Synthesis And Characterization Of Nanocomposite For Drug Delivery Approaches

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Abstract- The utilization of applied science for medical specialty applications, has potential to alter the landscape of the identification and medical care of the many diseases. many therapeutic nanocarriers are approved for clinical use. During this project compound perishable nanocomposites are synthesized as a drug carrier for antitumour drug. Chitosan (CS) and metal alginate (ALG) with completely different ratios were emulsified with different WTC of group mineral by solvent evaporation methodology. The radical mineral is synthesized by exploitation diammonium H phosphate and nitrate 4-hydrate as main compounds and characterized by FTIR analysis. Morphology and structure characterization of nanocomposites are going to be investigated by X-ray diffraction (XRD), and Fourier Transmission Infra-Red spectrometry (FTIR) severally. This project can conclude a somewhat additional realistic hope of that Novel nanocomposites of chitosan and alginate emulsified with hydroxyapatite have a decent potential to be used as drug carrier.

Keywords – Chitosan, Sodium alginate, Hydroxy apatite, Drug delivery

I. INTRODUCTION

Nanoscience and nanotechnologies have applications in areas as numerous as drug development, water remotion, data and communication technologies, energy storage devices, production of robust nonetheless materials etc.

Chitosan is another perishable,marine based compound obtained by the deacetylation of chitin and besides being perishable is additionally non- nephrotoxic additionally as has sensible adhesion and absorption. Variety of in vitro studies are administrated to search out the response of swish muscle cells, macrophages, osteoblasts, chondrcytes, erythrocytes and blood, to chitosan.

Hydroxyapatite is mimics the mineral element of bones and arduous tissues in mammals. For its bioactive nature, it's utilized in bone implants, wherever it integrates in bone structures and supports bone. Thus hydroxyapatite coatings area unit usually applied to aluminous implants to change their surface properties. This makes it easier for the body to just accept them. Nanosized hydroxyapatite may be utilized in drug delivery systems like enteric delivery of hypoglycaemic agent or alternative medication like antibiotics.

Alginate (ALG) isn't solely a perishable chemical compound, however conjointly mucoadhesive, and biocompatible. It is water soluble linear carbohydrate extracted from brown ocean weed and consists of alternating blocks of 1-4 coupled coupled and coupled mannuronic acid residues. Alignate includes a potential for applications in pharmaceutical and medical specialty trade like drug delivery system and cell encapsulation. Alginate has many distinctive properties that have enabled it to be used as a matrix for the demurrer and/or delivery of biomolecules like desoxyribonucleic acid, proteins, and cells.

II. PROPOSED METHOD OF APPROACH

Synthesis of hydroxyapatite

In this project, hydroxyapatite (HA) powders are synthesized via chemical precipitation technique. Diammonium gas phosphate and nitrate 4-hydrate were used as beginning materials and hydroxide answer was used because the agent for pH scale adjustment. The powder sample was evaluated by the technique FTIR analysis.The flow diagram for the synthesis of the hydroxyapatite is illustrated in Figure 2. Calcium Nitrate 4-hydrate (7.23 g; 98%) was dissolved in water (105 ml). Diammonium hydrogen phosphate (2.4 g; 99%) was dissolved in water (75 ml) and slowly additional to the nitrate answer with vigorous stirring.

Figure 1.Synthesis of hydroxy apatite

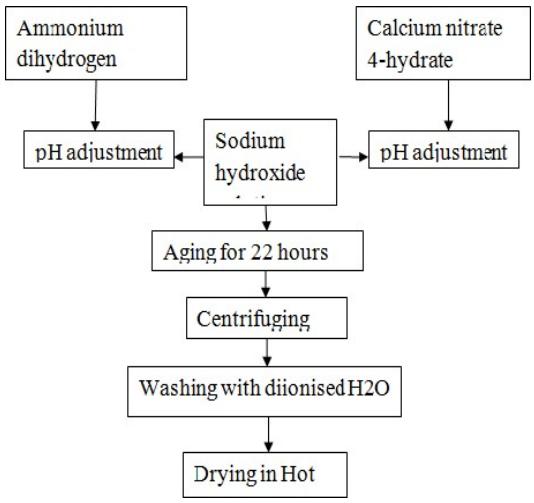

Figure 2. Flowchart of hydroxy apatite synthesis

The solution was supposed to be at pH of 11 by addition of concentrated sodium hydroxide solution (99%). The obtained precipitation was HA. The precipitation of HA can be described by Equations (1) and /or (2)

$$10Ca^{2+}+6HPO_4^{-}+2OH^{-} \longrightarrow Ca_{10}(PO4)_6(OH)_2+ 6H^{+} \quad \text{Eq. (1)}$$

$$10Ca^{2+}+6H_2PO_4^{-}+2OH^{-} \longrightarrow Ca_{10}(PO4)_6(OH)_2+ 12H^{+} \quad \text{Eq. (2)}$$

The precipitate was aged long at room temperature and was totally centrifuged and washed with de-ionized water. The processes of centrifuging and laundry were allotted 3 times. The functional groups of the precipitate was analyzed by quantitative analysis with a FTIR analysis.

Figure 3. Obtained Hydroxy apatite

Synthesis of Nano composite

The synthesis of nano composite includes compounds like Na alginate, chitosan as nano materials.The figure 4 represents the flow of nano composites synthesis.Both the Na alginate and chitosan solutions were ready by dissolving the chemicals in H2O and 1% acetic acid severally. Mix resolution of various compositions (i.e. the load ratios between chitosan and alginate of 1:1, 2:1, 1:2 (w:w) variously) were then ready by casting a mix of the solutions in a very respective weight magnitude relation on a Petri dish. To the present mix resolution of CS-ALG (1:1) group mineral (HA) of compositions 1wt% was further added with constant stirring for three hours at temperature to urge a uniform resolution. It ought to be noted that stirring was to homogenize the mixture before running onto the dish. The casting was let dry at temperature for 3 days.

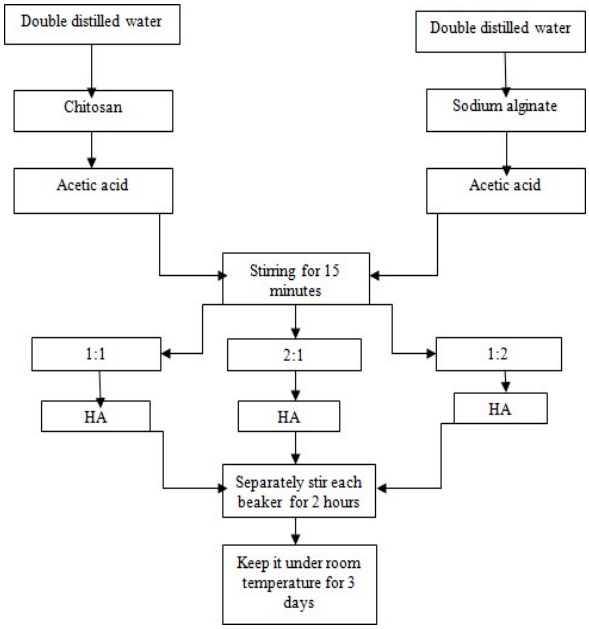

Figure 4.Flowchart of Nanocomposite synthesis

Sample 1

Sample 2 Sample 3 Figure 5.Different ratios of samples

III. EXPERIMENT AND RESULT

A. Fourier Transmission Infra Red Spectroscopy (FTIR)

FT-IR spectra of HA powders with characteristic band exhibited within the sample spectra assigned here:
(a) two bands were observed at 3555 cm-1 and 622 cm-1 because of the stretching mode of hydrogen-bonded OH- ions and liberation mode of hydrogen-bonded OH- ions, respectively; (b) the band at 1040 cm-1 arises from PO4, the bands at 603 cm-1 and 561 cm-1 arise from PO4. The FT-IR analysis showed all typical absorption characteristics of hydroxyapatite. Additionally, some carbonate content also was seen (CO3-2 peak around 1600 cm-1), which a sign of the presence of carbonate apatite. This may need originated through the absorption of greenhouse emission from the atmosphere Therefore, in keeping with these explanations, it's obvious that the synthesized powder is certainly hydroxyapatite.

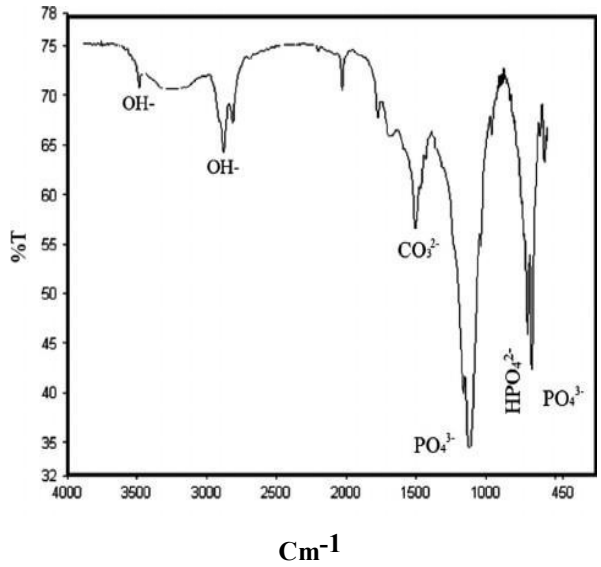

Figure 6. Fourier Transmission Infra-Red Spectroscopy (FTIR) of hydroxyapatite synthesis

B.RESULT

Figure 7. Obtained HA powder

Figure 8. Synthesized Nanocomposite

IV. CONCLUSION

Biodegradable Controlled delivery devices have a major advantage over competing delivery systems because there's no need for surgical removal of the devices and if the polymer degrades only at the surface, the drug release process is simplified in water diffusion into the majority is minimized and drug release rate is governed by polymer degradation rate. This overview demonstrates the vast variability of HA synthesized by a number of the foremost popular methodologies. Distinctive differences in physical powder properties (e.g. particle size, agglomeration, and morphology) further as chemical ones (e.g. Ca:P ratios and phosphate phases) is observed and indeed controlled.Different applications of HA require different physical and chemical properties thus the logical conclusion to draw from this report is the optimum characteristics for every application should be decided before a synthesis technique is chosen.Novel composites of chitosan and alginate blended with hydroxyapatite is prepared and canbe characterized by FTIR spectroscopy,X-ray diffractometry (XRD),Thermogravimetric analysis(TGA),Scanning Electron Microscopy(SEM) to see their suitability and honest potential as drug carrier.

REFERENCES

[1] Seema Tiwari, Sujata Marathe & et al..

[2] Dept. of Applied Science & General Engineering, Army Institute of Technology, e-ISSN: 2348-019X, p-ISSN: 2348- 0181, Volume 3, Issue 6 (Nov. - Dec. 2016), PP 01-07.

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[4] Debi Prasanna Mohanty, Yogesh Panditrao Palve, Debasish Sahoo and P.L.Nayak P.L.Nayak Research Foundation, Centre for Excellence in Nanoscience and Technology.

[5] Burcu Cengiz, Yavuz Gokce, Nuray Yildiz, Zeki Aktas, Ayla Calimli

[6] Department of Chemical Engineering, Faculty of Engineering Ankara University, Ankara 06100, Turke.

[7] P. Parhi, A. Ramanan, A.R. Ray

[8] A convenient route for the synthesis of hydroxyapatite through a novel microwave-mediated metathesis reaction

[9] ,Mater. Lett., 58 (2004).

[10] Emerich DF, Thanos CG. Nanotechnology and medicine. Expert Opin Biol Ther 3,2003,655 - 63.

[11] Chan WC. Bionanotechnology progress and advances. Biol Blood Marrow Transplant;12,2006.
[12] Brayden DJ. Controlled release technologies for drug delivery. Drug Discov Today;8,2003.
[13] Ferraz MP, Monteiro FJ, Manuel CM. Hydroxyapatite nanoparticles: A review of preparation methodologies. J App Biomateria & Biomech.; 2,2004.
[14] Stewart, B. W. & Kleihues, P. World Cancer Report,World Health Organization Press, Geneva, 2003.