Inna Rubchak
Kyiv National University of Technologies and Design (Kyiv)
Olena Babenko
PhD in Philology, Associate Professor
Associate Professor of Foreign Languages Department
Kyiv National University of Technologies and Design (Kyiv)

NANOCAPSULE AS A PROMISING DOSAGE FORM

In recent years, there has been a growing interest in drugs that have a targeted effect on certain cells, tissues or organs. To do this, nanoparticles are used as carriers of active substances. Nanoparticles are solid colloidal particles which size is very small and is measured in nanometers, on average from 100 to 500 nm. They can be divided depending on the internal structure into nanocapsules or nanospheres. These drugs are interesting because they can increase the therapeutic effect of active substances. It is also possible to minimize the side effects of the drug due to the fact that it will affect the appropriate place in the body. The main advantage of nanocapsules is the ability to reduce the dose of the active substance by 10,000 times. They can be administered orally, transdermally, by injection and by inhalation.

The paper aims at emphasizing the role of nanocapsules in modern pharmacy industry, in particular, its structural features, some method of obtaining nanocapsules, main methods of sterilization of nanoparticles, their advantages and disadvantages and practice of their in modern medicine and pharmacy.

Analysis of current research papers helps to focus on the key achievements in this sphere [1, 2, 3, 4].

Nanocapsules are hollow nanostructures of spherical shape with a diameter of less than 200 nanometers. They consist of an inner core and a polymer shell. It is due to the polymer shell by diffusion or rupture of this shell, the active substances are released in a given place in the body. Natural and synthesized substances are used for

the production of polymer shells. These can be polyethylene glycol, polyvinyl alcohol, alginate, gelatin, albumin. Alginate is a polymer that responds to the pH of the medium. Due to the alginate polymer shell, the active substances will be released in an alkaline environment. That is, with the help of this shell, you can deliver the active substance to the intestine by oral administration of the drug. The inner core may be a solid phase or an active substance dissolved in a solvent. Water, vegetable oils, fatty acids, etc. are used as solvents.

Nanocapsules can be obtained by such methods as: interfacial precipitation, interfacial deposition, interfacial polymerization, and self assembly procedures. Consider one of the methods of obtaining nanocapsules is the method of interfacial deposition. This method requires organic and aqueous phases. The organic phase is prepared by dissolving vegetable oil in suitable organic solvents. Next, the resulting mixture is added to the aqueous phase with a fine needle. Also, the polymer two-layer (inner and outer) shell can be filled by changing the temperature. At a certain temperature, the shell absorbs the active substances through the pores, then the temperature is changed and the pores of the inner shell are closed. The formed shell of the polymeric substance dissolves in the aqueous or organic phase or at a certain temperature, depending on the properties of the polymer. Surfactants can be added to increase the stability of the nanocapsule.

Membrane filters, which pore size is 0.22 μm, are used for sterilization of nanoparticles. Specialists use them to remove microorganisms from the aqueous suspension. The advantages of this method deal with the absence of additional chemicals, heat or radiation. The disadvantages are about the fact, that particles larger than 200 nm cannot be used. Sterilization in nanoparticle autoclaves is due to pressure and temperature control. Gamma irradiation can be used as sterilization, which will ensure uniform sterilization of microorganisms and the ability to avoid high pressure and temperature.

Most nanocapsules are unstable in aqueous suspensions, so they should be stored dried. It is recommended to use protective substances such as polyvinyl alcohol or inulin when drying the nanocapsules .

Australian scientists have developed antitumor nanocapsules that target the tumor, limiting the side effects on healthy tissues. Due to the fact that the nanocapsule enters the tumor, then it is directed infrared light with a laser, the capsule is opened and the active substances are released. The opening of the capsule is due to the fact that on the wall of the polymer shell are placed tiny gold particles that are sensitive to infrared light. Another example of the use of nanocapsules is the subcutaneous injection of insulin, which leads to a prolonged hypoglycemic effect.

To sum up, the nanocapsule was considered as a promising dosage form used in the pharmaceutical industry. Nanocapsules can be made of both natural and synthetic polymers that control the release of active substances in a given tissue, cell or organ. The choice of polymer for the shell depends on the physicochemical properties of the active substances and the purpose of the drug. This dosage form has a number of advantages such as targeted delivery of active substances, resulting in increased drug efficacy, minimal side effects on healthy areas of the body, reduced dose of active substances and frequency of drug administration, the ability to place in the nucleus nanocapsules various solids and liquids. Thus, the use of nanocapsules will not only create innovative drugs, but also improve existing ones. Nanocapsules can be used not only in the production of drugs, but also in such areas as agrochemistry, wastewater treatment, cosmetology, genetic engineering, household chemicals, food industry and more.

REFERENCES

1. Тихонова, С. О. Перспективи розробки інноваційних лікарських препаратів на основі нанотехнологій / С. О. Тихонова, О. І. Тихонов, О. О. Гайдукова // Вісник фармації. – 2012. – № 3. – С. 3-7.

2. Шигимага В. О. Бісумісні мікро- та нано- структури для спрямованого транспорту лікарських речовин: метод. вказівки для самост. вивчення дисц. "Матеріалознавство і біосумісні матеріали" для студентів денної форми навч. першого рівня вищої освіти (бакалавр), спец. 163 Біомедична інженерія, 208 Агроінженерія; Харків. нац. техн. ун-т сіл. госп-ва ім. П. Василенка. – Харків: [б. в.], 2020. – 22 с.

3. Getman V., Babenko O. V. Global challenges in Higher Education // Діалог культур у Європейському освітньому просторі: збірник тез доповідей V Міжнародної конференції, м. Київ, 12 травня 2020 р. / за заг.ред. Ю.А. Бондарчук. – К. : КНУТД, 2020. – С. 46-48.

4. Radhika P.R. Nanocapsules: A new approach for drug delivery /P.R. Radhika, Sasikanth, Sivakumar T. // Int J Pharma Sci Res, 2(6), 2011. – p.1426-29.