GENE AND DRUG DELIVERY SYSTEM WITH SOLUBLE INORGANIC CARRIERS JIN-HO CHOY AND MAN PARK pdf

1: Publications Authored by Jin-Ho Choy | PubFacts

Abstract. Inorganic-based delivery systems are attracting increased attention partially because their inertness gives rise to safety and stability in biosystems and partially because their frameworks can be readily and exactly manipulated.

Injectable drug carrier comprising layered double hydroxide Patent number: Provided is an injectable drug carrier including a non-toxic Layered Double Hydroxide LDH and pharmaceutically acceptable excipients. Provided is also a method of preparing the injectable drug carrier, the method including: A solution obtained by dispersing the LDH in a solvent is injected in vivo. According to the method, nano-size LDH that does not affect a blood vessel in vivo can be synthesized. Grant Date of Patent: April 28, Assignee: November 1, Applicant: The nanohybrid increases the in vivo stability of the siRNA, and a target-specific multifunctional ligand, which is bonded to the layered inorganic hydroxide and can bind specifically to a tumor, increases the efficiency of tumor-specific transfer of the siRNA such that the siRNA shows tumor therapeutic activity even at a relatively low dose. Thus, the nanohybrid will be widely useful for target-specific antitumor therapies. August 30, Inventors: The present invention relates to an ursodeoxycholic acid-synthetic hydrotalcite-Eudragit hybrid, a pharmaceutical composition containing the same and a method for preparing the same. The ursodeoxycholic acid-synthetic hydrotalcite-Eudragit hybrid according to the present invention is very useful as an active ingredient of a pharmaceutical composition because of its bitter-taste-blocking effect and improved body absorption rate with high solubility. June 21, Applicant: The present invention relates to a thermal transfer ribbon containing exfoliated layered inorganic nanoparticles or exfoliated layered double hydroxides and a manufacturing method thereof, and more particularly to a sublimation thermal transfer ribbon wherein a second adhesive layer, a transfer ink layer and a transfer protective layer are formed on one surface of a base film having a lubricating heat-resistant layer and a first adhesive layer formed on the other surface thereof, in which the lubricating heat-resistant layer, the transfer ink layer and the transfer protective layer contain exfoliated layered inorganic nanoparticles or exfoliated layered double hydroxide nanoparticles to improve the heat resistance, image uniformity and abrasion resistance of the thermal transfer ribbon. October 27, Inventors: The present invention relates to a receiving sheet for dye-sublimation thermal transfer recording and a method for manufacturing the same, and more particularly to a receiving sheet for dye-sublimation thermal transfer recording, which includes a base layer, a back coating layer formed on one surface of the base layer, and an ink-receiving layer formed on the surface opposite the surface of the base layer on which the back coating layer is formed, the ink-receiving layer containing porous metal oxide nanoparticles, and a method for manufacturing the same. The inventive receiving sheet for dye-sublimation thermal transfer recording includes the ink-receiving layer containing porous metal oxide nanoparticles. Thus, the resolution of images on the receiving sheet can be maintained, while the resistance to thermal deformation and durability of the receiving sheet can be greatly improved, thus offering many advantages in terms of image quality or cost. March 3, Inventors: February 25, Applicant: Provided are a boron compound-layered double hydroxide LDH nanohybrid in which a boron compound for boron neutron capture therapy is intercalated in between layers of LDH, a method of preparing the boron compound-LDH nanohybrid, and a pharmaceutical composition including the boron compound-LDH nanohybrid, which can be used in boron neutron capture therapy. August 11, Assignee: The present invention relates to a method for increasing a photocatalytic activity of zinc oxide, which comprises preparing zinc oxide nanoplate crystals having a planar morphology on their crystal faces. In addition, the present invention relates to a process for synthesizing zinc oxide nanoplate crystals, a tooth whitening composition and a composition for degrading organic pollutants. January 15, Applicant: January 1, Applicant: The present invention provides a molecular level of DNA information code which uses a base pair sequence as an information code unit. Also, the present invention provides a molecular code system which includes designing and coding DNA which is an information code unit; stabilizing the DNA information code by encapsulating it with an inorganic capsule and coating the

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DNA-inorganic capsule to a medium; taking and extracting the coated DNA information code which is present in a trace amount, collecting the DNA information code using a polypyrrole-maghemite nanohybrid; and amplifying the collected DNA information code using a polymerase chain reaction and reading the amplified DNA information code. According to the present invention, the DNA information code having high security is prepared by assigning a security unit to a DNA which has an excellent accumulating capacity, and then the DNA information code is stabilized so as to be coated to a medium. October 30, Inventors: Provided is a pharmaceutical composition for the treatment of liver cancer, including a layered metal hydroxide-retinoic acid LMH-RA hybrid as a novel drug delivery system which shows few side effects of retinoic acid, good drug stability, sustained drug release, and improved drug delivery efficiency. June 26, Applicant: Provided are a hybrid of a poorly soluble basic drug and a layered silicate, including a water-soluble basic polymer, and a method of preparing the same. The water-soluble basic polymer may be an aminoalkylmethacrylate copolymer e. May 22, Applicant: Cosmetic raw materials having improved properties and processes for preparing the same Patent number: The present invention provides a hybrid material comprised of an active component for raw materials for cosmetics and a layered metal hydroxide, showing good stability, low toxicity, low irritation, good sustained release and good dispersibility. The present invention provides a method for preparing the hybrid material, using the coprecipitation method, the ion-exchange method or the adsorption method, depending on properties of the active component for raw materials for cosmetics. The method may further comprise a step of coating the surface of the hybrid material after preparation of the hybrid material. The present invention provides cosmectics comprising the above hybrid material. October 30, Assignee: September 21, Inventors: January 26, Publication date: September 2, Inventors: There is provided a method for preparing an anatase type titanium dioxide photocatalyst having a particle size of nano level without a need of the sintering process at high temperature, and an anatase type titanium dioxide photocatalyst having a particle size nano level. The method for preparing an anatase type titanium dioxide photocatalyst having a particle size of nano level includes adding a titanium-based starting material to a selected solvent and adding an acid or base catalyst to the resulting aqueous solution. Finally, the anatase type titanium dioxide sol solution is coated onto a support to complete the preparation of the photocatalyst. June 10, Assignee: Disclosed is a bio-inorganic hybrid composite for retaining and carrying bio-materials with stability and reversible dissociativity, represented by the following chemical Formula I and a method for preparing the same. This composite is harmless to the body and artificially controls the appropriate expression of the bio-material retained therein. December 11, Inventors: A method for preparing a perpendicularly magnetizable material usable on magnetic recording media comprises the steps of: January 30, Inventors:

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2: mysite | Publication

In past decades, much attention has focused on the potential of inorganic nanoparticles as drug or gene delivery carriers due to their high cellular uptake capacity, non immunogenic response, and.

In this study, a new drug delivery system is proposed to overcome such limitations. To realize such a system, MTX was intercalated into layered double hydroxides LDHs , inorganic drug delivery vehicle, through a co-precipitation route to produce a MTX-LDH nanohybrid with an average particle size of approximately nm. Biodistribution studies in mice bearing orthotopic human breast tumors revealed that the tumor-to-liver ratio of MTX in the MTX-LDH-treated-group was 6-fold higher than that of MTX-treated-one after drug treatment for 2 hr. Taken together, our data demonstrate that a new MTX-LDH nanohybrid exhibits a superior efficacy profile and improved distribution compared to MTX alone and has the potential to enhance therapeutic efficacy via inhibition of tumor proliferation and induction of apoptosis. Over past decades, the desire to develop novel rationally designed materials for clinical applications has led to innovative attempts to hybridize diverse constituents that differ from each other at the nanoscale, with the development of nanolevel hybrids between different inorganic materials, organic and inorganic materials, or biomaterials and inorganic materials. Such nanohybridization can result in highly synergistic effects with unusual physico-chemical properties or complementary behaviors between the two hybridized materials 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 , 11 , 12 , 13 , In particular, biomaterial-inorganic nanohybrids possess unique properties that make them suitable for biological applications, providing stabilization, targeted delivery, and the controlled release of incorporated drugs or bioactive molecules 8 , 15 , 16 , 17 , 18 , Layered double hydroxides LDHs , also known as anionic clays, are promising candidates as drug delivery carriers. LDHs possess positively charged metal hydroxide layers within which solvated exchangeable anions are stabilized through charge neutralization 20 , 21 , 22 , The interlayer space is occupied by charge-balancing anions that are typically bound to the layer through electrostatic interaction and hydrogen bonding with water molecules. The exchangeability of these interlayer anions depends on their electrostatic interaction with the positively charged layer but, with the exception of carbonate ions, most organic and inorganic anions are exchangeable. According to our previous study, we found that LDH particles are least toxic compared to the other nanoparticles such as iron oxide, silica, micelles, liposomes, graphene oxide, carbon nanotubes etc 26 , 27 , As a result, LDHs are widely applicable to various supramolecular structures or heterogeneous hybrid systems. LDHs are currently attracting increasing attention as potential components of delivery systems for drugs, genes, or biofunctional molecules, a role that critically depends on their interaction with organic materials and biomolecules. In addition, various biofunctional molecule- and drug-loaded LDHs can be stabilized in body fluids during systemic application and exhibit considerably higher cellular uptake than free drugs 24 , 29 , 30 , By functioning as a folate antagonist, MTX inhibits the activation of dihydrofolate reductase DHFR in the cell, which catalyzes the reduction of dihydrofolate to tetrahydrofolate in a folate cycle that is coupled with DNA synthesis and cell proliferation. Since this effectively blocks the production of thymidine and de novo DNA synthesis, uptake of MTX into the cytosol ultimately results in cell death 29 , 32 , 33 , However, because of its very short plasma half-life and high rate of efflux relative to influx, a high administration dose of MTX is required. Our previous studies confirmed that clathrin-mediated cellular uptake of LDHs results in efficient transportation of drug-loaded LDHs in the size range from 50 to nm into cells 14 , 20 , In this study, a major novelty has been made for designing injectable device with the 2-dimensional inorganic nanovector in real animal tumor model, orthotopic breast cancer Model, for the first time, in the world. TEM and particle size distribution studies indicated that the MTX-LDH particles showed an even size distribution with an average particle size of approximately nm. The use of nanoparticles with a size of to nm as delivery systems should result in effective tumor targeting via the enhanced permeation and retention EPR effect, by which molecules within certain size ranges such as nanoparticles and macromolecules tend to accumulate to a higher level in

tumor tissues than in normal tissues 36 , 37 , Finally, we compared the therapeutic efficacy of MTX-LDH nanohybrids and free MTX in an orthotopic breast cancer model to determine the efficiency of drug delivery via the nanohybrid system. The basal spacing of pure LDH was estimated to be 7. Therefore, considering that the longitudinal and lateral molecular dimensions of MTX are

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3: Jin Ho Choy Inventions, Patents and Patent Applications - Justia Patents Search

14 Gene and Drug Delivery System with Soluble Inorganic Carriers Jin-Ho Choy, Man Park, and Jae-Min Oh Summary Inorganic-based delivery systems are attracting increased attention partially.

Jin Ho Choy Abstract: We have attempted to realize new biomolecular-inorganic nanohybrids with two different functions, one from inorganic moiety and the other from biological one. Recently we were quite successful in demonstrating that a two-dimensional inorganic compound like layered double hydroxide LDH can be used as gene or drug delivery carriers. Such inorganic vectors are completely new and different from conventionally developed ones such as viral-based, naked, and cationic liposomes, those which are limited in certain cases of applications due to their toxicity, immunogenecity, poor integration, and etc. But the mentioned problems can be overcome by synthesizing inorganic vectors properly with non-toxic metal ions having biological compatibility. Since LDHs with positive layer charge have an anion exchange capacity, functional biomolecules with a negative charge can be intercalated into hydroxide layers of LDH by a simple ion-exchange reaction to form a bio-LDH nanohybrid. We also found that the hydroxide layers of LDHs could protect the intercalated molecules very efficiently. If necessary, inorganic materials, as reservoir and delivery carrier, can be intentionally removed by dissolving it in an acidic which offer a way of recovering the encapsulated biomolecules. The possible roles of inorganic lattice as the gene and drug delivery carrier will be shown by demonstrating the cellular uptake experiments of FITC, fluorophore, with laser scanning confocal fluorescence microscopy. Results showed that wet purification could remove most of impurities. Treatment by alkaline and HCl of 1. Results showed that Attapulgite could adsorb metal cations in significant amounts. Sodium hydroxide activation had little influence on adsorption capacity. Influences of acid treatments to ATP on adsorption capacity varied on different concentration solutions. Housing unit is studied as cell in this paper. The cell model analyzes structure and usage of each primary apartment and room of a housing unit in a view of a biological cell. Individual human person is abstracted as ATP and electron in this model, and it is demonstrated that human has the dominant impact on urban management and social administration as an electron in a living organism. When the dosage of modified attaplgite clay was 0. Meanwhile, the type of absorption was Langmuir isotherm. The medicinal plant Scutellaria baicalensis Georgi has been used widely in traditional Chinese medicine for anti-inflammation, anticancer, antiviral and antibacterial infections, reducing the total cholesterol level and decreasing blood pressures. Baicalein and baicalin are two major flavonoid of Scutellaria baicalensis Georgi, exhibit various bioactivities. The survival rate of cells treated with baicalin or baicalein 0. In the presence of 5. Baicalin and baicalein exhibited significant stimulatory activity in a dose-dependent manner without apparent cytotoxicity at concentrations less than 0. Baicalin or baicalein could be candidates for a new class of anti-diabetic drugs.

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4: LDH Nanocontainers as Bio-Reservoirs and Drug Delivery Carriers | BenthamScience

Nanoceramics-Biomolecular Conjugates for Gene and Drug Delivery. Jin-Ho Choy, Jae-Min Oh and Soo-Jin Choi. Gene and Drug Delivery System with Soluble Inorganic Carriers. Chapter.

When x is 0. Montmorillonite is a 2: When Si atoms of the layered structure are substituted by Al atoms or when Al atoms of the layered structure are substituted by metal oxide, the SiO4 tetrahedra are negatively charged. In order to satisfy a net charge balance, monovalent or divalent alkaline metal or earth metal cations exist in an interlayer space between a Siâ€”Alâ€”Si layer and another Siâ€”Alâ€”Si layer. The most fundamental chemical composition of montmorillonite is represented by Formula 6 below: These drugs have an amine group with high basicity. The drugs are positively charged by cationic hydroxylation of the amine group, and thus, can be loaded onto inorganic carriers, such as montmorillonite, by cationic exchange between the drugs and the inorganic carriers. As the basicity of a drug increases, a cationic exchange between the drug and an inorganic carrier occurs more easily. A reaction between a drug with high basicity and an inorganic carrier may be performed in an acidic condition of pH As described above, this is because the drug with high basicity can be easily hydroxylated and the inorganic carrier can be easily swollen an increase of an interlayer spacing of the inorganic carrier in the acidic condition of pH , thereby inducing the synthesis of a drug-inorganic carrier hybrid. Eudragit E is diversely used as an excipient or a coating agent in various formulations. Eudragit E can be selectively dissolved according to pH, and thus, is also used for selective dissolution of a drug at pH 1. AEA is also used for selective dissolution of a drug under an acidic condition U. In particular, a butylmethacrylate- 2,2-dimethylaminoethyl methacrylate-methylmethacrylate-copolymer Eudragit E, Degussa and polyvinylacetal diethylaminoacetate AEA, Sankyo Co. Ltd may be used herein, which are respectively represented by Formulae 10 and 11 below. As represented by Formulae 10 and 11, these polymers have a basic functional group, and can be easily substituted for a drug loaded onto an inorganic carrier by cationic hydroxylation of the basic functional group. The polymers inserted in the interlayer of the inorganic carrier can maintain a net charge balance on a negatively charged surface of the inorganic carrier, thereby effectively increasing an dissolution of the drug. In particular, Eudragit E and AEA have an inherent selective property that can be selectively dissolved in an acidic condition. Thus, a Eudragit E- or AEA-coated, drug-layered silicate hybrid according to the present invention can be effectively applied to oral formulations requiring a high drug dissolution within a short time after orally administered. The drug inserted into the interlayer of the layered silicate, even though not used as an acidic salt form, has good stability and solubility in an aqueous solution and an ethanol solvent. However, in order for the hybrid of the drug with the above advantages and the layered silicate to be formulated into oral dosage forms, a sufficient amount of the drug must be released in gastrointestinal conditions within a predetermined time. For this, the drug inserted into the interlayer of the layered silicate must be substituted by another cations or cationizable molecules, e. Thus, the drug-layered silicate hybrid of the present invention may include a cationic inorganic material or a basic organic material to control the dissolution of the drug. However, the cationic inorganic material is not preferable due to low exchange capacity with a drug inserted into the interlayer of a layered silicate. Thus, the drug-layered silicate hybrid of the present invention is coated with a basic polymer to control the dissolution of the drug. Here, the basic polymer may be any cationic or cationizable organic material, and more preferably, a water-soluble cationic polymer or copolymer. Examples of the water-soluble cationic polymer or copolymer include aminoalkylmethacrylate copolymers such as dimethylaminoethylmethacrylate, aminoalkylmethacrylamide copolymers such as dimethylaminopropylmethacrylamide, cationic polysaccharides such as chitosan, and polyvinylacetal diethylaminoacetate. Eudragit E is particularly preferable since it effectively increases a drug dissolution due to good exchange capacity with a drug. The cationic polymer can be coated on the drug-layered silicate hybrid using any method well known in the art, e. When a coating material has good affinity with a substrate, direct coating is preferable. At this time, it is

preferable to use a spray drying method to achieve good coating uniformity. The spray drying method enables the creation of microparticles with a particle size of micron or less, in addition to rapid drying. The cationic polymer-coated, drug-layered silicate hybrid according to the present invention can be formulated into pharmaceutical forms, e. The hybrid of the present invention can be used alone or in combination with a pharmaceutically acceptable additive, such as a carrier, an excipient, or a diluent. The hybrid of the present invention can be administered orally or parenterally, but is suitable for use as oral formulations due to good stability and dissolution. In the hybrid of the present invention, the drug in the free-base form may be used in an amount of 0. Hereinafter, the present invention will be described more specifically by the following working examples. However, the following working examples are for illustrative purposes and are not intended to limit the scope of the present invention. EXAMPLE 1 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 3. A solution of 1. The resultant solution was filtered, washed with water, and spray-dried. A paroxetine-montmorillonite hybrid was identified by X-ray diffraction analysis, and the X-ray diffraction pattern of the paroxetine-montmorillonite hybrid is shown in FIG. The paroxetine-montmorillonite hybrid was quantified using a UV spectroscope. As a result, the content of paroxetine was EXAMPLE 2 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 3. The resultant solution was filtered, washed with water, and dispersed in ml of ethanol. A solution of 3. The resultant solution was spray-dried to give a Eudragit E-coated paroxetine-montmorillonite hybrid. The content of paroxetine, as determined by a UV spectroscope, was EXAMPLE 3 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 3. A solution of Eudragit E 0. The resultant solutions were spray-dried to give Eudragit E-coated paroxetine-montmorillonite hybrids. The contents of paroxetine, as determined by a UV spectroscope, were The analysis of the dissolution of paroxetine was performed using a UV spectroscope. The dissolution of paroxetine according to the presence or absence of Eudragit E coating is shown in FIG. EXAMPLE 5 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 2. A solution of 4. The reaction solution was filtered, washed with water, and spray-dried. A donepezile-montmorillonite hybrid was identified by X-ray diffraction analysis, and the X-ray diffraction pattern of the donepezile-montmorillonite hybrid is shown in FIG. The donepezile-montmorillonite hybrid was quantified by high-performance liquid chromatography HPLC. EXAMPLE 6 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 2. The reaction solution was filtered, washed with water, and dispersed in ml of ethanol. A solution of 2. The resultant solution was spray-dried to give a Eudragit E-coated donepezile-montmorillonite hybrid. EXAMPLE 8 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 1, 3, and 6. The reaction solutions were filtered, washed with water, and spray-dried. Sibutramin-montmorillonite hybrids were identified by X-ray diffraction analysis, and the X-ray diffraction patterns of the sibutramin-montmorillonite hybrids are shown in FIG. The sibutramin-montmorillonite hybrids were quantified using a UV spectroscope. As a result, the contents of the sibutramin-montmorillonite hybrids synthesized at pH of 1, 3, and 6 were EXAMPLE 9 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 1, 3, and 6. The reaction solutions were filtered, washed with water, and dispersed in ml of ethanol. The resultant solutions were spray-dried to give Eudragit E-coated sibutramin-montmorillonite hybrids. The contents of sibutramin in the Eudragit E-coated

sibutramin-montmorillonite hybrids synthesized at pH of 1, 3, and 6, as determined by a UV spectroscope, were EXAMPLE 10 5 g of montmorillonite used as a layered silicate was dispersed in ml of distilled water, and a hydrochloric acid or a phosphoric acid was added to the dispersion solution so that pH of the dispersion solution was set to 1, 3, and 6. The resultant solutions were spray-dried to give AEA-coated sibutramin-montmorillonite hybrids. The contents of sibutramin in the AEA-coated sibutramin-montmorillonite hybrids synthesized at pH of 1, 3, and 6, as determined by a UV spectroscope, were 15, The analysis of the dissolution of sibutramin was performed using a UV spectroscope, and the results are shown in FIG. A hybrid of a drug in a free-base form and a layered silicate, comprising a basic polymer capable of controlling a dissolution of the drug, wherein the drug is inserted into an interlayer of the layered silicate. The hybrid of claim 1 , wherein the layered silicate is selected from the group consisting of montmorillonite, beidellite, nontronite, hectorite, saponite, illite, celadonite, gluconite, clay, and bentonite. The hybrid of , wherein the drug is selected from the group consisting of amlodipine, paroxetine, donepezile, and sibutramin. The hybrid of , wherein the basic polymer is used in combination with an inorganic salt. The hybrid of , wherein the basic polymer is a cationic polymer or copolymer. The hybrid of , wherein the basic polymer is an alkylaminomethacrylate copolymer, polyvinylacetal diethylaminoacetate, or polyalkylaminoalkylmethacrylate. A method of preparing the hybrid of claim 1 , the method comprising: The method of , wherein in b , the ethanol or the water has pH of The method of claim 7 , wherein in d , the basic polymer is added to the hybrid using spray drying, fluidized-bed coating, vacuum drying, or common oven drying. An oral formulation comprising the hybrid of claim 1 as an effective ingredient.

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5: Table of contents for Nanobiotechnology

[et al.] -- Gene and drug delivery system with soluble inorganic carriers / Jin-Ho Choy, Man Park, and Jae-Min Oh -- Molecules, cells, materials, and systems design.

When x is 0. Montmorillonite is a 2: When Si atoms of the layered structure are substituted by Al atoms or when Al atoms of the layered structure are substituted by metal oxide, the SiO4 tetrahedra are negatively charged. In order to satisfy a net charge balance, monovalent or divalent alkaline metal or earth metal cations exist in an interlayer space between a Si-Al-Si layer and another Si-Al-Si layer. The most fundamental chemical composition of montmorillonite is represented by Formula 6 below: The drugs are positively charged by cationic hydroxylation of the amine group, and thus, can be loaded onto inorganic carriers, such as montmorillonite, by cationic exchange between the drugs and the inorganic carriers. As the basicity of a drug increases, a cationic exchange between the drug and an inorganic carrier occurs more easily. A reaction between a drug with high basicity and an inorganic carrier may be performed in an acidic condition of pH As described above, this is because the drug with high basicity can be easily hydroxylated and the inorganic carrier can be easily swollen an increase of an interlayer spacing of the inorganic carrier in the acidic condition of pH , thereby inducing the synthesis of a drug-inorganic carrier hybrid. Eudragit E is diversely used as an excipient or a coating agent in various formulations. Eudragit E can be selectively dissolved according to pH, and thus, is also used for selective dissolution of a drug at pH 1. AEA is also used for selective dissolution of a drug under an acidic condition U. In particular, a butylmethacrylate- 2,2-dimethylaminoethyl methacrylate-methylmethacrylate-copolymer Eudragit E, Degussa and polyvinylacetal diethylaminoacetate AEA, Sankyo Co. Ltd may be used herein, which are respectively represented by Formulae 10 and 11 below. As represented by Formulae 10 and 11 , these polymers have a basic functional group, and can be easily substituted for a drug loaded onto an inorganic carrier by cationic hydroxylation of the basic functional group. The polymers inserted in the interlayer of the inorganic carrier can maintain a net charge balance on a negatively charged surface of the inorganic carrier, thereby effectively increasing an dissolution of the drug. In particular, Eudragit E and AEA have an inherent selective property that can be selectively dissolved in an acidic condition. Thus, a Eudragit E- or AEA-coated, drug-layered silicate hybrid according to the present invention can be effectively applied to oral formulations requiring a high drug dissolution within a short time after orally administered. The drug inserted into the interlayer of the layered silicate, even though not used as an acidic salt form, has good stability and solubility in an aqueous solution and an ethanol solvent. However, in order for the hybrid of the drug with the above advantages and the layered silicate to be formulated into oral dosage forms, a sufficient amount of the drug must be released in gastrointestinal conditions within a predetermined time. For this, the drug inserted into the interlayer of the layered silicate must be substituted by another cations or cationizable molecules, e. Thus, the drug-layered silicate hybrid of the present invention may include a cationic inorganic material or a basic organic material to control the dissolution of the drug. However, the cationic inorganic material is not preferable due to low exchange capacity with a drug inserted into the interlayer of a layered silicate. Thus, the drug-layered silicate hybrid of the present invention is coated with a basic polymer to control the dissolution of the drug. Here, the basic polymer may be any cationic or cationizable organic material, and more preferably, a water-soluble cationic polymer or copolymer. Examples of the water-soluble cationic polymer or copolymer include aminoalkylmethacrylate copolymers such as dimethylaminoethylmethacrylate, aminoalkylmethacrylamide copolymers such as dimethylaminopropylmethacrylamide, cationic polysaccharides such as chitosan, and polyvinylacetal diethylaminoacetate. Eudragit E is particularly preferable since it effectively increases a drug dissolution due to good exchange capacity with a drug. The cationic polymer can be coated on the drug-layered silicate hybrid using any method well known in the art, e. When a coating material has good affinity with a substrate, direct coating is preferable. At this time, it is preferable to use a spray drying method to achieve good coating

uniformity. The spray drying method enables the creation of microparticles with a particle size of micron or less, in addition to rapid drying. The cationic polymer-coated, drug-layered silicate hybrid according to the present invention can be formulated into pharmaceutical forms, e. The hybrid of the present invention can be used alone or in combination with a pharmaceutically acceptable additive, such as a carrier, an excipient, or a diluent. The hybrid of the present invention can be administered orally or parenterally, but is suitable for use as oral formulations due to good stability and dissolution. In the hybrid of the present invention, the drug in the free-base form may be used in an amount of 0. Hereinafter, the present invention will be described more specifically by the following working examples. However, the following working examples are for illustrative purposes and are not intended to limit the scope of the present invention. A solution of 1. The resultant solution was filtered, washed with water, and spray-dried. A paroxetine-montmorillonite hybrid was identified by X-ray diffraction analysis, and the X-ray diffraction pattern of the paroxetine-montmorillonite hybrid is shown in FIG. The paroxetine-montmorillonite hybrid was quantified using a UV spectroscope. As a result, the content of paroxetine was The resultant solution was filtered, washed with water, and dispersed in ml of ethanol. A solution of 3. The resultant solution was spray-dried to give a Eudragit E-coated paroxetine-montmorillonite hybrid. The content of paroxetine, as determined by a UV spectroscope, was A solution of Eudragit E 0. The resultant solutions were spray-dried to give Eudragit E-coated paroxetine- montmorillonite hybrids. The contents of paroxetine, as determined by a UV spectroscope, were The analysis of the dissolution of paroxetine was performed using a UV spectroscope. The dissolution of paroxetine according to the presence or absence of Eudragit E coating is shown in FIG. A solution of 4. The reaction solution was filtered, washed with water, and spray-dried. A donepezile-montmorillonite hybrid was identified by X-ray diffraction analysis, and the X-ray diffraction pattern of the donepezile-montmorillonite hybrid is shown in FIG. The donepezile-montmorillonite hybrid was quantified by high-performance liquid chromatography HPLC. The reaction solution was filtered, washed with water, and dispersed in ml of ethanol. A solution of 2. The resultant solution was spray-dried to give a Eudragit E-coated donepezile- montmorillonite hybrid. The reaction solutions were filtered, washed with water, and spray-dried. Sibutramin-montmorillonite hybrids were identified by X-ray diffraction analysis, and the X-ray diffraction patterns of the sibutramin-montmorillonite hybrids are shown in FIG. The sibutramin-montmorillonite hybrids were quantified using a UV spectroscope. As a result, the contents of the sibutramin-montmorillonite hybrids synthesized at pH of 1 , 3, and 6 were The reaction solutions were filtered, washed with water, and dispersed in ml of ethanol. The resultant solutions were spray-dried to give Eudragit E-coated sibutramin- montmorillonite hybrids. The contents of sibutramin in the Eudragit E-coated sibutramin-montmorillonite hybrids synthesized at pH of 1 , 3, and 6, as determined by a UV spectroscope, were The resultant solutions were spray-dried to give AEA-coated sibutramin-montmorillonite hybrids. The contents of sibutramin in the AEA-coated sibutramin- montmorillonite hybrids synthesized at pH of 1 , 3, and 6, as determined by a UV spectroscope, were 15, The analysis of the dissolution of sibutramin was performed using a UV spectroscope, and the results are shown in FIG. A hybrid of a drug in a free-base form and a layered silicate, comprising a basic polymer capable of controlling a dissolution of the drug, wherein the drug is inserted into an interlayer of the layered silicate. The hybrid of claim 1 , wherein the layered silicate is selected from the group consisting of montmorillonite, beidellite, nontronite, hectorite, saponite, illite, celadonite, gluconite, clay, and bentonite. The hybrid of claim 1 , wherein the drug is selected from the group consisting of amlodipine, paroxetine, donepezile, and sibutramin. The hybrid of claim 1 , wherein the basic polymer is used in combination with an inorganic salt. The hybrid of claim 1 , wherein the basic polymer is a cationic polymer or copolymer. The hybrid of claim 1 , wherein the basic polymer is an alkylaminomethacrylate copolymer, polyvinylacetal diethylaminoacetate, or polyalkylaminoalkylmethacrylate. A method of preparing the hybrid of any one of claims 1 through 6, the method comprising: The method of claim 7, wherein in b , the ethanol or the water has pH of The method of claim 7, wherein in d , the basic polymer is added to the hybrid using spray drying, fluidized-bed coating, vacuum drying, or common oven drying. An oral formulation comprising the hybrid of any one of claims 1

through 6 as an effective ingredient.

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Nano-Sized Carriers for Drug Delivery. Gene and Drug Delivery System with Soluble Inorganic Carriers. Jin-Ho Choy, Man Park, Jae-Min Oh.

7: Nanoceramics-Biomolecular Conjugates for Gene and Drug Delivery

Keywords:Drug delivery system, gene reservoir, layered double hydroxides, molecular code system, nanomedicine, nanotoxicology Abstract: This review outlines research and patents relating to the use of inorganic nanomaterial, layered double hydroxide, as nanocontainers for drug delivery and gene reservoirs.

8: - NLM Catalog Result

The biodegradable inorganic nanovector based on a layered double hydroxide (LDH) holds great promise for gene and drug delivery systems. However, in vivo targeted delivery of genes through LDH still remains a key challenge in the development of RNA interference therapeutics.

9: Inorganic Nanovehicle Targets Tumor in an Orthotopic Breast Cancer Model

To realize such a system, MTX was intercalated into layered double hydroxides (LDHs), inorganic drug delivery vehicle, through a co-precipitation route to produce a MTX-LDH nanohybrid with an average particle size of approximately nm.

GENE AND DRUG DELIVERY SYSTEM WITH SOLUBLE INORGANIC CARRIERS JIN-HO CHOY AND MAN PARK pdf

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