligomer and a natural sorbent perlite have been synthesized. The influence of the zeolite mass fraction, temperature, air flow intensity, p reaction and oligomer concentration on the formation of a porous hybrid polymer has been studied. The content of natural sorbent in the polymer composition improves the thermal insulation properties of the resulting hybrid porous polymers. The sorption process of mixed porous amide-type polymers and the effect of the content of natural sorbents on their properties have been studied. The study showed that the degree of sorption of the obtained new types of porous hybrid materials is quite high (the degree of sorption within 5 hours in some cases exceeds 80%). The uniqueness of the results lies in the fact that for the first time it became possible to use natural sorbents to obtain new types of porous hybrid polymer materials, which are characterized by cheapness, high physico-mechanical and dielectric properties, selectivity, high sorption capacity, heat and sound insulation properties. Natural unmodified clinoptilolite was used to study the process of structuring carbamide in zeolite pores. According to the grain size, six fractions were identified, from which one fraction with a grain size of 2 mm was selected. The secondary pores of clinoptilolite were saturated with carbamide, the content of which in the pores was 5, 10, 15, 20 and 22%. To study the process of urea structuring in zeolite pores, a sample containing 22% urea was selected. It was found that urea is completely washed out of the pores when treated with water from saturated zeolite. The structuring of urea in the pores was carried out by heat treatment without a catalyst and its use. Polymerized aldehyde-paraform was used as the second component. Their molar ratio was 1 : 0.8; 1 : 1; 1 : 1.2; 1 : 1.5; 1 : 1.8 and 1:2 respectively. When carrying out the structuring process without a catalyst, the degree of polycondensation of urea is very low. Under these conditions, there is practically no structuring of urea and when samples are treated with water, the urea is almost completely washed out of the pores. With the same ratio of the initial components, when using a catalyst, the polycondensation process proceeds energetically, with a ratio of the initial components from 1:0.8 to 1:1, low-molecular oligomers are formed, which are almost completely washed out of the pores during water treatment. With an increase in the molar fraction of the aldehyde component in the initial mixture at the first stage, the resulting oligomers undergo further transformation and a structured carbamide is obtained. The higher the content of the aldehyde component in the initial mixture, the higher the quality of structuring. With a low content of the aldehyde component, the formed macromolecules are interconnected by rare bonds and practically form linear macromolecules. With an increase in the aldehyde content, the degree of crosslinking of macromolecules increases, and when the molar fraction of the aldehyde component is 1.5 – 2 moles, a structured product is formed that practically does not dissolve in water. Under the action of various enzymes in the soil, they gradually turn into a soluble form, assimilated by the plant, which causes the prolonged effect of the fertilizer. Due to the large size of the resulting macromolecules, structured urea cannot be washed out of the pores under the action of water, which is a necessary factor to achieve the prolongation effect. Structuring is carried out under conditions 135–150°C, the reaction duration is 1 - 1.5 hours. The structuring of carbamide in the alloy was carried out. When the molar ratio of the carbamide and aldehyde components in the initial mixture is 1: 1.2 – 1.5, its structuring occurs as a result of heat treatment. When it exceeds 1:5 mol, the degree of crosslinking of macromolecules is very high, which makes it difficult for various enzymes to penetrate, and the degradation of the structured polymer requires a long time, which significantly exceeds the growing season of the plant. The use of such a long-acting fertilizer is impractical for grain crops. A number of strains of free-living nitrogen-fixing microorganisms have been isolated from the soil. A laboratory technology for producing dry biomass from them has been developed. The amount of structural urea, which is optimal for the immobilization of the dried biomass of nitrogen-fixing microorganisms, was revealed, and their optimal ratio in the complex of structured urea and nitrogen-fixing bacteria was determined. Field tests were conducted in the conditions of Mukhran-saguramo, according to a scheme of nine variants with a four-fold repetition. The tests were carried out on winter wheat of the ubho-1 variety. The phases of plant development have increased in agricultural production and the maintenance of high crop yields are possible only through the applications of fertilizers. In such technologies, soluble fertilizers (mostly nitrogen-based) are applied in large concentrations, significant proportions of which are lost to the environment through leaching. Such pollution adversely affects ecosystems, including the health of humans and animals, and wastes resources. Therefore fertilizers technologies need to be developed that are environmentally friendly and conservative. Our objective is to develop fertilizers that contain natural sorbents (zeolites) and polymerized nitrogen (carbamide) that will release nutrients to plants in a controlled manner, thereby preventing losses due to leaching. This project proposes to develop a new type fertilizer that does not pollute because it is not readily soluble. In this technology, nutrients are made available to plants as they are required by plants through the buffering effect of a chemical reaction that occurs in the soil. The major plant nutrients (NPK) are released through an ion exchange reactions in which an ammonium- and potassium-containing exchanger (natural zeolite) is mixed with phosphate rock. Calcium ions from the phosphate rock travel through soil solutions and are sequestered in zeolite exchange sites, thereby releasing potassium and ammonium cations from the zeolite, and phosphate from the phosphate rock, for uptake by plants. As these NPK nutrients are used by plants, more are released to the soil solutions through the buffering reactions. Because the exchange capacity of zeolite is limited to about 2.5% nitrogen by weight, additional slow-release nitrogen is added to the system by sequestering nitrogen polymers (variously polymerized carbamide) in zeolite rock pores. The different natural zeolites of sedimentation origin have been obtained. The chemical, X-ray and IR analysis has been done. The method of ionic modification of natural zeolites has been developed. The degree of substitution of exchangeable ions of zeolite (Na, K and Ca) by modified ions (NH4+) has been determined. The introduction of carbamide into second pores of NH4-form of zeolites (Clinoptilolite, analcime and laumontite) has been studied. The saturation of pores of zeolite was carried out with a mixture consisting of carbamide and paraform at the different ratio. The structuring process was carrying out at different temperatures and during different time. After expiration of the proper time the structuring process was interrupted by the rapid cooling of reactionary mass. After treatment of patterns with water carbamide was washed from the pores of zeolite. In this case, the amount of the taken aldehyde component is sufficient for formation of the structured product with comparatively rare cross-links. The plant (wheat) development was studied in laboratory and fields conditions, at application of exchange fertilizer, consisting of Ka-substituted zeolite, unstructured carbamide and phosphate of calcium in soil. At the same time an exchange fertilizer on the basis of structured carbamide was inserted in soil. The study showed that the unstructured carbamide was not found in the soil after 14 days. This fact indicates that unstructured carbamide is washed from the soil and a plant has no time to assimilate it. For the receipt of multi-component drop the synthetic oligomer (aminoaldehyde type) carbamide-formaldehyde oligomer was used. It was obtained at initial ratio: 1:2 of components – carbamide and formaldehyde. Influence of amount of oligomer has been studied and the optimum terms of drop formation have been set. We continue study for the receipt of multi-components compositions, containing in zeolite framework

Results: 1. It has been established that thermally (heating 7000C) and chemically (organosilicon compounds) modified perlite in a polymer composition significantly improves the properties of a porous polymer - density, buoyancy, sorption properties, etc. 2. Experiments on thermal modification of diatomite were carried out: thermal modification of diatomite occurs within 3 hours 250, 300, 400, 450, 500, 550, 600, 700 and 10000C. 3. To obtain polymer compositions, mixed oligomers of urea-formaldehyde, melamine-formaldehyde and urea-melamine-formaldehyde were synthesized, which are promising materials for their use as matrices in compositions. The synthesis of oligomers is mainly carried out in an aqueous solution based on an amide component and formaldehyde. 3. Amide oligomers are also obtained by polycondensation in nalgohe, the components of the solution in the molar ratio (carbamide aldehyde) 1:1, respectively, at 1000C, the reaction duration is 1 hour. 4. The obtained results allow us to conclude that the optimal mass ratio of diatomite and aminoaldehyde oligomer to obtain an effective material is 0.3:0.7, respectively. 5. The influence of pH on the formation of a hybrid polymer, the regulation of which allows obtaining materials with specified properties, has been studied. 6. Composite porous polymers with different percentages of both natural and modified perlite were obtained. It is estimated that the optimal percentage of perlite content is 30-40%. 7. Sorption properties of samples of porous polymers of mixed amide type are investigated. 8. Samples of porous polymer were obtained with different percentages of diatomite - 20, 25, 30 and 40%. The best option is the diatomite content of 25%. 9. The desorption process has been studied on the example of oil fractions. 1. The process of structuring urea in the pores of zeolite (laumontite) has been studied. In order to facilitate the penetration of various enzymes into polymerized urea, linear polymers were synthesized in which the degree of crosslinking of polymer molecules is low, or macromolecules are not completely crosslinking. A high effect can be achieved with a certain molar ratio of the initial components. 2. The structuring of urea in the pores was carried out by heat treatment without a catalyst and its use. Polymerized aldehyde-paraform was used as the second component. The higher the content of the aldehyde component in the initial mixture, the higher the quality of structuring. With a low content of the aldehyde component, the resulting macromolecules are interconnected by rare bonds and practically form linear macromolecules. Structuring is carried out under conditions 135–155°C, the reaction duration is 1 - 1.5 hours. 3. The process of formation of a polymer of the linear structure of urea is studied at the following molar ratio of the initial components - urea and aldehydes - the main components: 1:0.8; 1:0.9; 1:1; 1:1.1 and 1:1.2, respectively. The duration of the process is from 0.5 to 6 hours. The reaction temperature is 60, 70, 80, 90, 100°C. 4. The process of structuring urea in an alloy during the interaction of urea and an aldehyde component – paraform is studied. The molar ratio of the carbamide and the aldehyde component is as follows: 1:0.5; 1:0.6; 1:0.8; 1:1; 1:1.2, accordingly. When the molar ratio of the carbamide and aldehyde component in the initial mixture is 1: 1.2 – 1.5, it undergoes structuring as a result of heat treatment. When it is above 1:5 mol, the degree of crosslinking of macromolecules is very high, which makes it difficult for various enzymes to penetrate, and the degradation of the structured polymer requires a long time, which significantly exceeds the growing season of the plant. 5. Lyximetric studies were carried out, the content Scientific results: 1. Nitrogen-fixing bacteria will be used for the first time in multi-component compositions. 2. Natural sorbents –zeolites will be used in compositions for the first time. Three types of natural zeolites: clinoptilolite, analcime and laumontite - have been selected and described for obtaining of exchangeable fertilizers; Technology of incorporation of nitrogen fertilizers and that of structuring in zeolite pores will be developed for the first time; fertilizers acting according to the prolonged/controlled mechanism will be prepared. 3. Three types of natural zeolites: clinoptilolite, analcime and laumontite - have been selected and described for obtaining of exchangeable fertilizers. 4. The introduction of carbamide into secondary pores of the zeolite was carried out for the first time. It was established that 20-25% of carbamide can bring in the pores of the zeolite. 5. The process of interaction between carbamide and aldehyde component in the melt and the regularities of this interaction was studied; 6. The regularities of the reaction of structuring of oligomers were studied. The influence of various factors - temperature, duration, ratio of initial components, catalyst, etc. were studied; 7. The main kinetic parameters of the process of structuring of oligomers were determined. The IR spectroscopic study of conversion of oligomers was carried out. 8. The mechanism of reaction of formation and structuring of oligomers was established; 9. The pelleting of multi-component composition of the exchange fertilizer of prolonged action consisting of a structured carbamide, potash fertilizers, non-modified natural phosphate (apatite) and trace elements was carry out and the influence on the formation of drops of different factors: pressure, endurance, weight and content of the composition was investigated; 10. The optimal mode of getting of pelleting compositions containing pills in the wheat grain was established; 11. Prepared and planted winter wheat region, to study the

GNSF/ST08/5-434	Extraction of oil and antioxidants from wine grape seeds using supercritical fluids	State scientific grants	Georgian National Science Foundation	94746 GEL	1.03.2009-31.03.2011	Giorgi Kvatskhava	M.Tsitsagi, M.Chkhaizde, I.Jinikashvili, M.Khachidze, R.Katsiteli, Saperavi, Aladasturi, Isabela)have been studied within the framework of the project.	Optimal conditions of supercritical fluid extraction of oil and analysis, extraction of polyphenolic compounds and analysis from 4 Georgian wine grape seeds and skin (Rkatsiteli, Saperavi, Aladasturi, Isabela)have been studied within the framework of the project. According to the World Health Organization, up to a million tons of 900 types of pesticides are consumed annually in the world. This is followed by their accumulation in the environment, changes in the chemical composition of the biosphere and other environmentally dangerous changes. Unfortunately, Georgia is no exception in this respect. Thus, it is essential to develop and use environmentally friendly or less dangerous insecticidal and fungicidal agents to protect strategically important crops for Georgia, in particular grapes, from pests and diseases. At the same time, our country has raw materials of plant origin - essential oils, the components of which can be used for the synthesis of various biologically active substances, including environmentally friendly and cost-effective pheromones. Pheromones make it possible to drastically reduce the amount and volume of spraying with pesticides, as well as the environmental burden on the environment. At the same time, resistance to the action of these drugs does not develop and its effectiveness does not decrease over the years. The main pests of vineyards in Georgia are mites and scale insects. Against them, a combination of commercially available preparations (Neoron, Envidor, etc.) with turpentine oil (a product of processing resin and needles pine) which causes activation and prolongation of the insect-acaricidal action of compositions against mites and scale insects. Premature leaf pigmentation is also a problem for the growth and development of the grape vine, which is probably caused by unbalanced plant nutrition, in particular, a lack of trace elements, including magnesium and iron. That is why it is necessary to strengthen overwintered and therefore weakened vines by introducing a preparations with micronutrients into the root system that strengthens the immune system and helps increase the yield. Such chelating type preparations can be used on the basis of peat or charcoal.	2 Article, Laboratory regulation
GNSF/ST08/8-516	Elaboration of Arrangements Against of Main Pests and Diseases of Vine, Their Testing and Field Employment in Georgia	Fundamental Research State Grants	Georgian National Science Foundation	97 650 GEL	01.03.2009 - 31.03.2011	Avtandil Dolidze	A.Dolidze, L.Tskhvedadze, I.Mikadze, L.Shubtitzde, O.Lomtadze, L.Taralashvili	Nowadays, mankind is justly concerned about the process of global pollution of the environment and raises a question of sanitary condition of atmosphere in big cities and surrounding territories of large industrial centers. Amount of harmful exhausts in the atmosphere is increasing constantly and concentrations of certain components in the atmosphere greatly exceed their thresholds. In spite of the fact that there are a lot of methods of exhaust gases purification from harmful components, choosing a rational method is getting more and more actual. Natural sorbents, zeolites, are less studied for this purpose. They are characterized by relatively high selectivity against air pollutants. The above sorbents are highly acid-resisted and thermo-stable substances, that enables us to purify gases containing such aggressive admixtures as CO ₂ , H ₂ S, SO ₂ , NH ₃ , N _x O _y and others. According from the above, we consider it reasonable to study adsorptive properties of natural zeolites of Georgian origin and their modified forms towards nitrogen, sulfur, carbon oxides and other air pollutants. The experiments will be carried out in the dynamic conditions on the specially designed device. The following methods of analyses, chromatographic, X-ray structural, thermogravimetric, chemical and others will be used to implement the project.	Pheromones of grape pests (grape worm,oriental codling moth), prepared according to a new synthesis scheme, pheromone traps for insects of a new design, insect-acaricidal, fungicidal and nutritional compositions, environmentally safe and with a low environmental load ("Antipest", "Zinc dihydrophosphate", "Humafid") obtained and made at the Institute of Physical and Organic Chemistry. Petre Melikishvili can be used to develop a rational scheme for an integrated pest and disease control system for grapes, which will become a real prerequisite for harvesting a high-quality grape harvest and, accordingly, for the production of wine materials that meet international standards.
GNTSF/ST08/5-448	Zeolites of Georgia and Protection of Atmospheric Air	State scientific grants	National Science Foundation of Georgia	75000 GEL	23.03.2009-31.08.2010	Pirtskhalava Nino	Rubashvili Imeda, Zautashvili Marine, Dzagania Maia, Burkishvili Nino	The aim of the project was to study the adsorption-adsorption properties of some natural zeolites and their modified forms in relation to nitrogen oxides and some other environmental pollutants. The following tasks were set for the implementation of the project: 1 - Natural zeolites of Georgia: Analcim (Kutaisi, Gelati); Clinoptilolite (K. Kaspi, Khandak); Phillipsit (city Lanchkhuti, Shukhuti); Mordenite (city Bolnisi, Ravevan) search, determination of their zeolitic phase content, mineralogical and chemical composition, approximate composition of the elementary cell; Preparation of modified forms of the mentioned natural zeolites with Na, K, Ca, H and Cu cations. Determination of their cationic composition. 2 - reception of polluting aggressive gases and graduated mixture; Study of the sorption properties of natural zeolites and their modified forms on the example of model mixtures of aggressive gases using the gas-adsorption chromatography method. 3 - Development of quantitative chromatographic analysis methodology for controlling the concentration of aggressive gases. 4 - study of the adsorption properties of natural zeolites and their modified forms on a specially constructed laboratory flow type dynamic device; Study of the effect of grain size and adsorption temperature of selected zeolite samples on the example of model mixtures under dynamic conditions. 5 - selection of conditions and method of regeneration of zeolites saturated with aggressive gases. 6 - Cleaning of gases emitted from objects by means of a selected sample. The achieved results are: 1) mordenite was selected from the natural zeolites of Georgia to perform the works envisaged by the grant based on the study of their sorption properties; 2) to study the sorption properties of zeolites by the chromatographic method, a graduated model mixture of aggressive gases was prepared by a relatively simple static method; 3) the method of quantitative chromatographic analysis was developed to control the concentration of aggressive gases; 4) The possibility of using hydrogen form of natural mordenite in the process of cleaning air containing a mixture of nitrogen oxides (N ₂ O or NO ₂) on a laboratory flow-type device under dynamic conditions was studied. The prospective and cost-effectiveness of using the mentioned zeolite in the cleaning processes of nitrous gases from the dispersed gases has been determined (it does not lose its sorption activity during repeated use in adsorption-desorption processes); 5) on the basis of the work carried out and the obtained results, the project staff proposes an approximate principle scheme of the technological process of cleaning nitrogen oxides scattered in the air;	Approximate principle scheme of the technological process of purification of nitrogen oxides dispersed in the air; 2 Scientific Articles

G-1599	New Generation of prolonged action composite fertilizers for protection of environment from pollution	International Science and Technology Center ISTC	170 730 USD	01.10.2008-30.09.2012	Marina Gurgenshivili

GEX - 1004020-TB-06

1-8/88	New generation hydrophosphate composition of Fe(II), Ca(II), Mg(II) against the fungi diseases of plant	Georgian National Science Foundation	80 000 GEL	09.03.2010-09.03.2012	N.Jabishvili
GNST/ST07/8-272	Parasitic mites and their control in Georgia	Georgian National Science Foundation	76 415 GEL	01.01.2008-31.12.2009	Goderdzishvili Guguli, (Chimakadze Givi)

Modern intensive agriculture uses enhanced doses of chemical fertilizers containing soluble and concentrated plant nutrients. Regular applications of such fertilizers may have long-term, adverse impacts in soil and environment. They may induce imbalances in nutrients supplied to plants, thereby badly affecting the health of humans and animals. Increase of costs for non-renewable energy have also led to concern about the rising cost of fertilizer in the modern food production. We propose to solve these problems by the further development of a radically different type of fertilizer named "exchange fertilizer". The following works were carried out within the grant project: 1. Study of carbamide's structuring process under temperature 90,100, 110, 120, 125, 130, 135, 140, 145, 150, 1550C and duration of process 1,2,3,5,7,9,12,15 and 20 min. 2. Study of carbamide's structuring process under temperature 90,100, 110, 120, 125, 130, 135, 140, 145, 150, 1550C and duration of process 1,2,3,5,7,9,12,15 and 20 min. 3. Study of the influence of the degree of urea structuring on the ability and rate of dissolution in the soil. 4. Elaboration of technology for production of pelleted-capsulated compositions of structured carbamide and wheat seeding materials in laboratory pelleting machine under different percentage content of structured carbamide and other components. 5. Investigation and synthesis of fixators for pelleting. Elaboration of one stage pelleting process and composition encapsulating. Cold setting of a pellet under various catalysts (AlCl3, SnCl2, NH4Cl, NH4NO3, H3PO4) Approximation of molasses, starch (2,5, 5, 7, 10% solutions). 6. Development of technology for production of a composite of the prolonged action containing structured nitric and potassium fertilizer. Production of composite in melt under various mass content of potassium fertilizer, under conditions of fixed optimal temperature and duration of structured carbamide formation. 7. Development of complex multi-component fertilizer of prolonged action on the base of natural phosphates, structured nitric and

The increase in agricultural productivity is still carried out using intensive technologies, which is associated with increased consumption of mineral fertilizers. This, in turn, creates harsh environmental conditions, since nitrogenous fertilizers (nitrates, carbamide, ammonia) are highly soluble in water, easily washed out by the action of groundwater and rainwater. When using intensive technologies, these losses are even higher. In addition to large economic losses, this leads to total pollution of the environment (soil, water, atmosphere). At present, real and comprehensive recommendations in practice that would provide an effective solution to this problem are unknown. The main goal of the project is to obtain long-acting nitrogen fertilizers based on a natural sorbent - zeolite and structured carbamide. The development of technology for obtaining universal fertilizers containing nitrogen (N), nitrogen-potassium (NK) and nitrogen-phosphorus-potassium (NPK) in the melt, the alternative system proposed by us and the possibility of its targeted management ensure the extension of the fertilizer application process in accordance with the growing season of various crops and, accordingly, the creation of a new generation of fertilizers will completely change the way they are applied, practically eliminates the possibility of fertilizer leaching and global environmental pollution, provides fertilizer savings (by 50% or more), significantly increases yields.

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Phosphate composites of fungicidal properties were obtained the basis of iron, calcium and magnesium hydrophosphates, which can be used in agriculture-for plant protection

In connection with the country's independence and the transition to a market economy, there have been fundamental changes in animal husbandry. Livestock has moved from the public sector to the private sector. There was a need to establish new values. Livestock technologies have changed. Appropriate veterinary drugs against ticks have not been produced in Georgia and are not being produced. We have developed the anti-tick preparation "Agiometrin" (conditional name) based on local raw materials, which, in terms of its effect on ticks in the same doses, is not inferior to similar preparations produced in other countries. It is environmentally friendly and has a much lower cost, which is very important from an economic point of view.

During the implementation of the grant project, work was carried out on threemain directions:

- 1.The study of vydov and the area of distribution of ticks, their bioecological fauna in two different zones of the country;
- 2.Creation of a competitive domestic anti-tick drug;
- 3.Development of anti-tick measures;

In different climatic and geographical zones of Georgia, taking into account the time of year. After taking measures against ticks, livestock workers will have the opportunity to take measures to prevent vector-borne diseases in a timely manner. Therefore, the project has both scientific and commercial significance. Having satisfied the domestic market, our country may well turn from an importer into an exporter. A commission examination of the developed measures will be carried out, temporary mailing lists and instructions with copyright patent rights approved by the Academy Council.

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Nitrogen fertilizers of prolonged action based on carbamide and zeolite are obtained by introducing carbamide and aldehyde into the pores of the zeolite. At the first stage, on the basis of polymerization and polycondensation reactions occurring in the pores, an oligomer is formed, which is then structured and a product that is difficult to dissolve in water is formed. The length of the oligomer molecules, the frequency of their crosslinking and solubility depend on the initial molar ratio of carbamide and aldehyde and can be regulated. Universal fertilizers containing NPK are multi-component fertilizers of prolonged action, which simultaneously contain nitrogen, potassium and phosphorus. The technology of obtaining a 2-component fertilizer consisting of structured nitrogen and potash fertilizers has been developed. Structuring of nitrogen fertilizer-carbamide was carried out at 135 and 155°C in the alloy. To obtain fertilizer composites containing potassium and nitrogen, the process is carried out by heating carbamide and potassium salt. Upon completion of the structuring process, a homogeneous alloy is formed, which contains structured urea with potassium salt dissolved in it. Optimal conditions were established and drained compositions of wheat seed material were prepared, which contain structured carbamide, provided for by agrotechnics full and half norms. A dragee was also made from the resulting alloy, which was tested in laboratory conditions. To obtain a complex fertilizer, a prototype of natural apatite - calcium phosphate was synthesized in the laboratory. Under the action of enzymes, the structured urea is transformed /transformed/, during which the formation of ammonium salts occurs. As a result of the action of the ammonium group and the released potassium during the exchange reactions, the potassium and ammonium groups are replaced in the phosphate and converted into a soluble state. This process proceeds by a prolonged mechanism. Zeolite substituted with ammonium and potassium was also used, which is also involved in exchange reactions with phosphate. The multicomponent fertilizer containing NPK was made in the form of a dragee, which was introduced into the soil together with the grain. The mass of fertilizers necessary for grain nutrition is 3-4 times higher than the mass of the grain itself, so it was considered advisable to introduce them into the soil simultaneously, but separately.

The goal of the project is to obtain an environmentally friendly phosphate fungicide. To this end, the following studies were carried out within the framework of the project. The technological process has been developed to obtain water soluble iron calcium and magnesium hydrophosphates. In technological processes, the Skreinemaker solubility method was used. The fungicidal and bactericidal properties of iron, calcium and magnesium hydrophosphates, on the basis of which a phosphate fungicide was obtained, were studied. Laboratory studies were carried out to determine the effect of aqueous solutions of phosphate fungicides on grape powdery mildew spores. Field tests have been carried out, according to the results of these studies, it is possible to use phosphorus fungicides in agriculture to protect against plant diseases. Competitive advantages: Non-toxicity, simple technology of preparation, low self-cost, high efficiency to plant diseases

Two disadvantaged zones for contagious animal diseases were selected (Kakheti and Kvemo Kartli). Clinical examinations of cattle and small cattle were carried out in several villages of both zones (cattle 1809, sheep and goats - 507, dogs - 18). At the same time, the study of the quality of biting and tick bite of cattle began. Determination of the distribution area of parasites, taking into account climatic and geographical conditions. A morphological study of ticks was carried out in order to determine their species. The study of the biology of parasitic mites of the Ixodidae family makes it possible to correctly determine the measures to combat them. Therefore, parasitic mites (3132 individuals, 2460 adults, 315 pupae, 357 nymphs) were collected both from animal skins and from cattle stalls (18 stalls), their environs and pastures. 9 species of parasitic mites (Haem punctata, Haem suleata, Haem otophila, H. morginatum, H. anatolicum, B. calcaratus, Rh. sanguinolus, Rh. bursa, I. ricinus) from 5 genera (Hoemaphsolis, Hyalomma, Ixodidae, Rhipicephalus, Boophilis) have been identified. It was very important to study the effect of the acaricidal preparation "Agiometrin" developed by us on ticks and its distribution in tissues, organs and milk of animals, 3, 24 and 72 hours after cantamination animal skin with preparation. According to the results of the study, the accumulation of the drug in the tissues and organs of the studied animals does not occur. No traces of preparations were found in milk. The exception was the hairline of the skin, where the amount of cypermethrin residue was 0.004±0.001 mg/kg. These data are very important for us, since it has been proven that the drug, on the skin, retains its acaricidal effect on ticks for a long time.

Hematological studies conducted on rabbits showed that the activity of cholinesterase in the blood decreased slightly (by 12-18%) 3 hours after contamination of the skin of rabbits with the Agiometrin preparation. There is a slight decrease in hemoglobin, a decrease in the number of erythrocytes and leukocytes. These indicators return to the original norm 72 hours after exposure to the drug on the skin, without any intoxication of the experimental animals. The conducted studies showed that all developed forms of anti-tick preparations (powder, lilyumant, emulsion) are characterized by an acute acaricidal effect, well-fed female ticks of the Ixodidae family died 5-7 days after exposure to the drug, hungry adults, nymphs and pupae after 42-48 hours, and in well-fed and hungry individuals, convulsive seizures began 10-20 minutes after cantamination.

1.The technology was developed for production of polymerized carbamide of linear structure. It is established that polymerization should be carried out at temperatures of 65- 1000C, with a molar ratio of urea and aldehyde component 1: 1.1-1.3. - The optimal mode of coating compositions consisting of structured urea and trace elements is established. - The influence of various factors on the formation of dragees has been studied: pressure, exposure, mass, composition of compositions. 2. The optimal concentration of the fixative - molasses for draining has been established. 3. A technology has been developed to produce a multicomponent fertilizer based on a melt consisting of structured carbamide and potassium fertilizer and unmodified natural phosphate (apatite). 4. The optimal mode of draining a mixture of grain and a composition consisting of structured carbamide and trace elements has been established. 5. The optimal mode of draining a mixture of grain and a composition consisting of structured carbamide and trace elements has been established. 6. A technology has been developed for the production of multicomponent exchange fertilizers of prolonged action containing natural tri-substituted calcium phosphate, potassium sulfate, structured carbamide and trace elements. 7. The optimal mode of draining the composition is set. 8. Research work on the development of technology for obtaining a drained composition based on nitrogen fertilizer of prolonged action by compression pressing has been completed. 9. A site has been processed and prepared for field testing, for studying the phenological phase of plant development, using an exchange multicomponent fertilizer of prolonged action. 10. For the first time, the structuring of carbamide in the melt was carried out. 11. The process of interaction of carbamide and aldehyde component in the melt has been studied and the regularities of this interaction have been studied. 12. The regularities of the reaction of the formation of

New types of long-acting universal fertilizers containing nitrogen, phosphorus and potassium (NPK) have been obtained. Technologies have been developed for the production of graded encapsulated compositions of seed material of the main grain crops (wheat, barley, rye, triticale) based on natural sorbents of cellulose and structured carbamide. Based on the action of enzymes present in the soil and the metabolic reactions occurring there, they gradually pass into solution and provide good nutrition of seeds in accordance with the growing season and, thus, protect the environment from pollution. 1. Obtained: a)- structured carbamide; b)-structured carbamide and potassium; c) - structured compounds containing carbamide, potassium and phosphorus. The technology of obtaining a 2-component fertilizer consisting of structured nitrogen and potassium fertilizers has been developed. Structuring of nitrogen fertilizer-carbamide was carried out at 135 and 155°C in the alloy. To obtain fertilizer composites containing potassium and nitrogen, the process is carried out by heating carbamide and potassium salt. Upon completion of the structuring process, a homogeneous alloy is formed, which contains structured urea with potassium salt dissolved in it. Optimal conditions were established and drained compositions of wheat seed material were prepared, which contain structured carbamide, provided for by agrotechnics full and half norms. A dragee was also made from the resulting alloy, which was tested in laboratory conditions. To obtain a complex fertilizer, a prototype of natural apatite - calcium phosphate was synthesized in the laboratory. Under the action of enzymes, the structured urea is transformed /transformed/, during which the formation of ammonium salts occurs. As a result of the action of the ammonium group and the released potassium during the exchange reactions, the potassium and ammonium groups are replaced in the phosphate and converted into a soluble state. This process proceeds by a prolonged mechanism. Zeolite substituted with ammonium and potassium was also used, which is also involved in exchange reactions with phosphate. The multicomponent fertilizer containing NPK was made in the form of a dragee, which was introduced into the soil together with the grain. The mass of fertilizers necessary for grain nutrition is 3-4 times higher than the mass of the grain itself, so it was considered advisable to introduce them into the soil simultaneously, but separately.

The technological process has been developed to obtain water soluble iron, calcium and magnesium hydrophosphates and new generation fungicide has been synthesized. Published 2 scientific articles in local publishing houses

The instructions for the use of the anti-tick drug "Agiometrin", which was developed within the framework of the grant, were reviewed and approved by the Veterinary Medical Scientific Council of the Agrarian University of Georgia. On the basis of an application prepared on the basis of the results of a study conducted within the framework of a grant, the National Intellectual Property Center of Georgia - "SAKPATENT" issued a patent for the invention R.5346 "Concentrate of oil-water emulsion of acaricidal action".

<p>Assessment of Effect ASSESSMENT OF EFFECT OF FORMER MILITARY BASES OF AKHALKALAKI AND AKHALTSIKHE REGION ON THE ENVIRONMENT, NEUTRALIZATION OF HAZARDOUS WASTES AND REHABILITATION OF POLLUTED TERRITORIES AS A FACTOR OF ECOLOGICAL-SOCIAL STABILITY</p>	<p>OSCE</p>	<p>150 000 EUR</p>	<p>2003-2005</p>	<p>Avtandil Dolidze</p>	<p>Zghenti Mikheil, Lomtadze Omar, Mikadze Irma, Tsitsagi Mzia, Zarkia Nino, Ebralidze Ketevan, Chedia Roin, Kvatskhava Giorgi, Tsintskaladze Giorgi, Dolidze Liparit, Barbakadze Natia, Tserodze Nana, Buzariashvili Manana, Karkashadze Nino</p> <p>Within the framework of the project, the rehabilitation of the contaminated territories of the former Soviet military bases in the Akhalkalaki-Akhalsikhe region and the removal of hazardous wastes from the territories of the military bases (10 bases), their processing and rehabilitation of contaminated soils were carried out.</p>	<p>By the order of the international organizations, works in the field of conversion of hazardous wastes "Melanj" and "Samine" left on the territories of former military bases after the withdrawal of Soviet troops and rehabilitation of contaminated soils were conducted. In the theoretical part the literature review of contemporary state of the problem has been done. It is shown that prospective trend is considered the creation and production of light composite materials with boron and carbon additives. On the basis of theoretical investigation the possibility of using zeolite (clinoptilolite with high content of calcium) as sorbent of radioactive isotopes Cs+ and Sr++ is shown. The zeolites can be also used as natural additives in polymer boron containing compositions for the absorption of helium isolated during the decay of nucleus of boron atom by the reaction 10B(n, α)7Li. Physico-mechanical properties of natural sorbent – diatomite have been studied and its chemical composition in oxide form has been established. Using mas-spectroscopic study it is established that at heating up to 2500C as low molecular product only water is extracted, an organic part does not undergo a change. More profound changes take place during chemical modification of diatomite. Considerable decrease of metals content is observed and SiO2 content increases from 84% to 96.6%. Simultaneously the porosity increases from 75 to 85%. Natural sorbent – zeolite, particularly clinoptilolite has been researched. It has high thermostability, resistance to the action of corrosive media and good mechanical strength. It is distinguished with cheapness which makes it competitive as compared with synthetic molecular sieves. Spectral and X-ray structural study of hydrogen form of zeolite was conducted. There was developed technology of obtaining of polymeric composite on the base of natural thermally and chemically modified sorbents – diatomite and zeolite, boron and boron containing compounds. Composites containing 40-60 mas.% sorbent have high physico-mechanical properties at stretching and pressing. The presence of boron and its compounds also provides the formation of strong plastic material. For obtaining of polymeric composite there were used thermoplastic and thermoreactive polymers. During the synthesis of polymers the main components determining physico-mechanical and other properties of polymers are monomers – bisphenols, especially of card type. On the base of card bisphenols thermoreactive oligomers (TRO) of resol and novolac type were synthesized. As filling and neutron absorbing component there are used natural (19%10B-81%11B) boron and its compounds (for example, B and B4C) and modified natural inorganic sorbents thermally modified diatomite (TMD) and chemically modified zeolite (CMZ). Plastic composites have been obtained by sprinkling of the solution of initial components in organic solvent. The obtained composites have increased physico-mechanical properties at bending and pressing. Studies were carried out on obtaining of neutron absorbing elastic composite materials on the base of card polycarbonate (PC), polyesterole (PS), sulfochloropolyethylene (SCPE) and elastomer (EM) which consists butadiene-methylsterole rubbers. Optimal concentrations of ingredients introduced in them for capturing of neutrons were established. To determine technological parameters of explosive compacting of powders Al-B(B4C) the characteristics of a number of blasting powders (BP) have been studied. It was established that the most acceptable are BP Ammonate N6:ЖВ-NH4NO3. At the same time the upper admissible heating point of powders must not exceed 500°C. On the basis of experimental and semiempirical calculations the upper level of ampoule diameter and a thickness of compacted boron-containing powder medium: dБ30 mm was established. An experimental curve of the dependence: E/M (E – quantity of explosive material; M – mass of powder) –</p>	<p>https://link.springer.com/chapter/10.1007/1_4020_2381_2_9</p> <p>1. Some physical-mechanical and thermophysical properties of such natural, enriched and thermally modified diatomite are studied. Their chemical compositions are established. 2. Some physical properties of thermally (250 C, 2h) modified diatomite (with graininess of 50mm) were studied and their comparison with analogous parameters for natural, annealed diatomite was conducted. 3. More profound change takes place during chemical modification of diatomite. In this case the content of SiO2 increases from 84.03 % to 96.6 %. The content of harmful elements: Fe, Al, Ca, Mg etc. abruptly drops. 4. technological modes of chemical modification of zeolite are established. It is shown that acid treatment of zeolite affects its structure. The ammonium form of zeolite is thermally more stable. 5. By the use of active form of diatomite, natural boron and thermoplastic polymer the experimental samples in the form of elastic plastic in organic solvent. Technological parameters of their obtaining are determined. 6. Finally it has been established that as neutron absorbing components in polymeric composites B4C on the base of natural boron and elementary boron with different content of isotope 10B will be used. 7. The synthesis of initial bisphenols of card type and their phenyl substituted derivatives in several stages has been performed. The intermediate compounds are characterized. 8. Methyl, dichlor- and tetrachloride bisphenols with card fluorene group were synthesized. 9. The optimal conditions of bisphenol synthesis and their phenyl substituted derivatives have been determined. 10. The influence of the nature of catalyst, temperature, duration, ratio of ketone, phenol cruse on the output of the final product- bisphenol was studied. Optimal conditions of the process were established. Bisphenol yield makes 80% from theoretical. 11. The synthesis of new not described in the literature polymers on the basis of card bisphenols and chloroanhydrides of aromatic</p>
<p>No: 070/MB-PMS/05 1A 1</p>	<p>Working out of technology for obtaining of materials having solid and elastic structure and absorption ability for neutron emission source</p>	<p>International Science and Technology Center ISTC</p>	<p>01.06.2003-31.05.2006</p>	<p>Givi Papava</p>	<p>The G-762 project provides for the development of multicomponent polymer compositions for obtaining polymer materials (highly filled) after their processing, capable of absorbing both radiation sources and ..., attenuating the radiation neutron flux. The composition consists of a matrix and adsorbing components – natural sorbents (diatomites, zeolites) and boron (and boron-containing) components. Chemo-, thermo- and heat-resistant thermoplastic (such as polyarylates, polycarbonates) and thermosetting (such as phenol- and bisphenol-aldehyde) polymers were used as matrices. It is known from the literature that polymers with a high content of aromatic and polycyclic (condensed) nuclei are characterized by increased resistance to radiation. Thermoplastic polymers are used to produce elastic materials. Thermosetting polymers are used to produce rigid materials. In addition, thermosetting polymers make it possible to obtain plastic materials with high filling, which also have high physical and mechanical properties. To obtain both thermoplastic and thermosetting polymers, bisphenols containing cardel substituents such as norbornan, adamantane, fluorene, etc. were used as monomers. The use of polymers in compositions makes it possible to manufacture products of various configurations of a complex profile by processing them. They are cheap, light, do not corrode (which is very important in the case of burial of radiation sources in the ground), resistant to high temperature, chemical agents (acids, alkalis, concentrated salt solutions, etc.). Under irradiation conditions of 106 neutrons / cm2.sec practically does not collapse and retains the basic physical and mechanical characteristics.</p>	<p>By the order of the international organizations, works in the field of conversion of hazardous wastes "Melanj" and "Samine" left on the territories of former military bases after the withdrawal of Soviet troops and rehabilitation of contaminated soils were conducted. In the theoretical part the literature review of contemporary state of the problem has been done. It is shown that prospective trend is considered the creation and production of light composite materials with boron and carbon additives. On the basis of theoretical investigation the possibility of using zeolite (clinoptilolite with high content of calcium) as sorbent of radioactive isotopes Cs+ and Sr++ is shown. 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