Open Access Journal
Letters in Applied NanoBioScience
www.NanoBioLetters.com
ISSN 2284 6808

Special Issue

NANOSIZED ANIONIC CLAYS AS DRUG DELIVERY VEHICLE

Tanushree Choudhury[1,*]

AIM AND SCOPE

Nanotechnology is expected to be one of the leading technologies of the future. The reduction of material size from micro to nanoscale offers benefits to diverse scientific fields and has the potential to revolutionize medical diagnostics and care. The development of multifunctional nanoparticles for biomedical and biotechnological applications may improve cancer therapy, DNA transfection, intravital imaging, targeted drug delivery, and enzyme immobilization. Though there is a growing literature on application of nanoparticles and nanotechnology, only limited information on the biological effects of nanoparticles on cells and tissues and their potential risks to humans and the environment is available.

Layered Nanohybrids (LNH) represent a promising class of therapeutic delivery systems. These nanoscale platform particles are based on a layered inorganic host such as layered double hydroxides (LDHs), hydroxyl double salts (HDS) and cationic clays that can intercalate various biological molecules into the nanometer size galleries between layers. The host consists of positively charged layers of a mixed divalent/trivalent hydroxide. Various molecules (such as drugs, herbicides, fertilizers, food ingredients, DNA, protein and enzymes and functional materials) can be incorporated between these layers via intercalation reaction to produce functional materials having versatile applications, e.g., controlled drug and DNA delivery.

Drug delivery using LDHs: Controlled-release drug delivery is ideal for drug therapy. Ideally, the correct dosage of drug is transported to and absorbed by the target, without delivery of the drug to other tissues. Polymer encapsulated drugs are used for the purpose and LDH s are being studied currently as potential carriers of biomolecules. Choy et al demonstrated that the DNA of herring tests and methotrexate (an anticancer drug) can intercalate into Mg-Al LDH by ion exchange. They also intercalated mono-and triphosphate nucleoside. Adsorption by LDH of adenosine 5'- triphosphate (ATP) increases the efficiency of ATP transfer into cells. This is attributed to alleviation of the electric repulsion at the cell wall when the negative charge on the phosphate groups is neutralized by positive hydroxide layers. A variety of anionic materials were intercalated into LDH e.g., ibuprofen, a nonsteroidal anti-inflammatory drug used to relieve symptoms of rheumatoid arthritis and osteoarthritis. Such hybrid system exhibits much slower release of drug in comparison to a commercial formulation, in phosphate buffer at pH 7.4. **Significance of the study.** The great potential of the drug delivery market [US$33 billion with an annual growth of 15% (based on global product revenue)] is based on two major drivers: first, present advances in diagnostic technology appear to be outpacing advances in new therapeutic agents. Highly detailed information from a patient is becoming available, thus promoting much more specific use of pharmaceuticals. Second, the acceptance of new drug formulations is expensive and slow, taking a significantly long period of time to obtain accreditation of new drug formulas with no guarantee of success. In this scenario, a broad spectrum of nanocarriers, e.g., carbon magnetic nanoparticles (size: 40-50 nm), dendrimers (size: 1-20 nm), liposomes (25-50 nm), nanolipispheres (25-50 nm) are ready to be used/being used for drug delivery, targeted cell destruction as well as for holding therapeutic substances e.g., DNA/lipophilic/hydrophilic drugs in their cavities. Of these, ceramic nanoparticles (size: ~35 nm) accumulate exclusively in the diseased cell (e.g., tumour tissue) and allow the drug to act as a sensitizer for photodynamic therapy without being released. In LDH ceramic nanoparticles, high affinity to carbonate ion and liability to acid dissolution offer desirable discharge of the loaded drugs as well as compatibility with diverse biosystems. Further, this category of nanovectors is administrable via intravascular/pulmonary route and may be used for simultaneous targeted (chemo/gene) therapy and molecular imaging. Also, these particles can be purposely removed slowly by dissolving in a pH controlled environment and the encapsulated biomolecules can be released inside the cell.

[1]Department of Chemistry, School of Advanced Sciences, VIT University, Chennai, Vandalur- Kelambakkam Road, Chennai-600127, India
*e-mail address: ***tanushree.c@vit.ac.in***

Keywords: *nanoclay, anionic clay, bio-/organic-inorganic hybrids, intercalation, gene and drug reservoir, micro and nano drug delivery system, new medicines, cancer and gene therapy*

SUBTOPICS

1	**Nanotechnology in Cancer Therapy**	**4**	**Anionic Clays: A Challenging Area to Explore in the Field of Medicine**
2	**Development of DNA delivery vehicles for gene therapy**	**5**	**Core- Shell nanoparticles as Efficient Drug Delivery System**
3	**Layered Nanomaterials in Medicine**	**6**	**Development of Nanoparticle drug carriers**

SCHEDULE

Manuscript submission deadline	**31st May 2014**
Peer Review Due	**14th June 2014**
Revision Due	**30th June 2014**
Notification of acceptance by the Guest Editor	**15th July 2014**
Final manuscripts due	**31st July 2014**