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Ultrasound-triggered drug delivery systems as a potential carrier of anticancer therapeutics

Plamen Simeonov[1], Plamen Katsarov[1,3], Bissera Pilicheva[1,3], Plamen Zagorchev[2,3]

[1]Department of Pharmaceutical Sciences, Medical University of Plovdiv, Plovdiv, Bulgaria

[2]Department of Medical Physics and Biophysics, Medical University of Plovdiv, Plovdiv, Bulgaria

[3]Research Institute, Medical University of Plovdiv, Plovdiv, Bulgaria

Tumor diseases are one of the leading causes of death amongst human population. This leads to the development of new therapeutic solutions that can tackle this problem. Targeted delivery of anticancer drugs has been investigated extensively due to advantages such as increased bioavailability in the tumor tissue and lower distribution in healthy tissues, which reduces the adverse reactions and increases patients' survival rate. A specific type of targeted drug delivery is the "triggered" drug delivery. It relies of specific stimuli that can trigger the release of drug in the tumor tissue. Two types of stimuli are being utilized extensively in the anticancer therapy, namely endogenous and exogenous. The aim of this study is to review the potential of exogenous stimuli in the triggered drug release with a particular focus on the acoustically activated systems. Generally, sonosensitive particulates are constructed of a shell, which can be polymeric, inorganic or a lipidic and a core, made of a gas or liquid substance. When exposed to ultrasound radiation, the core starts to oscillate and at a specific amplitude and frequency it leads to a collapse of the system, releasing its payload, a phenomenon known as "cavitation". Furthermore, microjet streams are formed from the cavitation process, that "pierce" the membrane and form temporary pores, through which the active substance is absorbed into the tissue. Many different nanoparticulate systems allow the inclusion of a sonoactive substance, i.e. mesoporous silica nanoparticles, polymeric micelles, carbon nanotubes etc., but the most utilized systems are lipid-based particles.

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