SYNTHESIS OF NOVEL GLUTAMATE-ZINC-ALUMINIUM-LAYERED DOUBLE HYDROXIDE NANOBIOCOMPOSITES

By

MOHD MOKRISH MD AJAT

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

April 2006

Dedicated to mama, Muzzaffar and arwah babah

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman : Professor Datin Khatijah Mohd. Yusoff, PhD

Faculty : Biotechnology and Biomolecular Sciences

Nanobiotechnology at present is very much important, especially for catalysis, composite applications and for the development of delivery vector for beneficial agents. A compound of zinc-aluminium layered double hydroxides (LDH) to be used as a host for a guest amino acid, glutamate was synthesized using direct assembly or co-precipitation method. Different parameters were used and optimized to form amino acid-intercalated pure phase materials. Two Bio-Inorganic Nanohybrid (BINH) were chosen for further characterization and showed that one of them had a dimer molecule intercalated into the interlayer region. Both BINHs exhibits the glutamate to be in vertical or perpendicular orientation to the inorganic layers. Cytotoxicty test indicated that the cells were insusceptible to the LDH synthesized at ratio (Zn/Al) = 1. Results from this study will be used in the development of a new delivery system for therapeutic agents comprising amino acids or peptides.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

SINTESIS SEBATIAN NANOBIOKOMPOSIT GLUTAMAT-ZINK-ALUMINIUM-LAPISAN BERGANDA HIROKSIDA

Oleh

MOHD MOKRISH MD AJAT

April 2006

Pengerusi : Professor Datin Khatijah Mohd. Yusoff, PhD

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Nanobioteknologi kini merupakan bidang yang sangat penting, terutamanya dalam kajian pemangkinan, aplikasi komposit dan untuk pembangunan vektor penghantaran agen-agen berguna. Sebatian hidroksida berlapis berganda zink-aluminium telah digunakan sebagai perumah kepada asid amino glutamat telah berjaya disintesiskan dengan kaedah pemasangan secara langsung atau kaedah ko-pemendakan. Pelbagai parameter telah diguna dan dioptimumkan untuk mendapatkan sebatian asid amino terinterkalasi dalam hidroksida berlapis ganda zink-aluminium dengan fasa tulen. Dua sebatian bio-inorganik nanohibrid (BINH) telah dipilih untuk dianalisis dan didapati salah satu daripadanya mempunyai pembentukan molekul dimmer terselit ke dalam kawasan antara lapisan. Kedua-dua sebatian BINH menunjukkan bahawa glutamat terletak di dalam kedudukan yang menegak di dalam lapisan berganda hidroksida zink-

aluminium tersebut. Ujian sitotoksiti menunjukkan bahawa sel tidak mengalami kesan toksik apabila dirawat dengan LDH yang disintesiskan pada nisbah (Zn/Al) = 1, zink kepada aluminum. Keputusan dari kajian akan digunakan untuk membangunkan satu sistem vektor penghantaran agen-agen teraputik yang terdiri daripada asid amino dan peptida.

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I certify that an Examination Committee has met on 17th of April 2006 to conduct the final examination of Mohd Mokrish Md Ajat on his Master of Science entitled "Synthesis of Novel Glutamate-Zinc-Aluminium-Layered Double Hydroxide Nanobiocomposites" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universitti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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MOHD MOKRISH MD AJAT

Date:

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