**CHEMICAL SENSOR FOR MEASURING TETRAFLUOROBORATE IONS ACTIVITY IN SOLUTION**

**Purpose**

A device for tetrafluoroborate potentiometric determination in solution.

**Application**

The chemical sensor can be used at factory-, research-, and chemical analytical laboratories dealing with environment protection, as well as in food industry, technology, and medicine.

**Description**

Tetrafluoroborate ion formed on acid fluoride solutions interaction with boron-containing materials is one of the important analytical forms of boron. Tetrafluoroborate anion is common in galvanic industry technologies and organic and inorganic synthetic preparations. The nature of electrode-active compounds is the essential factor determining basic metrological properties of the sensor. The object of the invention is the development of a tetrafluoroborate-selective chemical sensor superior to the analogs in selectivity and other analytical and metrological characteristics.

In order to fabricate the chemical sensor, an electrode-active compound, the ionic associate of 2-(N-ethylcarbazole-3-yl)-ethynyl-1,3,3-trimethyl-3Н-indolium tetrafluoroborate (ECTI), a plasticizer, and a polymer material were used in the following proportion: ECTI 0.5-8 %, plasticizer 44-77 %, and the polymer material up to 100 %.

Test models of the chemical sensors are developed and introduced into practice in the chemical analytical laboratory of Ukrprofzdravnitsa JSC. The sensor is used for boron determination in mineral and hydrothermal water of trans-Carpathian region.

**Advantages**

The chemical sensor exceeds the analogs in performance parameters: it is suitable for tetrafluoroborate ions activity determination in strongly acidic solutions (up to 6 M H2SO4) and in the presence of many other foreign substances; longer service life and shorter response time, as compared to those of the analogs, are the advantages of the sensor as well.

A Ukrainian patent is obtained.

*Food industry*

**NEW PREPARATION FOR WINE PRODUCT STABILIZATION**

**Purpose**

Wine product stabilization for wine quality improvement and stability period prolongation.

**Application**

Wine-making.

**Description**

Main cause of wine materials colloidal opacification is the existence of a labile fraction of wine biopolymers and their complexes. To avoid the opacity, auxiliary materials are often used (gelatin, bentonite, colloidal solution of silica), whose efficiency depends on functional properties determined by the structure, composition, or functional groups availability. Enogelatin, a gelatin-based preparation for wine-making, is created; the regimes and parameters of its production are developed (patent of Ukraine). The preparation possesses improved properties due to 1.5 to 2-fold increase in functional groups content, as compared to that in edible gelatin under GOST 11293 standard. This provided the possibility of interaction with wine tannins and processing efficiency enhancement, reduction of the amounts of the preparation, mineral sorbents used for wine material processing, and the volume of the precipitate formed (on an average by 21 %) and to ensure long-term stability of wine material. The developed technology is introduced into production. The preparation is produced as a dry powder, which is instantly soluble in cold water without preliminary preparation (swelling) or a solution ready for immediate use in wine making. A process message (TI V 00418030-14-2011) and technical specification (TU U 24.6-00418030-006 2001) are developed and approved, sanitary-hygienic examination has been conducted and an affirmative decision is obtained.

Technology is developed of Enogelatin use in wine-making for white-, red table- and -fortified-, as well as sparkling wine materials processing. Full-scale approbation and introduction are realized in Massandra JSC and Odessavinprom JSC wine-making enterprises. Enogelatin is used in compliance with the process message TI 00011050-1272-2011 approved by the Ministry of Agrarian Policy and Food of Ukraine. A patent of Ukraine is obtained.

*Microbiology*

**BIO-FUNCTIONALIZED FLUORESCENT NANOPARTICLES
FOR PATHOLOGIC CELLS DETECTION**

**Purpose**

Development of bio-functionalized fluorescent and luminescent nanoparticles is of great importance thanks to their potential use as biosensors for molecular diagnostics.

**Application**

Detection systems in medical diagnostics; *in vivo* detection; scientific studies.

**Description**

Luminescent nanoparticles are developed that contain a rare-earth element providing for green or red florescence, depending on the wavelength of absorbed wave and polystyrene nanoparticles containing up to 0.5 % fluorescein in the core, these ensuring bright green fluorescence. Nanoparticles of the both types are covered with a polymer carbon chain of functional surface-active peroxides bearing reactive epoxide groups necessary for fluorescent core isolation and ensuring specific proteins binding to the surface of nanoparticles. The authors obtained nanoparticle conjugates with lectins capable of selective detection of cells dying by apoptosis or necrosis. These nanoparticles efficiently revealed the apoptotic and necrotic cells and provided bright and stable signal.

**Advantages**

Organic dyes used for biolabeling are commercially available and ensure high quantum yields, but they have also the shortcomings: broad spectral bands, short fluorescence life and quick decay. Unlike the dyes, nanoparticles containing rare-earth elements and covered with neutral medium for toxic reactions elimination possess narrow emission bands in the red and infrared ranges, which is perfect for multichannel determination *in vivo*, large Stokes shift in florescence spectra, and long fluorescence lifetime. The innovations resulted from the use of the nanoparticles are brightness and low decay of nanoparticles fluorescence; the nanoparticles can easily be used for the most part of fluorescent microscopy and flow cytometry techniques; simultaneous emission in 2 or more channels; diversity of scales and bands of fluorescence; high specificity of lectin-nanoparticle conjugates toward dying cells; the possibility of various biospecific molecules binding to nanoparticle surface; high quantum yield and photostability. One patent of Ukraine and three patents of other countries are obtained.

*Medicine*

**METHOD FOR *HELICOBACTER* ASSOCIATED
HEPATOGENOUS STOMACH ULCER TREATMENT**

**Purpose**

Gastroenterology and treatment of *Helicobacter*-associated hepatogenic stomach ulcers.

**Application**

The invention can be used in any gastroenterological medioprophilactic institution, as well as for scientific studies.

**Description**

Method of *Helicobacter*-associated hepatogenic stomach ulcer treatment comprises complete clinico-instrumental examination and anti-*Helicobacter* pharmacotherapy of patients. Anti-*Helicobacter* therapy includes administration of Clarithromycin, Amoxicillin and Pantoprazole for 7 days, lactulose (Duphalac) twice daily, and an ursodeoxycholic acid preparation, in particular Ursochol, for 5 to 6 weeks.

**Advantages**

In Ukraine, the method developed is superior to the prototypes in a number of aspects, namely, it is clinically effective, promotes full healing of ulcers and *Helicobacter* infection eradication, is comparatively inexpensive, prolongs periods of remission of basic disease, fit for long-term use, eliminates side effects of drugs and ameliorates quality of life in patients. As compared to the foreign analogs, the invented method is more effective at clinical use, due to better healing of ulcerous defects and more complete *Helicobacter* pylori eradication, ensures prompt remission of underlying disease and prolongs the remission period, ensures prevention of complications of this type of lesions and improvement of the quality of life in patients.

A patent of Ukraine is granted.

*Medicine*

**METHOD FOR LOWER EXTREMITIES TISSUE ISCHEMIA MANAGEMENT**

**Purpose**

Comprehensive treatment of lower extremity tissue ischemia of various geneses (against the background of atherosclerosis, endarteritis, or ischemic form of diabetic foot syndrome).

**Application**

Ministry of Health of Ukraine, medical institutions (therapeutic, surgical and trauma departments).

**Description**

The developed treatment method includes: 1). a technique of access to the bottom of the peritoneal artery and it catheterization, reliable fixation and removal of the catheter, twenty-four-hour administration of antibacterial and vascular drugs through the catheter via infusion pumps at a speed of 10-15 ml/h for 20-25 days with a parallel course of arterial blood irradiation through the catheterized lower part of the peritoneal artery with low-energy laser radiation of red spectrum (wavelength 632.8 nm, power 5 MW, exposure 20-25 min), infrared spectrum (wavelength 850 nm, power 5 MW, exposure 20-25 min), and incoherent ultraviolet radiation (wavelength 270-320 nm, power 5-8 mW, exposure 20-25 min) via a monofiber polymer or quartz-polymer light guide 0.4-0.6 mm in diameter with the length of 30-40 cm adapted to the specific catheter; 2) a technique of tibia splitting (under spinal anesthesia, the tibia is accessed mechanically and split with a chisel, partially separated bone fragment is fixed with Ilizarov frame, and the distance between the bone and the separated fragment is subsequently increased, which stimulates collateral circulation formation in the soft tissue via the vessels of the bone) after 3 or 4 days of the above therapeutic manipulation.

**Advantages**

Patent search did not yield any technical solutions with similar features. A patent of Ukraine is granted.

*Medicine*

**METHOD OF LATE GESTOSIS DIAGNOSIS VERIFICATION**

**Purpose**

New competitive method for timely diagnosis of late gestosis severity and method of differential diagnosis of hypertensive conditions in pregnant women.

**Application**

The offered method of late gestosis diagnosis verification can be used in antenatal clinics and maternity hospitals.

**Description**

In obstetric practice, general examination of pregnant women is used for late gestosis diagnosis. However, the conclusions based thereon are not always unambiguous, since it is based on nonspecific symptoms of late gestosis and requires a comprehensive assessment. The aim of the useful model is to reveal the late gestosis specific features in the photoluminescence spectra of blood serum and urine of pregnant women in order to verify the diagnosis. The problem is solved by development of a late gestosis diagnosing procedure, which includes general examination of a pregnant woman with additional analysis of photoluminescence spectra of her blood serum and urine. The diagnosis is then verified based on the photoluminescence spectra peculiarities.

The method is introduced into the clinical practice of the City Perinatal Center of Uzhgorod.

***Advantages***

The method ensures more objective assessment of the hypertensive state in pregnant women. A patent of Ukraine is obtained.

*Power Engineering*

**GELIO-HEATER FOR FLUIDS**

**Purpose**

Improvement of gelio-heater efficiency by maximum utilization of the energy of solar radiation.

**Application**

Farming industry, processing industry, and other branches of industry.

**Description**

Solar fluid heater is developed with a housing with light-transparent coating, parallel tubes with absorbing surface located inside the housing, and reflectors optically bound to the tubes and the housing. Thanks to the fact that the cross-section of the tubes is drop-shaped, a light-absorbing carrier flows inside the tubes, and the reflectors have a parabolic surface with the parameters similar to those of the tube section’s greater diameter and focus coinciding with the center of the diameter, the solar energy directed by the reflector surface is utilized to the most extent via the tubes.

*Physics of metals*

**METHOD FOR TOOL PLATE METALLOTHERMIC WELDING TO THE TOOL BASE**

**Purpose**

Tool blanks production by welding and casting using metallothermic mixture. The method can be used for urgent tool blanks (for example, cutters) manufacture and for tool materials thermite deposit welding onto blank surface in maintenance shops.

**Application**

Tool production (metal-cutting tools production), repair works (recovery of highly rigid and directional elements of machines and equipment) etc.

**Description**

The method includes metallothermic reaction of a liquid alloy formation as a result of burning of thermite mixture with alumina powder. Tungsten oxide powder is additionally used at the metallothermic reaction conduction, and a master alloy (ferromanganese, ferrosilicium, ferromolybdenum, ferrochromium, and cobalt) is added to the liquid alloy for tool plate metallothermic welding to the tool base.

The developed method and technique ensure high-speed steel efficient production in repair- and maintenance shops and in conditions of other types of production, where the common alloy melting methods cannot be used; the opportunity emerges of items and blanks surfacing with high-speed-steel alloys.

**Development stage**

The invention is in the process of using the experimental design; technologic preparations for the invention introduction into mass production will take 1 year.

**Advantages**

The method of synthesis is completely independent on either expensive equipment, or major power sources; the features of the whole process are its high speed and productiveness (burning time of the mixture is 20 to 30 seconds.), which opens up the possibilities for the thermite high-speed steels use for tools surfacing. No foreign analogs are available to the composition of the mixture for high-alloy high-speed instrumental steels metallothermic synthesis. A patent of Ukraine is obtained.

*Metallurgy*

**HEATPROOF CORROSION-RESISTANT STEEL**

**Purpose**

Commercial and industrial food equipment, home appliances and consumer commodities production.

**Application**

Instrument engineering, automobile production etc.

**Description**

Heatproof corrosion-resistant steel contains (mass %): carbon 0.02-0.12, nitrogen 0.01-0.10, manganese 5.0-10.5, chromium 16.0-19.0, nickel 2.0-3.8, silicon 0.04-0.8, aluminum 0.02-0.15, copper 0.1-0.45, rare-earth metals from the group of cerium, lanthanum, praseodymium and neodymium 0.001-0.01, molybdenum 0.2-0.6, niobium 0.1-0.4, barium − less than 0.001, and iron up to 100 %.

**Advantages**

Increased high-temperature strength, corrosion resistance in aggressive media at high temperature, and much lower production costs, as compared to the closest analogs. A patent of Ukraine is obtained.