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The receipt and investigation of liposomal structures with biologically active substances

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Abstract

Phospholipid nanoparticles in the form of nanoemulsions systems like "water in oil" which represent natural compositions on the basis of the oil and water extracts of raw materials are received. The nanoparticles are resistant at storage, biologically compatible and well transferable. The developed nanoemulsions systems can be used as carriers of active agents in pharmaceutical compositions, and also by production of food, cosmetic and veterinary products on a natural basis. Products of petroleum and its derivatives may be used as oil extractants nature in the preparation of nanoemulsions.

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Keywords: liposomes; nanoemulsions; biologically active substances

1. Introduction

The perspective direction in the modern pharmacology and medical cosmetology is the delivery of therapeutic preparations using different types of nanosystems. It allows to obtain preparations with significant advantages [1, 2].

Nanoparticles of different kind can be used as transport systems [3, 4]. For example: polymeric nanoparticles based on the natural materials, metals etc., as well as nanodispersion on their basis. The systems of delivery based on phospholipids are very interesting because they can be exposed to biological degradation, they do not cause allergic reactions, surface of nanoparticles can be easily modified. Liposomes are the most well – known among

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phospholipid nanoparticles [5]. Liposomes are self-organizing, spherical, closed colloid systems, consisting of a lipid bilayer surrounding a central hydrophilic space. Such structures are formed spontaneously as a result of dispersion of phospholipids in water.

Liposomal structures improve pharmacokinetics and pharmacodynamics of officinal substances associated with them, they are able to protect the encapsulate drugs from the premature degradation, moreover they are able to increase the circulation time and to ensure passing over cells membranes [6-8].

Thus, development the technology to obtain phospholipids nanoparticles and transport systems based on them to increase the bioavailability and therapeutic drugs efficiency is an important task.

The purpose of this research is development of natural liposomal compositions. They are based on oil and aqueous extracts of plant raw materials. In addition liposomal compositions have to be storage stable, biologically compatible, well tolerated and appear in the form of nanoemulsions type like "water in oil".

This emulsion particles are hemisphere formed by a lipid bilayer membrane, comprising external and internal hydrophilic layers. The hydrophobic superficies of the lipid bilayer membrane is located between the hydrophilic layers (external and internal) and the polar charged molecules are arranged on the surfaces of hydrophilic layers (external and internal). The lipid bilayer membrane contains aqueous extract of plant raw materials as external and internal hydrophilic layers, and raw plant oil extract is hydrophobic superficies [9].

The plant extracts are perspective components of natural products for many reasons. First of all, they (plant extracts) contain a full complex of biologically active substances, that may have a complex effect on the organism, it exhibits a wide spectrum of pharmacological activity and it has low toxicity level. Moreover the composition of extracts can vary widely by the selection of plant raw materials for extraction, thus therapeutic effect of liposomal compositions can be strengthen. In this work pharmaceutical herbs such as a chamomile, a nettle, birch buds, oak bark, sea-buckthorn yields dried and frozen have been used as raw materials.

2. Experimental

The extraction of bioactive substances from plant raw materials was carried out by repeated two-phase extraction on a laboratory extractor and ultrasonic extraction. According to preliminary theoretical and experimental researches on the selection of optimal conditions for the biphasic extraction [10], the extraction was conducted at room temperature, the concentration of ethanol amounted 40 %, correlation alcohol:plant oil is 1:2, mixture intensity is 3000 turn/min.

In the time of conducting ultrasonic extraction of bioactive substances some factors were taken into account. On the one hand, an ultrasound can change the activity of bioactive extracted substances. On the other hand, it can contribute to the components destruction. That is why the extraction was carried out at the ultrasonic processing with frequencies $2 \cdot 10^4 – 2 \cdot 10^8 c^{-1}$ and capacity 80 watts.

Aqueous and oil extracts of plant raw materials are mixed with a homogenizer until a homogeneous emulsion. This emulsion is performed with an ultrasonic disperser, filtered through membrane filters (a pore size of 220 nm) and dispensed into vials for sterilization [11]. The nanoemulsion was obtained as a result.

3. Results and discussion

A definition of the extracts total antioxidant activity is equivalent assessment of their biochemical activity (AOA) (Fig. 1). As indicator of the relative antioxidant activity is the extract volume in milliliters (ml), which spent on titration of 1 ml of 0.05 N potassium permanganate solution [12]. Antioxidant activity of the preparation will be higher if the amount of the preparation consumed in the titration will be low.