

Development of Gentamicin-Loaded Biphasic Gypsum-Monetite Pellet: Drug Release and Mechanical Property = Pengembangan Pelet Biphasic Gyosum-Monetite Berisis Gentamicin: Pembebasan Obat dan Sifat Mekanik

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Abstrak

Latar Belakang: Bidang biomaterial semakin maju setiap tahunnya, terutama pada sistem penghantaran obat. Setiap bahan yang akan dijadikan biomaterial wajib mempunyai beberapa karakteristik, salah satunya adalah sifat mekanik. Sifat mekanis, seperti Diametral Tensile Strength (DTS), berperan dalam integritas struktural pelet, terutama bila ditanamkan ke dalam tubuh manusia. Namun informasi dan eksplorasi mengenai pelet gipsium-monetit masih sangat terbatas. Tujuan: Untuk mengevaluasi kemampuan pelet gipsium-monetit bifasik terhadap pelepasan gentamisin menggunakan pemeriksaan UV-Vis dan Diametral Tensile Strength (DTS). Metode: >36 Spesimen pelet gipsium-monetit dibagi menjadi 4 kelompok dengan perbandingan komposisi berbeda, yaitu kelompok 1 (100%gipsium), kelompok 2 (90%gipsium-10%monetit), kelompok 3 (80%gipsium-20%monetit), dan kelompok 4 (60%gipsium-40%monetit). Satu set percobaan terdiri dari 12 spesimen uji, masing-masing kelompok terdiri dari 3 spesimen uji. Dua set percobaan dilakukan uji kuat tarik diameter menggunakan Universal Testing Machine (UTM), satu set tanpa perendaman gentamisin, dan satu set setelah perendaman gentamisin. Satu set sampel lainnya digunakan untuk percobaan pelepasan obat (gentamisin) setelah perendaman gentamisin dengan merendam satu per satu dalam 4 ml aquadest. Pengambilan data dilakukan pada waktu 24 jam, 2 hari, 4 hari, dan 7 hari pada percobaan pelepasan gentamisin. Semua data dianalisis menggunakan IBM SPSS Statistics. Hasil: Kelompok 1 dan kelompok 2 menunjukkan penurunan nilai DTS yang signifikan setelah perendaman gentamisin ($p\text{-value} < 0,001$), sedangkan kelompok 3 dan kelompok 4 menunjukkan peningkatan nilai DTS yang signifikan setelah perendaman gentamisin ($p\text{-value} = 0,018$). Tidak ada perbedaan yang signifikan pada konsentrasi pelepasan gentamisin antar kelompok. Gentamisin yang dilepaskan pada 24 jam pertama ditemukan signifikan dibandingkan dengan cap waktu lainnya ($p\text{-value} = 0,001$), yang menunjukkan pelepasan awal secara burst release diikuti dengan pelepasan berkelanjutan hingga 7 hari. Kesimpulan: Penambahan gentamisin meningkatkan sifat mekanik pelet 80%gipsium-20%monetit dan 60%gipsium-40%monetit secara signifikan. Pelet gipsium-monetit memiliki kemampuan mempertahankan mekanisme pelepasan berkelanjutan hingga 7 hari.

.....The field of biomaterials is becoming more and more advanced every year, especially on drug delivery systems. Every material which is intended to be used as a biomaterial is required to have a several characteristics, one of them is mechanical property. Mechanical property, such as Diametral Tensile Strength (DTS), plays a role in the structural integrity of the pellet, especially when implanted within the human body. However, information and exploration regarding gypsum-monetite pellet is still very limited. Objective: To evaluate biphasic gypsum-monetite pellet's ability for gentamicin release using UV-Vis examination and its diametral tensile strength (DTS). Methods: 36 Specimens of gypsum-monetite pellet were divided into 4 groups with different composition ratios, group 1 (100%gypsum), group 2 (90%gypsum-10%monetite), group 3 (80%gypsum-20%monetite), and group 4 (60%gypsum-

40% monetite). One set of experiment consists of 12 specimens, 3 specimens from each group. Two sets of experiment underwent diametral tensile strength testing using Universal Testing Machine (UTM), one set without gentamicin loading, and the other one after gentamicin loading. Another set of samples was used for drug (gentamicin) release experiment after gentamicin loading by submerging individually in 4 ml of aquadest. Data were taken on 24 hours, 2 days, 4 days, and 7 days during gentamicin release experiment. All the data were analysed using IBM SPSS Statistics. Results: Group 1 and group 2 showed a significant decrease in DTS value after gentamicin loading ($p\text{-value} < 0.001$), while group 3 and group 4 showed a significant increase in DTS value after gentamicin loading ($p\text{-value} = 0.018$). There was no significant difference on gentamicin released concentration between the groups. Gentamicin released on the first 24 hours was found to be significant compared to the other timestamps ($p\text{-value} = 0.001$), indicating initial burst release followed by a sustained release up to 7 days. Conclusion: Addition of gentamicin improved the mechanical properties of 80%gypsum-20%monetite and 60%gypsum-40%monetite pellet significantly. Gypsum-monetite pellet has the ability to maintain a sustained release mechanism up to 7 day.