acceleration voltage, voltage on the additional electrode and the residual pressure in the discharge gap. Therefore, taking into account the small time constant for electrical method of beam current control, such guns are very promising to application in modern electron-beam technological equipment. Creating of novel up-to-date technologies with using high-effective and cheap triode GDEG is also possible.

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АНАЛІТИЧНІ СПІВВІДНОШЕННЯ ДЛЯ РОЗРАХУНКУ ЕНЕРГЕТИЧНОЇ ЕФЕКТИВНОСТІ ТРІОДНИХ ГАЗОРОЗРЯДНИХ ЕЛЕКТРОННИХ ГАРМАТ

Отримані та представлені у даній статті залажності енергетичної ефективності тріодних електронних гармат високоволтного тліючого розряду від прискорювальної напруги, тиску залишкового газу у разрядному проміжку, та від напруги на керувальному електроді. Запропонована математична модель зформована шляхом аналітичного розв'язування алгебраичніх рівняннь, отриманих як результат аналізу рівняння балансу іонів в анодній плазмі та рівняння самоузгодження розряду. Отримані результати показали, цо енергетична ефективність тріодних газорозрядних електронних гармат лежить в діапазоні 80–90%, тому такі гармати можуть успішно використовуватися у сучасних електронно-променевих технологіях.

Ключові слова: *електронна гармата, електронно-променеві технології, високовольтній тліючий розряд, анодна плазма.*

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АНАЛИТИЧЕСКИЕ СООТНОШЕНИЯ ДЛЯ РАСЧЕТА ЭНЕРГЕТИЧЕСКОЙ ЭФФЕКТИВНОСТИ ТРИОДНЫХ ГАЗОРАЗРЯДНИХ ЭЛЕКТРОННЫХ ПУШЕК

Получены и представлены в данной статье зависимости энергетической эфффективности триодных электронных пушек высоковольтного тлеющего разряда от ускоряющего напряжения, остаточного давления в разрядном промежутке и от напряжения на управляющем электроде. Предложенная математическая модель получена путём аналитического решения алгебраических уравнений, полученных в результате анализа уравнения баланса ионов в анодной плазме и уравнения самосогласованости горения разряда. Полученные результаты показали, что энергетическая эффективность триодных газоразрядных электронных пушек лежит в диапазоне 80–90%, поэтому такие пушки могут успешно использоваться в современных электронно-лучевых технологиях.

Ключевые слова: *электронная пушка, електронно-лучевые технологии, высоковольтный тлеющий разряд, анодная плазма.*

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MAIN PROBLEMS OF ANTICANCER DRUGS' MODIFICATION

Limit capabilities and low efficiency in the treatment of locally advanced and disseminated forms of cancer shows that anticancer drugs are need to be modified. This modification needs solving some special tasks. So there was created the program of their realization. There are main tasks and results, shared at this moment, shown in this article.

Keywords: *cancer, oncodrugs, modification, radiation, bubstones.*

The experience of anticancer chemotherapy has shown limit capabilities and low efficiency in the treatment of locally advanced and disseminated forms of cancer. One of the most actual problem of modern pharmacology and oncology practice is an identification of new biologically active materials, studding of their physical-chemical and

therapeutic properties and creation of effective and low-toxic anticancer drugs [1, 2, 3]. Establishing of the relationship between the physical and medical - biological properties of anticancer drugs is important. The modification of the anticancer agents pharmacological properties direct to increasing of an efficiency and reduction of toxicity.

There is a basic tendency to individualization of cancer treatment since human body is unique.

Modern domestic practical oncology [1, 2, 3] makes it possible to determine the molecular profile of the tumor cells of each patient. As a result the individual and antitumor therapy must to be treated. And it is in contravention of medical standards.

According to current medical standards medical treatment of cancer patients provids by specific cycles of chemotherapy. It is extremely toxic and not all patients need of written standard treatment. It is know that individual sensitivity to therapeutic agents varying in 10–40 times [3], which requires consideration of this factor in determining of the optimal treatment scenario. A formation of drug resistance is another extremely serious problem for treatment.

Almost 80% of patients were sensitive to the intensive anticancer chemotherapy 40 years ago. Nowadays 40% of primary cancer patients are sensitive to chemotherapy and they lost one after 3–4 courses. Therefore, the creation and modification of new anticancer drugs is one of the most relevant in the modern oncology.

The absence of selectivity of drugs activity and their general toxicity stipulate to improve the efficiency, selectivity and safety. Also the modern methods of radiation medicine and nanophysics can involve the synergetic mechanisms of oncodrugs anticancer action. In most cases, for creation such nanocomposites components with properties of which are known in pharmacocorrection or in direct cytostatic action have used. Onrush development of molecular biology and chemistry provides rapid utilization of de novo synthesized drugs. Plants still are traditional and rich sources of pharmacologically active substances. Thus, almost half of modern drugs was derived from plant extract [4, 5].

Several plant-derived compounds have been approved as anticancer drugs: vinblastine, vincristine, etoposide, teniposide, taxol, taxotere, topotecan and irinotecan, just to name a few. The main bioactive agents of plants used in medicine for the treatment of malignant tumors are alkaloids.

The last exhibits pronounced cytostatic effect at the tumor cells. The crucial issue is the selection of the optimal nanostructured modifier [1–5]. Modification of the medical drug molecules by surface-active nanoparticles has a great theoretical and practical importance. It allows receiving active drugs with fixed size molecules and achieving biocompatibility with the human organism cells [2]. The selection of the modifying nanoimpurities essentially depends on the reason of the drug therapeutic action improvement. This can occur due to 1) the transfer of drug molecules in conformational state with increased activity, 2) the complex formation of the molecule drugs and molecule (nanoparticle) of modifying substances, 3) increasing sensitivity of patient injured points to drugs under modifying agents. In the last case the binary drugs with targeted action are created. The first two ways are the most relevant at this stage because their implementation is possible without detailed information about the specific biological mechanisms of drugs action.

In above cases, the lifetime of molecule drugs in newly formed states needs exceed the time of their therapeutic action. The following factors at choosing of modifying nanoparticles should be taken into account [2, 6]. The properties of nanoparticles depend on their size (size effect). For nanoparticles the percentage of surface atoms increases as the particle size decreases and it leads to variation of chemical, physical, chemical, biological, pharmacological properties. The nanoparticles properties are determined by their surface tension and energy. These characteristics influence on another thermodynamic nanoparticles parameters. In nanoparticles can realize phases that do not exist in macroparticles. As the particle size decreases the specific surface energy increases.

One of the factors, which cause the modification of the nanoparticles thermodynamic properties are the boundaries change of the phonon frequency distribution function.

This leads to increase of the nanoparticles specific heat could be 10–15 times higher than for macro dimensional ones. The optical properties (frequency dependence of the absorption and reflection) of nanoparticles are significantly different. The propagation of light is likely to have the band character. Another important feature of nanoparticles is a strong dependence of their characteristics on the medium parameters. This property is cause by the relative number of surface atoms in nanoparticles. An alternative possibility to use doping medicines (or solutions) by nanoparticles is the use of high-energy radiation. The last one transfer molecule drugs in the metastable state, following which its conversion to a state of increased medical capacity [7]. Thereby, the modification of anticancer drugs needs solving the following tasks.

1. The creation of physical – health picture of oncodrugs, the studying of connection between the physical and pharmacological properties of drugs, development of methods of physical identification for their therapeutic suitableness.

2. Examination of mechanisms of radiation and impurity modification of electronic, optical and therapeutic properties of biomolecules, nanostructures and their composites for drugs creation with low toxicity and high efficiency with respect to resistant tumors.

3. Determination of ways formation, properties and patterns of relationship of radiation defects (including bubblestones [6]) long life clusterization in biologically compatible liquid media.

4. Investigation of the double charged electrical layers formation surrounded by radiation-induced defects in liquid media with the specified structure of electric charge distribution.

5. The influence determination of electric surrounding of nanoparticles on their thermodynamic properties and stability nanocomposites conditions for their participation.

6. The ways identification of reconstruction structuring conformational state of the molecule oncology medicines under the influence of radiation induced defects in solvent.

7. Preparation of templates based on ordered nanostructures to enhance the efficiency and sensitization of oncology medicines.

The program realization was started within the range of budget subject at the Physics of functional materials department of Physics faculty of Kiev National Taras Shevchenko University at collaboration with R.E Kavetsky Institute of Experimental Pathology, Oncology and Radiology, Physics, F. D. Ovcharenko Institute of Biocolloidal Chemistry of National Academy of Science of Ukraine and National Cancer Institute at 2012. The main results are:

1. The calculus of approximations for range control conformational changes of polymer organic and biomolecules by using radiation and impurity modification were developed.

2. Methods of given conformational state realization of photosensitive organic biomolecules were created.

3. Physical mechanisms of the impurities effect of carbon nanostructures on pharmacological and biophysical properties of oncodrugs in order to develop methods for the modification of their medical properties were investigated.

4. The enhancement of the therapeutic effect of certain drugs at doping alkaloid in the presence of water-soluble fullerenes was registered.

5. The methods of template modification of physical-chemical and medical–biological parameters were proposed.

6. The influence of surface electric charge on the surface tension of some polymeric liquids was determined. The conditions of surface instability were established.

7. Based on the case study the perspective using of polysaccharides, doxorubicin alkaloids and some compounds of stilbene series for the creation of an effective anticancer drugs was proven.

These results show potential implementation of the above program.

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ОСНОВНІ ПРОБЛЕМИ МОДИФІКАЦІЇ ПРОТИРАКОВИХ ПРЕПАРАТІВ

Обмежені можливості та низька ефективність у лікуванні місцево поширених та дисимінованих форм раку показує, що протиракові препарати потребують модифікації. Цей процес вимагає від лікарів та медичних фізиків вирішення деяких особливих задач. Тому було створено і запроваджено програму реалізації їх розв'язку. В цій статті представлено основні її завдання та результати отримані на даний момент.

Ключові слова: *рак, онкопрепарати, модифікація, радіація, бабстони.*

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ОСНОВНЫЕ ПРОБЛЕМЫ МОДИФИКАЦИИ ПРОТИВОРАКОВЫХ ПРЕПАРАТОВ

Ограниченые возможности и низкая эффективность в лечении местных и дисиминированных форм рака показывает, что противораковые препараты нуждаються в модификации. Этот процес требует от врачей и медицинских физиков разрешения некоторых специальных задач. Для этого была разработана програма реализации их решения. В этой статье представлены ее основные задания и результаты, полученые на сегодняшний день.

Ключевые слова: *рак, онкопрепараты, модификация, радиация, бабстоны.*

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PASSIVE FERRITE RESONATOR-BASED MILLIMETER WAVE BAND COMPONENTS

The review of magnetodynamic resonances in ferrite resonators and their mm-wave band applications was given. Ferrite resonator eigenexcitations classification has been presented. The analytical theory for modes resonant frequencies calculations is stated and a number of prototype electronically tunable mm-wave devices, utilizing the "above" and "below FMR" magnetodynamic resonances, including isolator, phase shifter, band-pass and band-stop filters have been demonstrated.

Keywords: *magnetodynamic modes; mm-wave devices; barium hexaferrite; nickel ferite; yttrium-iron garnet.*

Introduction. The mm-wave band of the electro-magnetic spectrum is of particular importance for applications related to security systems, radars, radio astronomy, and satellite communication [14]. There is a need for device components such as isolators and phase shifters, and others for signal-processing devices working at these frequencies. Such low-loss components can be constructed using ferrites. Since ferrites are magnetic dielectrics, eigenoscillations of ferrite resonators, in general case, belong to magnetodynamic type. Magnetic nature of ferrites influences such oscillations most prominently in resonance region near ferromagnetic resonance (FMR) frequency, where dipole-exchange spin oscillations and waves can exist. Most known oscillations of such kind are the Walker modes. Their main peculiarities are wide-range magnetic field tuning of frequency and fast spatial variations of rf-fields, which, in turn, makes retardation effects insignificant and allows miniaturizing resonator dimensions, which can be important for low-power microwave microelectronics. Theoretical analysis of Walker modes, at frequencies well below that of ferrite resonator main electromagnetic mode (assuming resonator is nonmagnetic dielectric), can be done in magnetostatic approximation.

Meanwhile, in such wide spread ferrite devices like circulators and isolators, ferrite resonator operates at frequencies far from FMR and its magnetic properties influence magnetodynamic modes [1, 3] due to, basically, Faraday effect. Such resonators have much larger dimensions, although can operate at higher power. A lot of research on ferrites resonators, mostly fabricated from