

Nanotechnology in Biomedical Applications

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Abstract: While silicon has been the choice material for much of the research done with MEMS, the methacrylates and acrylates provide a rapid and inexpensive base for future work. Cyclodextrins have been used for two purposes: as a solubilising agent of paclitaxel, which it is a very lipophilic compound, and for their ability to disturb and inhibit the activity of the intestinal P-gp. a polymeric ligand PMAA [PMAA = poly(acrylic acid)] with controllable low-molecular-weight and a terminal double bond was synthesized through CCTP Catalytic chain transfer polymerization (CCTP) has emerged as an efficacious method to produce low-molecular weight polymers.

Keywords: Nanotechnology, Characterization, Biomedical, Thermal, Applications.

I. INTRODUCTION

Still, it is essential that the polymer ligands can form strong chemical bonds with polymers as to improve the compatibility between NCs and polymer matrices. For these purposes we are focused on addressing this problem by introducing a new versatile polymer ligand prepared by catalytic chain transfer polymerization (CCTP) technique, where the interaction between the polymer ligands and NCs is increased by the presence of multiple anchor groups and outer double bond functionality. Metal-based nanoparticles, such as palladium, platinum, or their alloys, have been frequently used as electrocatalysts by anchoring them on carbon-based support [1], [2] and [3]. The performance of such a hybrid catalyst depends on two main issues: (i) the properties of the catalyst – involving the activity of the metal catalyst and the overall electroactive area; (ii) the properties of the support – involving processes such as fuel diffusion (for fuel cell application), good anchoring of catalysts to the support ensuring both long-term stability and efficient electron conductivity, and finally a good electron bulk conductivity of the support to efficiently transfer the electrons to the electrode. Over the last years, a variety of supports, such as carbon nanotubes, graphene, carbon fibers, and conductive polymers have been tested in electrocatalytic applications such as fuel cells and biosensors. C60 is a less studied support, as explained by the lack of a “one-dimensional” structure and a relatively low conductivity. However, the low conductivity of C60 originates solely from a low concentration of charge carriers, due to its large bandgap of 1.6 eV. In fact, the electron mobility of crystalline C60 is rather high, making it popular in, for example, solar cell and field effect transistor (FET) applications.

The anticancer drugs are administered through i.v. injection or infusion. Such a way causes high peak above the maximum tolerable concentration (MTC) of the drug in the plasma and then fast excretion of the drug from the circulation system, resulting in a limited area-under-the-curve (AUC), which is a quantitative measurement of the therapeutic effects, and a large part of AUC would be

associated with high drug concentration above MTC, thus causing serious side effects. Instead, oral chemotherapy could maintain a sustained moderate concentration of the drug in the circulation to achieve a prolonged exposure of cancerous cells to the drug as well as to avoid high peak above MTC.

This theme issue includes a number of invited reviews that address important aspects of the use of principles of bio nanotechnology in drug delivery and modern therapeutics. Special emphasis was placed by the invited authors to outline the importance of biomimetic systems and intelligent substrates in truly innovative drug delivery systems. In recent years, there has been considerable work in preparing materials and finding new uses for nanoscale structures based on biomaterials. Uses, such as carriers for controlled and targeted drug delivery, micropatterned devices, systems for biological recognition, have shown the versatility of these biopolymeric materials as indicated by Langer and Peppas. Nanotechnology often is associated with parenteral drug delivery, particularly for anticancer therapies, but it also has applications in oral drug delivery. Some recent developments show the potential of nanotechnology through this route of administration.

These elegant advances are a challenge placed before the polymer community to create new more efficient analytical, synthetic, processing, and characterization methods useful for the study of other polymer problems. The goal of our research program is the development of a system of HT methods for rapid, detailed study of polymer nanocomposites. Whenever possible we attempt to keep the cost of the approach in mind and use standard commercially available equipment. An additional goal of our research focuses on the development of fundamental structure-property relations for polymer nanocomposites. Our primary interest is to develop an understanding of the governing, fundamental, mechanisms behind the enhanced mechanical properties and improved flammability properties of nanocomposites. Polymer nanocomposites are prepared by mixing a polymer (or monomer) with some dissimilar material, or additive, that has one or more

dimensions on the nanometer scale. Over the last few decades, a wide variety of materials and synthesis approaches have been developed that allow molecular-level control over the design and structure of nanocomposite materials. Nanocomposites have been prepared by sol gel methods [1], by in situ polymerization routes, and by using simple compounding methods. All of these approaches share a common theme; the intermingling, on the nanometer scale, of dissimilar materials for the purpose of creating new materials with properties not available from either of the component pure materials. Over the past two decades, a lot of coordination polymers [1] (nonporous CPs and porous CPs also called metal-organic frameworks, MOFs) have been synthesized based on a variety of organic ligands and they exhibit the fascinating functional properties and potential applications in the fields such as luminescence [2e5], magnetism [6,7], gas storage [8e10], sensor, catalysis, ion exchange [17e19], and so on.

II. ANALYSING BIOMEDICAL METHODS

The mixture was heated under nitrogen atmospheres at 55 °C after degassing using six alternating cycles of evacuation and pressurization with high purity nitrogen (starting with evacuation). Polymerization carried out after the injection of a CoBF/MAA mixture (7.5 mg CoBF dissolved in 74.0 g MAA). The reaction was allowed to proceed for 2 h with continuous stirring under nitrogen atmosphere and then quenched with an ice-water bath. The as-prepared PMAA was precipitated in diethyl ether, and then redissolved in DI water and reprecipitated in diethyl ether for several times. UV-vis absorption spectra were taken with a Perkin-Elmer Lambda 900 UV-vis spectrometer with the scan range from 260 to 450 nm using DMF as solvent. The powder X-ray diffraction (XRD) patterns were conducted on a Bruker-AXS D8 ADVANCE X-ray diffractometer at a scanning rate of 6°/min in 2 θ ranging from 10° to 80° with CuK α radiation ($\lambda=0.1542$ nm). Fourier transform infrared (FT-IR) spectra were recorded on a NICOLET-NEXUS 670 spectrometer. The samples were grounded with KBr crystal and the mixture of them was pressed into a flake for IR measurement [4].

A high-resolution transmission electron microscope (HRTEM; Model JEOL JEM-2100 electron microscope) was conducted on JEOL JEM-2100 TEM at an acceleration of 200 kV and used to observe the morphology of the NC and the nanocomposites. The samples were dispersed in DMF, and a drop of the solution was placed on a copper grid that was left to dry before transferring into the TEM sample chamber. Molecular weight distributions were analyzed by gel permeation chromatography (GPC) using a Waters 1515 isocratic pump, a Waters 717 plus autosampler, a column set consisting of three Waters Styragel columns (7.8 9 300 mm 2) HR4, HR3, HR1, and a Waters 2414 differential refractive index detector. Tetrahydrofuran (TEDIA, HPLC grade) was used as eluent at 0.6 mL/min. Calibration of the GPC equipment was carried out with narrow

polystyrene standards (molecular weight range 1,200–538,000 g/mol).

H-NMR spectra were acquired with a BRUKER DAX 500 with TMS as internal standard in deuterated DMF. Fourier transform Raman (FT-Raman) spectroscopy were performed on an NXR FT-Raman Module by sharing interferometer installed in the Fourier transform infrared (FT-IR) bench.

Adhesion and diffusion of the drug in the mucosal microenvironment of the GI tract is another problem for oral chemotherapy. Before the drug molecules reach their final destination (e.g., the blood system, the lymphatic system, the target tissue or cell), it must go through the stomach, the lumen of the intestine, the mucus layer coating the intestinal epithelium, and finally the epithelium itself. The human intestinal epithelium is highly absorptive and is made up of the villi that vastly increase the total surface area of the epithelium available for absorption of the drug in the GI tract, which could be as large as approximately 400 m². Absorptive enterocyte cells and mucus secreting goblet cells cover the villi, which are interspersed with follicle associated epithelium (FAE). These lymphoid nodules, Peyer's patches, are covered with microfold cells (M cells) specialized for antigen sampling. M cells are significant for drug delivery [29] since they are relatively less protected by mucus and possess a high transcytotic activity.

Polymer toxicity is something we'll have to investigate further, but during this study, we discovered that thioketal nanoparticles loaded with siRNA have a cell-toxicity profile similar to nanoparticles formulated from the FDA-approved material poly(lactic-co-glycolic acid)," said Murthy in the press release. In the future, thioketal nanoparticles may become a significant player in the treatment of numerous gastrointestinal diseases linked to intestinal inflammation, including gastrointestinal cancers, inflammatory bowel diseases and viral infections, according to Murthy.

The traditional definition of nanotechnology speaks of 'control of matter'. Many newly developed nanomedicines (e.g., targeted liposomes, polyplexes, nanotubes, modified/artificial viruses) can be designed to serve specific therapeutic purposes. Physicists, biologists, chemists, informatics experts, physicians, and pharmaceutical scientists all play a role in developing these 'smart' technologies for targeted delivery, for bio-imaging or for the development of new devices. In this context, as the first speaker (Daan Crommelin) proposed. One of the basic ideas of modifying polymers with nanoplates of clays is to enhance the material's mechanical properties. DMA was frequently used in nanocomposites characterization since it allows the measurement of two different moduli of the nanocomposites, a storage modulus (E') which is related to the ability of the material to return or store mechanical energy and a loss modulus (E'') which is related to the

ability of the material to dissipate energy as a function of temperature. DMA data show significant improvements in the storage modulus over a wide temperature range of a number of polymer nanocomposites with MMT, such as PVDF, PP and PMMA. For all aluminum cast alloys, the transformation from liquid to solid state is accompanied by a decrease in volume in the ranges between 4% and 8%, dependent on the type of alloy. In order to fulfill the volume deficit, the cast parts during solidification need to be fed with extra volume of liquid melt. The main intention in this case is to prevent shrinkage formation by maintaining a path for fluid flow from the higher heat mass and the pressure of the riser to the isolated liquid pool. Campbell [8] summarized the five characteristic feeding mechanisms that can occur during solidification of aluminum cast alloys. They are: liquid feeding, mass feeding, interdendritic feeding, burst feeding and solid feeding. Among these mechanisms liquid and mass feeding are relatively uncomplicated because of the low viscosity and wide active feeding path. After mass feeding resistance to melt flow increased considerably [4].

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III. CONCLUSION

Experimental results have demonstrated pretty fair agreements between results obtained using cooling curve technique compared with rheological measurements. We used a felodipine/PAA system to illustrate how the proposed method is used. The results predicted that the equilibrium solubility of felodipine in PAA is below 0.1

wt%. It should be noted that equilibrium solubility of drug in polymer at temperature below the glass transition temperature could not be experimentally determined, and this method provided a way to predict them. In addition, our method predicted that the felodipine/PAA system, if amorphous phase separated, would form a phase of almost pure drug and the other phase of almost pure polymer. The same dependence can be found in the potential distributions of objects. The next consequence of it is increasing total electric current and the number of current paths in the structure. The differences between currents flowing in individual current paths become smaller. Freeze dried HPMC and MC can be used as alternative stabilizers to hydrogenated oils in peanut butter, and may be applied to other nut and seed butters. This prediction was consistent with the two Tgs measured in experiments.

With good luminescence property could be synthesized with the similar method. Then, the hydroxyl-ending alkyl group thus introduced onto the surface of ZnS NCs enhances their dispersity in solvent, allowing the particle size of NCs to be controlled. We have found that the particle size of the ZnS NC characterized by TEM is about 2.6 nm, in agreement with the calculated data from UV-vis absorption spectra according to Brus's model and Debye-Scherrer formula

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