Title: Spray-dried nanoparticle-loaded microspheres for dexamethasone nasal delivery
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By: HAFNER, Anita (University of Zagreb, Faculty of Pharmacy and Biochemistry, Department of Pharmaceutical technology, Zagreb, Croatia)
Co-author(s): Bisera Jurišić Dukovski: Department of Pharmaceutical technology, University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb, Croatia<br>Lea Mrak: Department of Pharmaceutical technology, University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb, Croatia<br>Jelena Filipović-Grčić: Department of Pharmaceutical technology, University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb, Croatia<br>Jasmina Lovrić: Department of Pharmaceutical technology, University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb, Croatia<br>Anita Hafner: Department of Pharmaceutical technology, University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb, Croatia, ()

Abstract:
Backgrounds: Nasal administration of corticosteroids is a natural choice for the treatment of chronic rhinosinusitis with nasal polyps. Aims: Focus is on the development of delivery systems that could improve efficiency and safety of nasal corticosteroid administration through delivery to the polyp site, prolonged residence time at the nasal mucosa and moderated pharmacokinetic profile. Methods: Dexamethasone (Dex)-loaded lipid/alginate nanoparticles were obtained by injection of ethanolic lipid/Dex solution into aqueous alginate solution. The non-entrapped Dex was separated by filtration. Nanoparticles were characterized in terms of size, zeta-potential (Zetasizer 3000 HS, Malvern) and Dex content (UPLC, Agilent Infinity 1290). Nanoparticle suspension in pectin continuous phase was subjected to spray drying (B&uuml;chi 190). Spray-dried microspheres were characterized in terms of particle size (Olympus BH-2), zeta potential, Dex content and swelling behavior. Results: Nanoparticles with mean diameter of 280 nm, polydispersity index of 0.229 and zeta-potential of -35.1 mV were obtained. Spray-dried microspheres were characterized by diameter of 3.83 mm, zeta-potential of -38.0 mV, drug loading of 3.0% (production yield 44.8%) and swelling behavior controlled by Ca2+ crosslinking (simulated nasal fluid (Ca2+ conc. 5.3 mM) and water uptake of 40 and 98 ml/mg, respectively). Summary/Conclusion: This study shows the potential of nanoparticle-loaded microspheres to act as a Dex nasal delivery platform. Controlled swelling behavior is a prerequisite for the prolonged residence time and Dex release at the nasal mucosa. Such properties could improve the local therapeutic effect and minimize the possibility for adverse effects.