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Abstracts

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PT1

EFFECT OF EXTERNALLY SPRAYED LUBRICANT COMBINATIONS ON EJECTION FORCE AND PHYSICAL CHARACTERICS OF TABLETS

BAILEY, S.,[1]

[1] Department of Pharmaceutical Technology Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

e-mail: baileys@faf.cuni.cz

Lubricants play a crucial role in the manufacturing of tablets, one of the most common dosage forms. Without them, large-scale production would be impossible, as they reduce friction between the tablet and the die, allowing successful ejection and preventing damage.[1] However, when used internally and in high concentrations, lubricants can negatively impact tablet properties.[2] This study explores methods to minimize these negative effects by applying lubricants externally and in combination, thereby reducing the total amount lubricant material used. It also explores whether lubricant combinations exhibit synergistic effects on ejection force and tablet properties. The study tested binary combinations of magnesium stearate (MgSt) with sodium stearyl fumarate (SSF) or sodium lauryl sulfate (SLS), along with their individual effects on ejection force and tablet properties at compression forces 5 kN, 10 kN, and 15 kN. The findings suggest that lubricant combinations may benefit tablet manufacturing and warrants further investigation.

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PT2

PLGA NANOPARTICLES FOR LOCAL TREATMENT OF BONE INFECTIONS WITH DUAL-RELEASE OF ION-PAIRED ANTIBIOTICS

FROLOV, V.,[1] SOVÁNY, T.,[2] SNEJDROVA, E.,[1]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

[2] Institute of Pharmaceutical Technology and Regulatory Affairs, Faculty of Pharmacy, University of Szeged, Hungary

e-mail: frolovv@faf.cuni.cz

The use of vancomycin hydrochloride and gentamicin sulfate in combination has demonstrated efficacy when locally applied for the treatment of orthopedic infections. Poly(lactic-co-glycolic acid) (PLGA) nanoparticles represent a promising delivery platform for antibiotics, however the limited affinity between the hydrophobic PLGA and the hydrophilic antibiotics can lead to suboptimal encapsulation efficiency and rapid drug release. Employing hydrophobic ion-pairing (HIP) to formulate a complex of the antibiotics with anionic surfactants as counterions can improve this issue.[1,2] This study aimed to develop vancomycin- and gentamicin-loaded PLGA nanoparticles for impregnation into allogenic bone grafts to treat localized orthopedic infections. The optimal drug-to-counterion ratio was found by potentiometric titration and used for further HIP-complex preparation. The nanoparticles loaded with HIP-complexes were prepared using simple emulsion and nanoprecipitation techniques. The particles size was in the range of 167–281 nm with a polydispersity index less than 0.2. Smooth and spherical morphology of the particles was confirmed by scanning electron microscopy. The PLGA nanoparticles loaded with HIP-complexes of the antibiotics exhibited the encapsulation efficiencies, reaching 23.8% for vancomycin and 42.1% for gentamicin. The drug release was prolonged up to 12 and 22 days for the vancomycin and gentamicin HIP-complexes, respectively, making the nanoparticles suitable for impregnation into allogenic bone grafts.

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PT3

STUDY OF SPECIFIC DRUG DELIVERY TO MACROPHAGES USING PLGA NANOPARTICLES

GROSSOVA, P.,[1] HOLAS, O.,[1] LOCHMAN, L.,[2] PAVKOVA, I.,[3] LECOVA, L.,[3]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

[2] Department of Pharmaceutical Chemistry and Pharmaceutical Analysis, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

[3] Department of Molecular Pathology and Biology, Faculty of Military Medicine, University of Defence, Czech Republic

e-mail: grossovp@faf.cuni.cz

Gentamicin, an aminoglycoside antibiotics, is considered the gold standard for the treatment severe infections of tularemia.[1] However, in the case of intracellular pathogens, high doses must be administered to reach therapeutic concentrations in infected macrophages because of its highly hydrophilic character. This can lead to serious adverse effects on other body tissue such as ototoxicity and neurotoxicity.

Encapsulation of antibiotics into biodegradable hydrophobic polymer such as poly(lactic-co-glycolic) acid (PLGA) can not only reduce the risk of adverse effect but also improve the efficacy inside cells while lowering the therapeutic dose. This can be achieved by formulating nanoparticles with the appropriate size, charge and surface properties to provide specific distribution to macrophages by passive targeting.

In this project, a double emulsion solvent evaporation method was used to formulate gentamicin-loaded PLGA nanoparticles and optimized, from which two different formulations were selected for further in vitro testing. MICs and MBCs were determined using bacterial strain *F. tularensis* FSC200. To comfirm viability and intracellular efficacy, the cellular model of infected primary macrophages (murine bone marrow derived macrophages) was used.

The study was supported by SVV 260 661, GAUK No. 153924, and 4INV06-0006.

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PT4

STUDY OF SKIN BARRIER LIPIDS PRECURSORS

HRDINOVÁ, I.,[1] KOVÁČIK, A.[1]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

e-mail: hrdinovi@faf.cuni.cz

The skin barrier, located in the *stratum corneum* (SC), is a crucial component for existence of terrestrial mammals, including humans. Changes in the amount of barrier lipids (ceramides, free fatty acids, and cholesterol) and their lamellar/lateral arrangement in the intercellular spaces of SC, typical for certain skin diseases (*e.g.*, atopic dermatitis), result in damage to barrier function, particularly increased water loss.[1] Understanding the process of skin barrier formation, *i.e.*, the „release" of barrier lipids from their precursors and their subsequent arrangement into lamellar structures, is essential for rational design of new approaches to treating skin diseases. The aim of this project was to prepare models that mimic skin barrier formation, containing both barrier lipids (*e.g.*, ceramides and free fatty acids) and their natural precursors (*e.g.*, glucosylceramides and phospholipids). A total of 4 types of models with barrier lipid precursors that partially or completely replaced barrier lipids were prepared. The presence of lamellar structures in models were assessed using X-ray diffraction. Lateral organization were studied through infrared spectroscopy. The permeability of models to water or other permeants were evaluated. The knowledge of permeability and phase behavior of models explains and helps to understand the process of formation of the physiological skin barrier. The results obtained, *i.e.*, the establishment of a competent barrier, could have significant implications for the design of therapeutic formulations with barrier lipids for the treatment of skin diseases.

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PT5

BIODEGRADABLE POLYESTER FILGOTINIB LOADED NANOPARTICLES DESIGNED FOR RHEUMATOID ARTHRITIS TREATMENT

MRÓZKOVÁ, N.[1], GROSSOVÁ P. [1], HOLAS O. [1], NAVRÁTILOVÁ A. [3,4], ALQUICER BARRERA G. P. [4], ANDRÉS CEREZO L. [3,4], ŠENOLT L. [3,4], PÁVEK P.[2], PAVELKA K. [3,4]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy in Hradec Králové, Charles University

[2] Department of Pharmacology, Faculty of Pharmacy in Hradec Králové, Charles University

[3]Department of Rheumatology, 1st Faculty of Medicine, Charles University

[4]Institute of Rheumatology, Prague

e-mail: mrozkovan@faf.cuni.cz

Rheumatoid arthritis (RA) is a systemic autoimmune disease characterized by chronic inflammation of the synovial membrane, significantly reducing quality of life. Up to 30% of patients fail to respond to first choice treatment, methotrexate, or must discontinue it within the first year due to adverse effects. Second choice treatments, such as biological drugs or Janus kinase (JAK) inhibitors, offer alternatives. Filgotinib, a selective JAK1 inhibitor, has shown rapid clinical effects, comparable to or surpassing adalimumab. The efficacy-risk ratio of filgotinib versus anti-TNF drugs in different age groups is still under investigation. The use of nanomaterials as drug carriers could reduce side effects and enhance therapeutic efficacy.

This study explores the nanoformulation of filgotinib using biodegradable poly(lactic-co-glycolic) acid (PLGA) for local and systemic anti-inflammatory therapy. Filgotinib-loaded PLGA nanospheres were prepared via emulsion solvent evaporation and nanoprecipitation methods. Both methods incorporated about 25% of filgotinib into the nanospheres, with particle sizes of 205 ± 6.96 nm and 192 ± 14.43 nm, respectively, and polydispersity indices below 0.2 and 0.1. The formulation demonstrated high biocompatibility, with nearly 100% cell viability. Preliminary *in vitro* data showed a dose-dependent reduction in IL-6 secretion in lipopolysaccharide-stimulated peripheral blood mononuclear cells treated with filgotinib-loaded nanospheres, with the greatest reduction at a concentration of 500 μM (10318 ± 3665 vs. 8717 ± 3038 pg/ml, $p < 0.05$). These results indicate that the modification does not exhibit signs of toxicity and contributes *in vitro* to the reduction of inflammatory activity.

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PT6

PLASTIC POLLUTION AND HUMAN SKIN

PRATIHAST, A.K.,[1] PARASKEVOPOULOS, G.,[1] VÁVROVÁ, K.,[2]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

[2] Department of Organic and Bioorganic Chemistry, Faculty of Pharmacy in Hradec Králové, Charles University, Czech Republic

e-mail: pratihaa@faf.cuni.cz

Plastic pollutants are generated during plastic production, degradation, and decomposition processes. The widespread distribution of microplastics and nanoplastics has hugely impacted human health[1]. Skin layers, in particular stratum corneum (SC), play a major role in first-line protection of the human body. Any alterations in the skin lipid composition cause a disturbed barrier function and are linked with skin diseases[2]. Additionally, SC is in close contact with the environment, as well as, with personal and cosmetic products which leads to constant plastic exposure[3]. Therefore, the aim of this work was to examine the effects of selected plastic-related molecules on skin lipid barrier function. More specifically, the effect of styrene dimer (SD) and styrene trimer (ST) on the skin lipid nanostructure, and the permeability through SC-mimicking lipid membranes were investigated. The results indicated that the ST has an influence on the lamellar organization as well as on the permeability of model permeants. However, further research is required to understand how the observed effect will be translated on the human skin which will provide a better understanding of the impact of plastic pollutants on skin disease prevalence and prevention.

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