ChinaNANO 2009

International Conference on Nanoscience and Technology, China 2009

September 1-3, 2009, Beijing, China

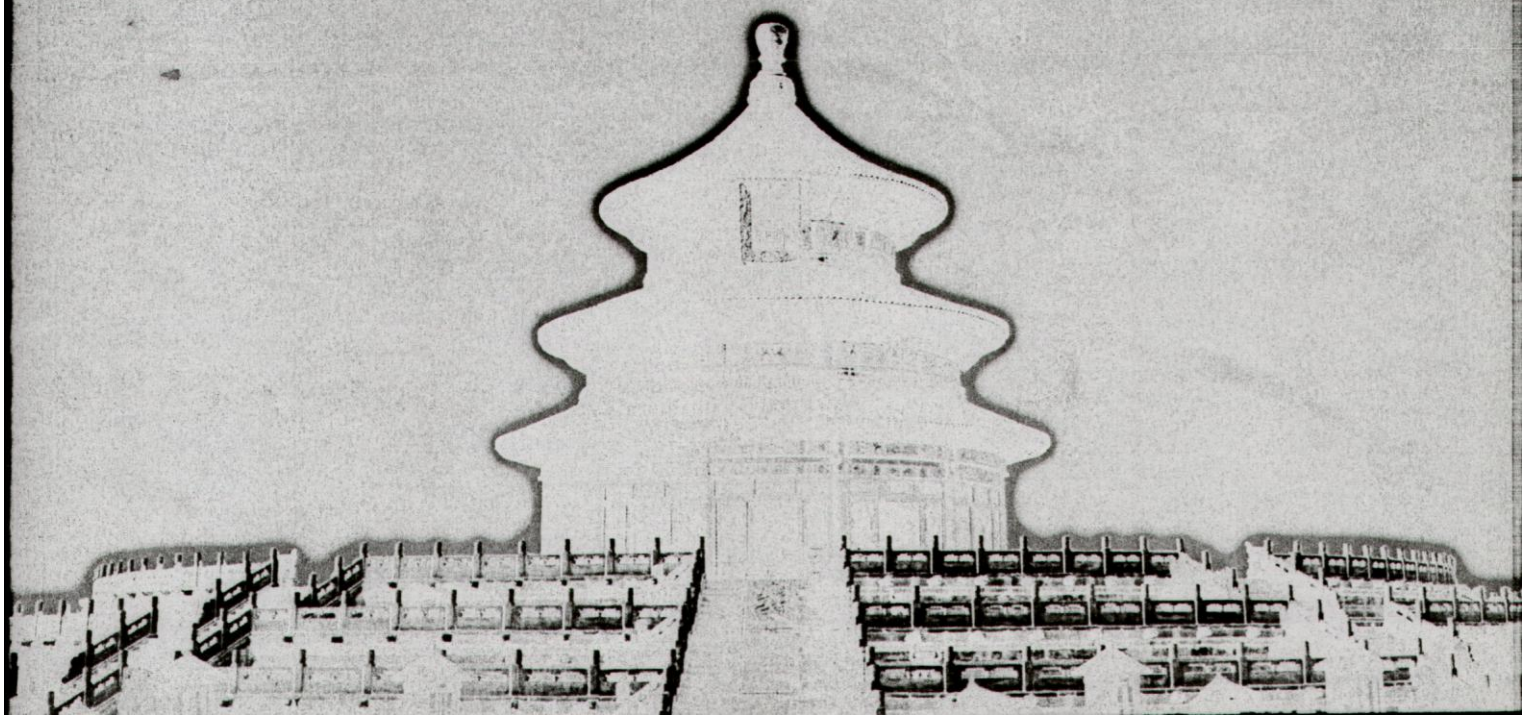
Abstracts Book

Sponsored by

National Steering Committee for Nanotechnology

Organized by

National Center for Nanoscience and Technology, China



Keywords: Insulin, Nanoparticles, Preparation, Physicochemical characterization, Transdermal delivery

Abstract: The subcutaneous route of administration is the current standard treatment for patients insulin-dependent diabetes. While Transdermal drug delivery (TDD) is an important advance in the approach to painless delivery of insulin. Our research aimed to study the feasibility of insulin nanoparticles for transdermal delivery using Supercritical Antisolvent (SAS) micronization process. The influences of various experimental factors, such as concentration of insulin solution, precipitation temperature, precipitation pressure and insulin solution flow rate on the morphology and the mean size (MPS) of insulin nanoparticles were investigated. Uniform nanoparticles were obtained when the precipitations were conducted in the supercritical region of carbon dioxide -DMSO mixture. Under optimum conditions, Spherical insulin nanoparticles with a MPS of 68.2±10.8 nm were obtained. Moreover, the insulin nanoparticles obtained were characterized by Scanning Electron Microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Differential scanning calorimeters (DSC) and Gas chromatography (GC) analyses. The results showed that SAS process has not induced degradation of insulin and that insulin nanoparticles are amorphous. The residual DMSO content in insulin nanoparticles is less than the ICH limit for class 3 solvents. Evaluation in vitro showed that insulin nanoparticles were accorded with the Fick's first diffusion law and had a high permeation rate. These results suggest that insulin nanoparticles can have a great potential in TDD systems of diabetes chemotherapy.

4P-2087

Preparation of Liposome containing Mycophenolic Acid and in vitro Skin Permeation Study

Sirirat Pinsuwan[1,a], Napaporn Rattanat[1,b], Kamonthip Wiwattanawongsa[2,c], Thanaporn Amnuaikit[1,d] and Chalermkiat Songkram[3,e]
Department of Pharmaceutical Technology[1], Department of Clinical Pharmacy[2], Department of Pharmaceutical Chemistry[3]
Faculty of Pharmaceutical Sciences, Prince of Songkla University, Hatyai, Songkhla 90112, Thailand
[a]sirirat.pi@psu.ac.th*, [b]nahnar@yahoo.com, [c]kamonthip.w@psu.ac.th, [d]chomchan.a@psu.ac.th, [e]chalermkiat.s@psu.ac.th

Keywords: liposome, mycophenolic acid, skin permeation

Abstract: Topical application has been an attractive option to pharmaceuticals, particularly for diseases located in the skin and related tissue. MPA is a specific inhibitor of de novo purine synthesis and blocks proliferation of both T and B lymphocytes [1]. For dermatology, MPA and its prodrug, mycophenolate mofetil (MMF) have been reported for the therapy of skin disorders such as allergic contact dermatitis and psoriasis. However, it has been reported the low efficiency of MPA in a topical preparation due to the insufficient of its skin penetration [2]. Since liposomes can enhance the skin absorption [3], the liposome formulations for MPA from various lipid compositions have been developed in this study. In addition, the skin permeation of MPA from the liposome was evaluated. The liposome of MPA could be prepared by modified ethanol injection method using phospholipids from soybean, cholesterol and deoxycholic acid as a wall material. Their optimum ratio was found to be 2: 1: 1 (molar ratio) with the total lipid 200 μmol/ml. The phosphate buffer pH 7.4 was used as aqueous dispersion medium of liposome to prevent the precipitation of the unloaded drug in the formulation. The average size of MPA liposomes was found to be 447.50 ± 21.47 nm and their entrapment efficiency was about 59%. The in vitro skin permeation study showed that the liposome formulation provided significantly higher skin permeation of MPA as compared to the MPA suspension or the MMF suspension with the same concentration (1%w/v). The steady state flux of MPA from the liposome was 13.47 $\mu g/h/cm^2$ which significantly ($p < 0.05$) higher than the value obtained from the suspension of free drug. These results illustrated the feasibility of the liposome as the transdermal drug delivery system for the lipophilic drug as MPA, consequently can be considered for further developing as topical formulation

References:

[1]Shaw, L.M., Sollinger, H.W., Halloran, P., Morris, R.E., Yatscoff,R.W., Ransom, J., Tsina, I., Keown, P., Holt, D.W., Lieberman, R., Jaklitsch, A., Potter, J. 1995. Mycophenolate mofetil: a report of the consensus panel. Therapeut. Drug Monitor. 17: 690-699.

[2]Jahn, K., Fischer, A., Neubert, R.H.H. and Wohlrab, J. 2001. Investigation of the penetration behaviour of mycophenolate mofetil from a semisolid formulation into human skin ex-vivo. Pharm. Pharmaco. 53: 1581-1587.

[3]Erdogan, M., Wright, J.R., and Mcalister, V.C. 2002. Liposomal tacrolimus lotion as a novel topical agent for treatment of immune-mediated skin disorders: experimental studies in a murine model. Br. J. Dermatol. 146: 964-967.

4P-2088

Magnetic Properties of Superparamagnetic Polymeric Nanospheres Synthesised in a New Route of Emulsifier-Free Emulsion Polymerisation

Seda Beyaz[1,a,*], Hakan Kockar[2,b], Taner Tanrisever[1,c,¶]
[1] Department of Chemistry, Balikesir University, Balikesir 10145, Turkey
[2] Department of Physics, Balikesir University, Balikesir 10145, Turkey
[a]sedacan@balikesir.edu.tr, [b]hkockar@balikesir.edu.tr, [c]taner@balikesir.edu.tr

Keywords: Polymeric nanospheres, Superparamagnetism, emulsifier-free emulsion polymerization.

Abstract: The advantage of superparamagnetic polymeric nanospheres over conventional polymer nanospheres is that they can be rapidly separated from the mixtures by magnetic extraction. In our study, a new route has been developed for this method and it has been used to synthesise the superparamagnetic polymeric nanospheres. In the new route of the process, the magnetite nanoparticles were synthesized by coprecipitation and then dispersed in water that has pH=~2 using perchloric acid. They are added to the emulsifier-free emulsion polymerization system of methyl methacrylate (MMA) in presence of potassium persulfate (KPS) at certain time intervals after the polymerization starts. Therefore, the process was carried out without using any surfactant as opposed to the literature. In this method, the effect of parameters (KPS content, adding speed and time of magnetic fluid and stirring rate) on magnetic properties of nanospheres were examined since the naked magnetite nanoparticles are exposed persulfate initiator. The magnetic characterization of particles was performed by vibrating sample magnetometer and the results showed that all magnetite nanoparticles and polymeric nanospheres are superparamagnetic with zero coercivity and remanence. The crystal structure of superparamagnetic magnetite was examined by x-ray diffraction and the morphology of magnetic polymeric nanospheres was studied by high resolution transmission electron microscopy. On the increase of the adding speed of magnetic fluid into polymerization system, saturation magnetisation increased from 0.260 emu/g to 0.343 emu/g. Furthermore, the increase of the adding time of magnetic fluid caused a slight increase in the saturation magnetisation of the superparamagnetic polymeric nanospheres. It was also noted that saturation magnetisation reduces at high KPS content and stirring rates. Synthesis of superparamagnetic polymeric nanospheres containing magnetite nanoparticles with the size of ~10 nm was achieved with the new route of emulsifier-free emulsion polymerization.

4P-2089

In-vivo Test of Implantation of Metallic, Ceramic and Polymeric Nanoparticles

Antonietta M Gatti, James Kirkpatrick*, Federico Capitani, Hansen Torsten*
Lab. of Biomaterials , University of Modena and Reggio Emilia Italy
Inst. of Ptahology, Univ. of Mainz, Germany

Abstract: Nanotechnology is a very rampant science, but some researchers express concern about possible risks related to some nanosized particles and the human health. Engineered nanoparticles can represent a possible risk if inhaled or digested for the workers and the end users. The present work investigated the possible toxicity of 5 different types of nanoparticles (NP) after implantation in rats. 5 types different materials were selected: Titanium Oxide (TiO_2), Silica (SiO_2), Nickel (Ni), Cobalt (Co) and Polyvinyl chloride (PVC). Every material was prepared in two forms: discs of 12mm in diameter and 0.9mm in height and nanosized particles.

Five groups out of 10 Sprague-Dawley rats were implanted for 6 and 12 months. In each group, 10 animals were implanted, subcutaneously, bilaterally with the same material in the two forms. Animals were anaesthetized and a dorsal bilateral pocket was created in the back where the materials were inserted: right side for the bulk materials, left for NP. After sacrifice, a complete autopsy of the animals was performed and special attention was paid to the area of the implantations. The excised samples were prepared for the histology (ematossillin-eosin), others for the observations under an Environmental Scanning Electron Microscope equipped with an x-ray microprobe for elemental analyses.

The histological evaluation showed that malignant mesenchymal tumours (pleomorphic sarcoma) were obtained in five of six cases with Cobalt NP, while a preneoplastic lesion was observed in an animal with the Co in disc shape. The Ni group of rats developed visible nodules at the implanted sites between 4- 6 months which were diagnosed as rhabdomyosarcoma. The TiO_2, SiO_2 and PVC showed biological reactions like inflammatory granuloma, fibrotic capsules. The ESEM evaluations showed two singular results:
1.The implantation areas with TiO_2, SiO_2 and PVC NP showed them strictly agglomerated. There was a coalescence that transformed them in a bulk object.
2 .The EDS analyses showed that the chemical composition of Cobalt and Nichel NP was transformed respectively in Cobalt and Nickel phosphates.