Materials of Conferences

HEALTH EFFECTS OF MICROWAVE RADIATION

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Electromagnetic waves come in a very wide range of wavelengths: there are radio, microwave, infrared (heat), visible light, ultraviolet, X-ray, and gamma-ray waves. All are used in medicine in one way or another. Microwave radiation is used in certain kinds of heat treatment, where the heat is generated in the target tissue (as in a microwave oven). Microwaves are a form of electromagnetic radiation with wavelengths ranging from one meter to one millimeter; with frequencies between 300 MHz (100 cm) and 300 GHz (0,1 cm). They are classified as non-ionizing radiation – radiation which can change the position of atoms but it is not strong enough to alter their structure, composition, or properties.

At the present time, there is substantial scientific fact that establishes negative health effects associated with the direct exposure to microwave radiation. Microwave radiation penetrates the body, the exposed molecules move about and collide with one another causing friction and, thus, heat. This is known as the thermal effect. If the radiation is powerful enough, the tissue or skin will be heated or burned. The scientific literature indicates a relationship between exposure to microwave radiation and birth defects, such as mongolism (Down's Syndrome) and central nervous system damage. It has been demonstrated that microwave radiation may cause eye and testicular damage due to their high vulnerability to radiation damage because they contain few blood vessels. As for the effects on the eye, several scientific investigations have shown that cataracts among humans and laboratory animals have occurred as a result of the intense heating of high frequency microwave radiation.

As noted, microwave radiation may also cause damage to the male testes/reproductive organs. Specifically, scientists have demonstrated that exposure to microwave radiation may result in partial or permanent sterility. In addition, some scientific evidence suggests similar effects associated with microwave exposure and female reproductive problems.

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STUDY OF THE POSSIBILITY FOR APPLYING OF POROUS SILICON NANOPOWDERS AS A SYSTEM FOR THE TARGETED DRUG DELIVERY OF "VINPOCETINE"

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Nowadays diagnostics and treatment of disorder of the cognitive functions is one of the most intensively studied areas of the modern neurology. Vinpocetine is one of the widely used medicinal preparations for the treatment of such kind of diseases [1]. Presently vinpocetine is produced in the form of pellets containing 5 and 10 mg of the drug. Such drug dosage form proves to be rather efficient but it does not provide the desired prolonged effect [2]. Moreover, chemical structure of vinpocetine can be the reason of instability of this drug dosage form.

Therefore, now an actual problem is the elaboration of stable and biocompatioble drug dosage forms with the delayed release of vinpocetine.

One of the prospective ways for solution of this problem is the development of systems for the targeted drug delivery based on silicon nanoparticles including those ones obtained from porous silicon. It is well known that these systems are biocompatible and biodegradable [3]. Now quite successful attempts in the use of porous silicon nanopowders in the systems of the targeted drug delivery are presented in scientific community [4].

The purpose of this work is the elaboration of vinpocetine delivery system on the basis of porous silicon and the study of efficiency of the processes concerned with adsorption and desorption of the medicinal preparation in this system.

Materials and methods of research. Porous silicon nanopowder was obtained according to a standard procedure using electrochemical etching of silicon in the alcoholic solution of fluoric acid [5], followed by ultrasonic grinding. Specific surface area of the porous silicon nanopowder was of ~ 60 m^2/g. Some features in morphology and composition of the particles used in the work are presented in [6].

The obtained nanopowder was submerged into 5 %-solution of vinpocetine (ND 42-9175-03) for 20 and 60 minutes. Adsorption of the drug onto porous silicon was controlled by IR-spectroscopy method with the use of VERTEX 70 Bruker spectrometer. Kinetics of vinpocetine release from the nanoparticles into 0,1 M solution of hydrochloric acid was determined at the temperature of

37 ± 0,5 °C. The volume of dissolution medium was of 100 ml. Dialysate tests (5 ml) were sampled after strictly determined intervals of time (15, 30, 45, 60, 90, 120 minutes). Required amount of medium was supplied with the same solvent. In order to determine vinpocetine content spectrophotometric method in the UV-spectral range (314 ± 2 nm) was applied. Concentration of the analyzed substance was determined by the calibration plot. Producing of vinpocetine microcapsules with the shells made of gelatin, ethylcellulose and sodium alginate as well as the procedure of biopharmaceutical investigations for these drug forms can be found in [7].

Results of research and their discussion. Comparative analysis of IR-transmission spectra for nanopowders of porous silicon in the range of 400–4000 cm^{-1} after deposition of the drug with those ones of the primary powder of porous silicon and vinpocetine substance demonstrated the presence of the bands characteristic of the medicinal preparation in the samples (absorption bands at 1720, 1680 and 1607 cm^{-1}). Note that composition of the porous silicon particles according to IR-spectroscopy data did not considerably change [8].

Our investigations demonstrated that the release of vinpocetine from Si nanoparticles was of 60 % for 6 hours of the experiment that is comparable with the degree of vinpocetine release from microcapsulated forms (70 and 94 % from microcapsules with the shells of ethylcellulose and gelatin, respectively).

Conclusion

The performed study showed a possibility of using porous silicon as an agent of prolonged vinpocetine delivery and significance of the further pharmacologic investigations of this system.

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IDENTIFICATION OF PHENIBUT IN MICROCAPSULES BY SPECTROSCOPIC TECHNIQUE IN IR- AND UV-RANGES

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Vascular encephalopathy takes the second place in the structure of mortality as a result of circulatory system diseases. Annual death rate from the stroke is one of the highest in the world. It should be noted an important physiological role of gamma aminobutyric acid (GABA) in the regulation of the functional activity of central nervous system for these kinds of diseases.

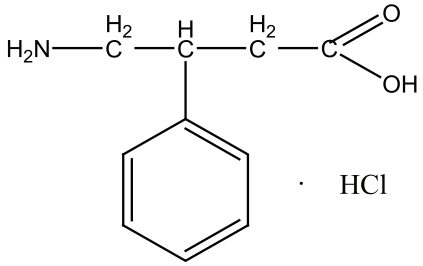
At present, the establishment of the new drug formulations for such derivative of GABA as phenibut characterized by a prolonged action is quite actual [1].

In order to obtain a prolonged action microcapsules seem to be rather perspective formulation [2, 3, 4]. Microcapsules of phenibut were obtained by extrusion technique.

Object of the research work was to perform a qualitative estimation of the components compatibility comprising a composition of the established drug formulation, namely, microcapsules.

Experimental tchnique

In the experimental investigations while preparing microcapsules a substance of phenibut was used as an active pharmaceutical substance corresponding to the requirements of ND 42-00380051-00 (Fig. 1), and additives allowed for the medicinal application and corresponding to the requirements of the normative documents.



$C_{10}H_{13}NO_2$

γ-amino-β-phenylbutyric acid hydrochloride

Fig. 1. Structural formula of phenibut

IR-spectra were surveyed with Vertex 70 spectrometer (Bruker Optik GmbH, Germany), in the middle part of IR-region in the range of 4000–400 cm^{-1} applying ATR technique (attenuated total reflectance method), using ZnSe attachment with the diamond window; as a result, IR-absorption spectra were obtained for phenibut substance, placebo-microcapsules and microcapsules with phenibut.