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| (51) International classification | :A61L 27/54, A61L 27/22, A61L 27/56, A61L 27/20, A61L 27/58 | (71)**Name of Applicant :**<br>**1)JSS COLLEGE OF PHARMACY – JSS ACADEMY OF HIGHER EDUCATION & RESEARCH**<br>Address of Applicant :Post Box No. 20, Rocklands, Ootacamund, The Nilgiris - 643001, Tamil Nadu, India. Ootacamund, Ooty Tamil Nadu India<br>(72)**Name of Inventor :**<br>**1)Dr.Tharani Mohanasundram**<br>**2)Dr. Ramachandran Vadivelan**<br>**3)Dr. Natarajan Jawahar**<br>**4)Dr. Ruchi Tiwari** |
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(57) Abstract :

The present invention relates to a nanostructured lipid carrier embedded sustained-release osteogenic scaffold for bone regeneration. The scaffold comprises phytomolecule-loaded nanostructured lipid carriers (NLCs) immobilized within a biodegradable three-dimensional polymeric matrix containing chitosan, polyvinyl alcohol and gelatin, and further incorporating a bioactive mineral phase comprising nano-hydroxyapatite and/or β-tricalcium phosphate. The NLCs encapsulate osteo-inductive phytomolecules selected from icariin, icaritin, daidzein, genistein or derivatives thereof and are molecularly integrated within the scaffold matrix through electrostatic and hydrogen-bonding interactions to form a structurally unified composite. The scaffold exhibits interconnected porosity ranging from 80–250 μm and demonstrates a biphasic drug-release profile characterized by an initial release of ≤20% within 24 hours followed by sustained release for at least 21–60 days. The integrated nanocarrier-scaffold architecture enhances osteoblast proliferation, alkaline phosphatase activity, collagen synthesis and mineralized matrix deposition, resulting in accelerated bone defect healing compared to conventional drug-loaded scaffolds.

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