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Biodegradable depot delivery systems for the local treatment of joint replacement infections

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Musculoskeletal infections which commonly accompany orthopaedic surgery are still a major problem and require effective therapy. Currently, this consists of a combination of systemically and locally applied antibiotics in the form of targeted delivery systems with prolonged drug release. Antibiotics administered locally provide a high drug concentration at the target site. This approach benefits from minimizing systemic drug exposure and potentially reduces resistance development [1, 2].

The aim of this work was to formulate and characterize vancomycin loaded PLGA nanoparticles (NPs) for impregnating bone grafts used in treatment of musculoskeletal infections. Commercial or non-commercial PLGA were used in NPs preparation by water-in-oil-in-water double emulsion solvent evaporation technique. Polyvinyl alcohol or poloxamer were used for emulsion stabilization of primary emulsion.

Size, polydispersity and zetapotential of prepared NPs were determined using a Zetasizer Nano ZS. Encapsulation efficiency was estimated by UV-spectrophotometry directly by measuring the amount of encapsulated drug after dissolution of NPs in organic solvent and extraction of drug by water. Thermal behaviour of blank PLGA nanoparticles and drug-loaded nanoparticles was studied using a DSC. The drug release into the PBS pH 7.4 at 37°C was measured.

As a result of our work, NPs up to 300 nm in size and polydispersity below 0.2 were successfully obtained. The created NPs will be used in further tests connected with impregnation of morselised bone grafts after optimalization of other parameters, such as encapsulation efficiency and drug loading.

References:

1. Andersson DI, Hughes D Nat Rev Microbiol 8: 260 – 271. (2010).
2. Prokes L, Snejdrova E. Molecules, 27, 6487. (2022)