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Nano- and submicro-sized mesoporous silica particles with tunable size and porosity as perspective biopharmaceutically active excipients

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Conventional development in an understanding of the reasons of diseases with a deepening of knowledge in pharmacokinetic mechanisms allows developing modern dosage forms for the effective, safe and reliable application of bioactive compounds at the targeted site of action within a desirable time and duration. Unfortunately, current excipients cannot meet all the requirements to the modern pharmaceutical formulations and mostly play a role of fillers. However, an active ingredient is just one part of the medicine administered to the patient and it is the formulation of the drug and an excipient that translates drug properties into clinical effect. It is shown that dosage forms engineered using the nano- and submicro-scaled excipients have an additional functionality and can control a pharmacological effect of a drug. Nanomaterials as active excipients not only improve pharmacokinetic of cargo molecules but also increase their solubility and permeability, which is of great importance because just nearly 25% of all pharmaceutically active compounds are recognized as highly soluble and permeable, while the rest of them has either/or low solubility and permeability or even both of them simultaneously with other disadvantages (very short or very long shelf-life, poor adsorption through GIT). In the sight of aforementioned a concept of therapeutic treatment is realized in a development of silica-based nanomaterials that maintain drug concentration in GIT at a desired value as long as possible, i.e. they are able to exert a control on the drug release rate and duration, for further pharmaceutical implementation as an active excipient in solid dosage forms. Silica-based submicro- and nanoparticles were prepared using a template sol-gel approach in the presence of cationic and nonionic surfactants. Methotrexate was loaded into silica-based mesoporous materials with different textural properties. An amount of the drug loaded and an *in vitro* release kinetics were revealed as a function of the pore size of the materials. Release of methotrexate from synthesized carriers in comparison with the release from the commercially available pharmaceutical form mimicking an oral administration was investigated. It was turned out that silica-based materials exhibit control release kinetic with the absence of a burst effect, while the later one is considerably worst in an adjustment of controllable *in-vitro* pharmacokinetic of a drug. Mesoporous materials with a wide range of size (25-1000 nm) and variable textural characteristics were obtained that allowed to adapt different synthetic routs for further use as the perspective reservoirs for carrying in pharmaceutical means. Further development of the pharmaceutical forms on the basis of silica-based nano- and submicro-materials will ensure that a drug will be available at the desired site within the required time and duration. Those materials can serve as substituents of current fillers in pharmaceutical formulations.

Biography

Katerina O Filatova has completed her Master's in 2009 from VNMU Pyrogov b.n., Pharmaceutical Faculty. Currently, she is studying Doctoral program at the Technological Faculty at the TBU in Zlin, Czech Republic.

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