

active agent is an antibiotic, it may be present in an amount, for example, of from about 1-12 wt %. As another example, when the biologically active agent is a protein, it may be present in an amount of from about 0.01 to about 10000 µg/ml of scaffold; or in an amount from about 0.1 to about 5000 µg/ml of scaffold; or in an amount from about 1 to about 5000 µg/ml of scaffold.

[0023] Additional embodiments of the present invention include compositions that comprises materials of the scaffolds described herein. One aspect is a composition that comprises at least one polyisocyanate, polyisocyanate prepolymer, or both; at least one polyester polyol; at least one catalyst; and at least one biologically active component in powder form. The biological agents are described above.

[0024] Additional embodiments include methods of using the compositions and scaffolds of the present invention. One example is their use in a method of delivering a biologically active agent to a wound site. This example can comprise providing a composition that comprises at least one polyisocyanate, polyisocyanate prepolymer, or both; at least one polyester polyol; at least one catalyst; and at least one biologically active component in powder form; and contacting the composition with a wound site. The wound site may be, for example, part of a bone or skin.

[0025] As another embodiment of the present invention relates to infection being a significant clinical problem in bone wound healing (1), even in the presence of an osteogenic factor, especially for open fractures with large gaps in the bone which happens frequently in combat-related trauma. Present clinical approaches require a two-step process, in which the infection is first controlled by implantation of non-degradable antibiotic-impregnated PMMA beads, followed by implantation of a bone graft to promote bone healing. To reduce the healing time of the patient, it is desirable to promote bone fracture healing and control infection through one surgical procedure. The present inventors have shown that sustained delivery of BMP-2 from polyurethane (PUR) was able to promote new bone formation in rat femora (2). Other embodiments relate to the delivery of vancomycin free base (V-FB) from PUR for up to 8 weeks at a concentration well above minimum inhibitory concentration (MIC) which inhibited infection in contaminated rat femoral segmental defect (submitted work). The purpose of the present study is to incorporate both drugs in the same PUR scaffold, and to test the composite's ability of controlling infection and promoting bone wound healing simultaneously.

[0026] Other embodiments will be apparent from a reading of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. 1 shows an example of the delivery of an embodiment of the present invention.

[0028] FIG. 2 is a graph showing tobramycin release kinetics.

[0029] FIG. 3 shows a rat wound healing model.

[0030] FIG. 4 is graph showing tobramycin release.

[0031] FIG. 5 shows in vivo response to foam in a rat excisional dermal wound.

[0032] FIG. 6 is a scanning electron micrograph (SEM) of T6C3G1L-PEG0 scaffold.

[0033] FIG. 7 shows in vitro tobramycin release from PUR scaffolds and PMMA beads. Materials were incubated at 37°

C. in PBS, which was completely removed and refreshed at each time point. Tobramycin concentration in the releasate was measured by HPLC.

[0034] FIG. 8 shows zones of inhibition (ZI) measured after 24 hours for PUR scaffolds using the Kirby-Bauer test. PMMA control: ~6-mm PMMA beads with 4.0 wt-% tobramycin. Positive control: 10 µg tobramycin BBL SensiDiscs. Negative control: PUR scaffolds with no tobramycin. Asterisks denote statistical significance ($p < 0.005$) with respect to the positive control and PMMA.

[0035] FIG. 9 shows bioactivity of tobramycin released from PUR scaffolds after 8, 20, and 30 days of incubation in PBS, evaluated by Kirby-Bauer tests. Blank BBL SensiDiscs were loaded with 0.5 µg tobramycin (in 10 µL) PBS) from each releasate (as determined by HPLC), as well as 0.5 µg exogenous tobramycin for the positive control. Asterisks denote statistical significance ($p < 0.005$) with respect to the positive control.

[0036] FIG. 10 shows storage (bold) and loss moduli as a function of shear rate in compression mode during DMA frequency sweeps from 0.1 to 10 Hz. Illustrated are the results from T6C3G1L scaffolds with (A) 0%, (B) 30%, and (C) 50% PEG, each with (solid line) and without (dotted line) tobramycin.

[0037] FIG. 11 shows DMA stress relaxation response to 2% strain (compression) over 20 minutes of PUR scaffolds with (A) 0%, (B) 30%, and (C) 50% PEG, with (solid line) and without (dotted line) tobramycin.

[0038] FIG. 12 is a chart that shows in vitro release profile of BSA-FITC from PUR scaffold. BSA-FITC was included into the scaffold as solution in presence of 0.5% glucose, and as powder in presence of different weight percentage of glucose.

[0039] FIG. 13 is a chart that shows in vitro release profile of PDGF-BB from PUR scaffold including PDGF-BB powder (PUR-PDGF). Also included are 0.05% heparin and 2% glucose, and the release kinetics was determined by Iodine125 labeling and ELISA respectively.

[0040] FIG. 14 is a chart that shows in vitro release profile of PDGF-BB from PLGA particles, granules and polyurethane scaffold containing granules (PUR-Granules). The release kinetics was determined by Iodine125 labeling (A) and ELISA (B) respectively.

[0041] FIG. 15 is a chart that shows in vitro cell proliferation ability of PDGF-BB releasates from PUR-PDGF (A), Particles (B), Granules (C), and PUR-Granules (D) respectively.

[0042] FIG. 16 is scanning electronic microscopic images of polyurethane scaffold containing 2% glucose (A), and containing 15% granules (B).

[0043] FIG. 17 is scanning electronic microscopic images of polyurethane scaffold containing 80 µm PLGA particles (A), and 1 µm PLGA particles (B).

[0044] FIG. 18 shows data in connection with the release of BSA-FITC from PUR scaffolds.

[0045] FIG. 19 shows data in connection with the release of BMP-2 from PUR scaffolds.

[0046] FIG. 20 shows the results of an ALP assay of BMP-2 releasate liquids.

[0047] FIG. 21 shows a photograph of a 6 mm segmental defect in a rat femur stabilized by a polyacetal plate.

[0048] FIG. 22 is a chart that shows bacterial counts measured in soft tissue after 14 days of treatment. The groups