Major research achievements of Uzbekistan Academy of Sciences during independence

Since independence, the scientists of Uzbekistan Academy of Sciences have obtained a number of important scientific results of global significance.

1. Most important results of basic research in the field of:

Astronomy

- for the first time in the history of independent Uzbekistan in October 2007, at Maidanak observatory, new minor planet number 2007 TN2 was opened in the solar system, which in 2009 was assigned the number 210 271by the Harvard Minor Planet Center, and in 2010, on proposal of the President of Uzbekistan Islam Karimov this planet was named “Samarkand”. In 1994, a rare event was registered at the observatory - falling of the comet Schumacher-Levy 9 onto the Jupiter, it being known that the localities of impact of broken comet fragments were placed on record.

Mathematics

- development of the fundamentals of the probability theory, mathematical statistics, and ordered algebras with respect to a number of topical problems of mass service, epidemiology, aerohydrodynamics, optimal control, stationary stochastic processes, quantum theory, etc.

Physics

- development of the fundamentals of the nuclear theory of heavy elements, including a three-stage nuclear fission of uranium to form magnesium isotope, optical solitons in condensed systems, ionic sputtering of surface as nanoclusters, radiation coloring of crystals, etc.

Using the concentrated solar energy, the stable superconducting materials with increased to 110 - 150 degrees of Kelvin temperature of transition to the superconducting state have been produced for the first time in the world.

For work on the development and study of the properties of advanced semiconducting materials based on solid solutions, the team of scientists from the Physical Technical Institute of the AS RUz in 2007 was awarded the State Prize of the Republic of Uzbekistan in the field of science and technology.

Chemistry

- opened a new mechanism in modern supramolecular chemistry, establishing dependence of the structure of the particular substances on the conditions of their formation. Based on the rules set out by scientists, the results obtained allow construction of new materials with predetermined properties for use in various sectors and industries.

A new research field was developed – adsorption-energy stoichiometry with the development of new concepts and producing the semiempirical and theoretical equations of isotherms and differential heats of adsorption, and energy, kinetic, molecular and structural criteria were created for the study of the mechanism of adsorption and catalytic reactions.

A 10-volume edition of the Reference Book of the unique “Natural compounds (plant resources, the structure and properties)” was prepared by the Institute of Plant Chemistry, AS RUz, and was first published by “Springer” Publishers (London) in English.

Genetics and Cotton selective breeding

- the largest scientific breakthrough in the country's cotton industry was the creation with the use of developed gene-knockout technology of the first unique transgenic cotton varieties (four new species,

series Porlock 1 - Porlock 4), which has an extensive root system, a wide range of economically useful characteristics, such as high yield, high quality and length of fiber (1-2 type), early ripening, salt tolerance, etc. A joint patent is issued (pending) to this technology in consort with the University of Texas, USA (Uzbekistan's share is 70%).

Work on development of new cotton varieties of the team of scientists-plant selection breeders from the Institute of Genetics and Plant Experimental Biology, AS RUz in 2011 was awarded State Prize of the Republic of Uzbekistan in the field of science and technology.

Pharmaceutics

- more than 30 new original domestic pharmaceuticals were produced based on local plant raw materials that possess antiviral, anti-arrhythmic, analgesic and other medicinal properties.

For the development of “Allapinin”, the original domestic antiarrhythmic pharmaceutical, the group of scientists of the Institute of Plant Chemistry of Uzbek Academy of Sciences was awarded the State Prize of the Republic of Uzbekistan in the field of science and technology in 2007.

Seismology

- a four-stage “Geophysical model of the processes of earthquake predictive modeling, based on the results of long-term monitoring observations at seismo-prognostic geodynamic polygons” was established, a map of general seismic zoning was made, and the methodology of prognostication of strong earthquakes in Uzbekistan. These studies are important in the development of Republican measures to prevent threats and reduce the impact of earthquakes in large cities and densely populated areas of Uzbekistan.

Geology

- the theoretical basis of a new direction of metallogenic statistical analysis was established, the formation and location of the deposits were substantiated for deposits of gold, copper, platinum, tungsten, rare metals, what is essential for further development of the mineral resources base in Uzbekistan.

Bioecology

- fundamental principles were developed for the study and conservation of biodiversity of flora and fauna of the Republic, including the zone of ecological disaster - the Aral Sea region, The Red Book of Uzbekistan was prepared and published in two volumes.

Archeology

- the centers of the ancient civilization were discovered in the territory of Uzbekistan (Obirakhmat Grotto), where the most ancient remains of modern man were found, that event became the “discovery of the year” which showed that in Uzbekistan the processes of formation of modern-type humans occurred, which took place in Mesopotamia, the Mediterranean area, Ancient China and other regions of the world.

History

- the fundamental monographs “History of statehood in Uzbekistan” and “History of Uzbekistan (16th - first half of the 19th century)” have been written and published for the first time in domestic science. They cover the major historical stages in the development of the Uzbek state. Prepared and published over 10 books and a number of manuals on various topics and periods of the history of Uzbekistan, which are widely used in education.

Oriental Studies

- scientific processing and systematization was accomplished and a voluminous catalog was published - the catalog of unique cultural and historical heritage of Uzbekistan, that of the Fund of ancient oriental manuscripts, which has more than 25,600 volumes and individual works. Thanks to the work of scientists

orientalists the wealth of cultural and historical heritage became known to a wide international audience.

The research work of the Institute of Oriental Studies of the Academy of Sciences of Uzbekistan, “Research on Scientific Heritage of Central Asian scientists worked in research centers in the period between the 9th and 15th centuries (by the example of the Baghdad Academy, Khorezm Academy of Mamun and Samarkand school)” in 2009 was awarded the State Prize of the Republic of Uzbekistan in the field of science and technology.

Linguistics and Literature

- more than 30 fundamental monographs were prepared and published, including the Explanatory Dictionary of Uzbek language in 5 volumes, Orthographic Dictionary Uzbek language, Brief Russian-Uzbek and Uzbek-Russian Dictionary, Concise Dictionary of Uzbek Classical Literature, Grammar and Lexicology of Uzbek language, Theory of Literature, Works of Uzbek and Karakalpak Folklore, intended for a wide range of readers. The complete set of works of Alisher Navoi, the founder of Uzbek literature, in 20 volumes was published.

Art Studies

- formation of a new paradigm of Arts of Uzbekistan independence period was explored, whose achievements were put into the context of world culture, the traditional musical heritage of Boisun - a masterpiece of intangible culture of mankind was studied, a number of new findings on issues of artistic culture of the Central Asian antiquity was made.

“The series of works on the history and cultural history of Uzbekistan and Central Asia” of the Institute of Art, AS RUz was awarded the State Prize of the Republic of Uzbekistan in the field of science and technology in 2007.

Economics

- based on the study of theoretical models of business competition and the specificities of market reforms in Uzbekistan theoretical and methodological basis was developed of the strategy of accelerated innovation development and competitiveness of the national economy, taking into account the internal capacity, and external factors.

2. Most important outcomes of applied research and innovation development projects.

Applied research of the NIU AS RUz, mainly aimed at solving topical problems of the real economy of the country, at import substitution and export-oriented high technology products:

In order to promote and integrate scientific research and innovation projects of academic, sectoral and university research institutions in Uzbekistan, Uzbek Academy of Sciences has developed and published the “Concept of the priority research areas of the Academy of Sciences for 2008-2015” (2008), which determines the prospects for the development of scientific research.

The following data illustrate most important outcomes of applied research projects commercially developed in various industries:

Enterprises of chemical industry:

- a number of new industrial technologies for high-performance home-based fertilizers on the basis of Kyzylkum phosphorites (nitrofos, granular superphosphate, nitrogen-phosphorus fertilizer); over the last 6 years (2006 to 2011), the chemical plants JSC “Samarkandkimyo”, JSC “Navoiazot” and JSC “Ferganaazot” manufactured fertilizers of over 480.0 thousand tons worth more than 130.0 billion Uzbek soums, 10% of products are exported to foreign countries (Afghanistan, Turkmenistan and Kazakhstan) in the amount of more than 5.0 million U.S. dollars;

- effective defoliants “SUPER-HMD-zh”, “UzDEF” and Polidef, which were produced over the past four years (2008 to 2011) in the amount of more than 25.0 thousand tons, worth over 45 billion Uzbek soums, over 65% of the cotton fields, subject to defoliation were treated;

Petrochemical industry:

- import substitution ceramic filtration devises, pontoons, membranes for fine cleaning of oil and gas that were introduced at the enterprises “Uzbekneftegaz” and “Uztransgaz” by the Republican program of localization.

- aviation fuel production technology for gas turbine engines of the fuel-grade “Jet A-1” of aircrafts Boeing, Airbus, RG from local hydrocarbon raw materials, first among the CIS countries, developed jointly with Bukhara refinery plant and successfully introduced into production. For the period August 2009 - September 2010 the plant produced and shipped to customers of NAC “O’zbekiston havo yo’llari” 115.98 tons of aviation fuel “Jet A-1” in total of worth 51.83 billion Uz.soums, the economic effect of the airline company from the sale made up over 11.0 billion Uzbek soums;

Materials technology:

- Domestic technology of polycrystalline silicon was developed and a pilot batch was obtained of polycrystalline silicon (OSI Investment Company (Korea) 500 thousand USD);

- the original nuclear technology and the line of radiation treatment of semi-precious stones by the orders of jeweler firms (exported goods worth more than 1 million USD). The unique technology of coloring natural stones introduced into the Tashkent enterprise “Onyx”. A pilot contract was concluded with the German company “Zimmermann BCS Stones Gmbh”, also the research was conducted for the Tashkent Open Company “Samotsvety” (“Gem”).

Mining and metallurgical industry:

- five different innovations were developed commercially at the Almalyk Mining and Metallurgical Combine, including filtration systems to treat liquid sulfuric acid waste and water purification of the “Kauldy” mine, new-type dust collectors, the technology of concentrated bacterial leaching of copper, line method of determination of osmium-187 and other components in industrial products.

Pharmaceutical industry:

- highly effective technologies were developed for the industrial production of 15 new pharmaceuticals (Ecdysten, Ayustan, Rutan, Gossitan, Getasan, Punitan and others.)

- domestic technologies developed commercially to produce more than 30 kinds of new domestic pharmaceuticals being sold through pharmacies.

Agricultural sector:

- a number of new high-efficiency cotton varieties (zoned varieties “Mehnat”, “Beshkahramon”, “AN-16”, as well as advanced varieties “Kupaysin”, “Gulbahor-2”, “UzFA-703”, “Ishonch”, “Nasar” “Hamkor” “Kelajak”, “Navbahor-2”, “Genetics-1”, etc.) that are applicable for growing in different climatic zones;

- seeds of cotton worth more than $ 2.1 bln Uzbek soums were produced and sold to farmsteads in 2006-2010;

- plant growth stimulants, biotechnological methods of plant pest management, including cotton bollworm pheromone traps in the total of worth 1.5 bln Uzbek soums, which were delivered to the farms for destruction of cotton bollworms and turnip moths in the fields, and others;

- high-efficiency cellular biotechnology for cultivation of seed potatoes, which received practical approval in farms of Tashkent and Kashkadarya provinces and yielded over 300 tons of seed potatoes.

Food, construction and textile industries and production of detergents

- technology of production of carboxymethyl cellulose (CMC) technically purified from cotton cellulose, which is implemented at LLC “Karbonam” (production of 1.5-2.0 thousand tons per year) and Ferghana HZFS (800 tons per year) for the needs of NHC “Uzbekneftegaz”.

3. Exports of scientific output of scientific institutions AS RUz

Over the past 7 years, export of scientific production of UzAS scientific institutions was increased in 2.1 times.

Thus, the eight items of biological substances and pharmaceuticals, produced by the UzAS Institute of Plant Chemistry were exported in the amount for more than 7.6 million USD.

On the basis of the nuclear reactor and cyclotron of the UzAS Institute of Nuclear Physics launched production of several radionuclides, the volume of export deliveries from 2006 to 2012 made up over 16.5 million USD.

New technology was developed for the jewelry industry - technology of radiation coloring the natural crystals of colorless topaz and pale beryl when irradiated with gamma rays and neutrons, a number of foreign contracts were concluded for these products, export deliveries of which exceeded 1.0 million USD.

Two international scientific journals issued by Uzbekistan Academy of Sciences are published in translation into English – “Applied Solar Energy” and “Chemistry of Natural Compounds”, which are published abroad and distributed by subscription, thereby also provided foreign currency earnings.