**Supporting information**

# 3D-printed magnesium-doped micro-nano bioactive glass composite scaffolds repair critical bone defects by promoting osteogenesis, angiogenesis, and immunomodulation

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**1.**

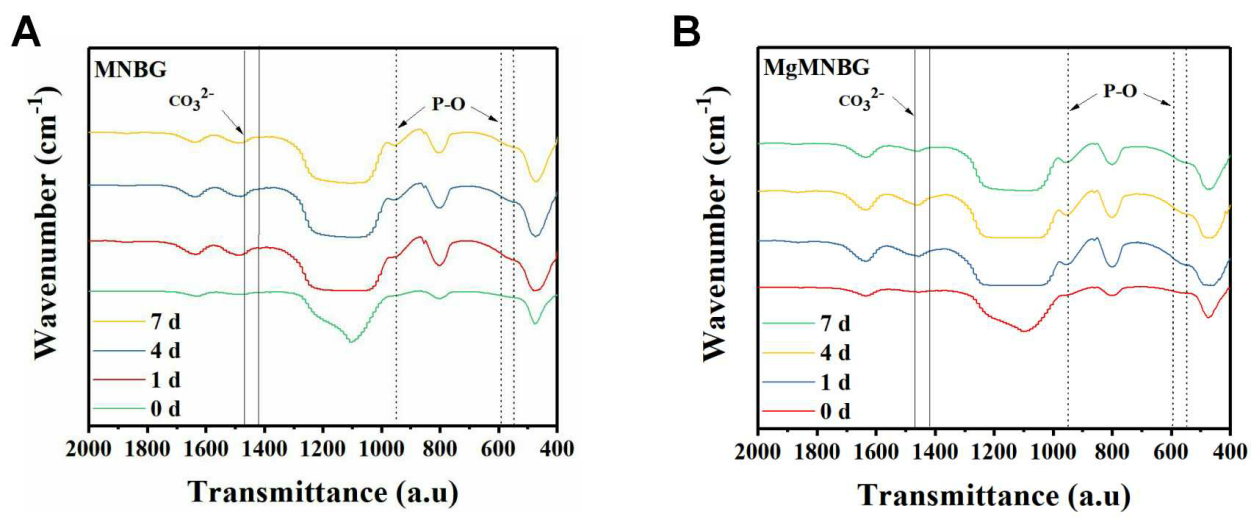
图片66调整

**MNBG**

**MgMNBG**

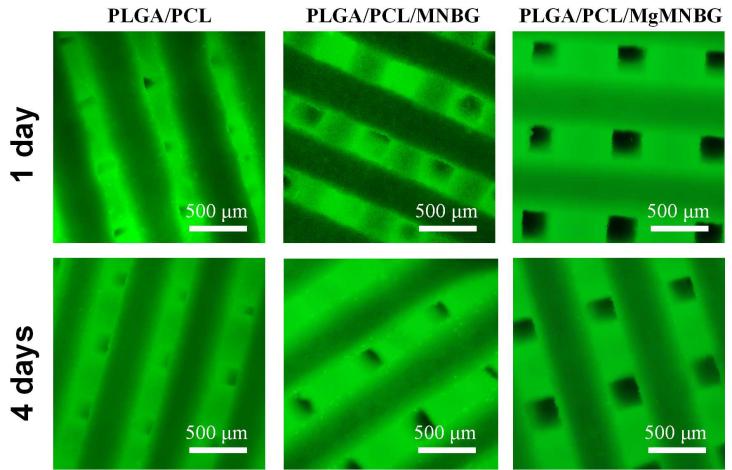
**Figure 1.** Energy spectrum analysis of MNBG and MgMNBG

**2.**



**Figure 2.** Infrared spectra of MNBG and MgMNBG mineralized in SBF solution for 1, 4, and 7 days

**3.**



**Figure 3.** Living-dead staining of mBMSCs on the scaffolds for 1 and 4 days

Live–dead fluorescence staining was used to observe the cell survival of mBMSCs cultured on the scaffold surface for 1 and 4 days (Figure 3). Cells adhered and grew on the strands, which showed that the scaffolds had good biocompatibility.

**Table 1 Concentration of ions in the extract of osteoblastic basic culture medium**

**(after diluted)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Si(mg/L)** | **Ca(mg/L)** | **P(mg/L)** | **Mg(mg/L)** |
| DMEM | 0.00 | 57.79 | 26.83 | 19.22 |
| MNBG/DMEM | 15.92 | 65.47 | 26.39 | 19.03 |
| MgMNBG/DMEM | 18.46 | 68.83 | 27.21 | 32.28 |

**Table 2 Ion concentration of endothelial cell culture medium extract (after diluted)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Si(mg/L)** | **Ca(mg/L)** | **Mg(mg/L)** |  |
| ECM | 0.00 | 56.32 | 19.97 |  |
| MNBG/ECM | 14.06 | 67.24 | 19.65 |  |
| MgMNBG/ECM | 16.28 | 64.59 | 33.51 |  |

**Table 3 Gene primer sequence pairs used in RT-qPCR for osteogenesis related genes**

|  |  |
| --- | --- |
| **Gene** | **primer sequence** |
| GAPDH | Forward： 5，-CTCCCACTCTTCCACCTTCG-3， |
| Reverse： 5，-TTGCTGTAGCCGTATTCATT-3， |
| ALP | Forward： 5，-TGCCTACTTGTGTGGCGTGAA-3， |
| Reverse： 5，-TCACCCGAGTGGTAGTCACAATG-3， |
| OCN | Forward： 5，-AGCAGCTTGGCCCAGACCTA-3， |
| Reverse： 5，-TAGCGCCGGAGTCTGTTCACTAC-3， |
| RUNX2 | Forward： 5，-CACTGGCGGTGCAACAAGA-3， |
| Reverse： 5，-TTTCATAACAGCGGAGGCATTTC-3， |
| COL1 | Forward： 5，-ATGCCGCGACCTCAAGATG-3， |
| Reverse： 5，-TGAGGCACAGACGGCTGAGTA-3， |
| OPN | Forward： 5，-GCAGTCTTCTGCGGCAGGCA-3， |
| Reverse： 5，-CACCGGGAGGGAGGAGGCAA-3， |

**Table 4 Gene primer sequence pairs used in RT-qPCR for angiogenesis related genes**

|  |  |
| --- | --- |
| **Gene** | **primer sequence** |
| GAPDH | Forward： 5，-CTCCCACTCTTCCACCTTCG-3， |
| Reverse： 5，-TTGCTGTAGCCGTATTCATT-3， |
| FGF-2 | Forward：5，-CTGTACTGCAAAAACGGG-3， |
| Reverse： 5，-AAAGTATAGCTTTCTGCC-3， |
| SDF | Forward：5，-TGAGAGCTCGCTTTGAGTGA-3， |
| Reverse：5，-CACCAGGACCTTCTGTGGAT-3， |
| Angiogenin | Forward： 5，-GTGCTGGGTCTGGGTCTGAC-3， |
| Reverse：5，-GGCCTTGATGCTGCGCTTG-3， |

**Table 5 Gene primer sequence pairs used in RT-qPCR for macrophage inflammation related genes**

|  |  |
| --- | --- |
| **Gene** | **primer sequence** |
| GAPDH | Forward：5’-CTCCCACTCTTCCACCTTCG-3’ |
| Reverse：5’-TTGCTGTAGCCGTATTCATT-3’ |
| Arginase | Forward：5’-CATATCTGCCAAGGACATCG-3’ |
| Reverse： 5’-GGTCTCTTCCATCACTTTGC-3’ |
| IL1β | Forward：5’-TGGAGAGTGTGGATCCCAAG-3’ |
| Reverse：5’-GGTGCTGATGTACCAGTTGG-3’ |
| TNFα | Forward： 5’-CTGAACTTCGGGGTGATCGG-3’ |
| Reverse：5’-GGCTTGTCACTCGAATTTTGAGA-3’ |
| IL6 | Forward：5’-ATAGTCCTTCCTACCCCAATTTCC-3’ |
| IL10 | Forward：5’-GAGAAGCATGGCCCAGAAATC-3’ |
| Reverse：5’-GAGAAATCGATGACAGCGCC-3’ |
| IL1ra | Forward：5’-CTCCAGCTGGAGGAAGTTAAC-3’ |
| Reverse：5’-CTGACTCAAAGCTGGTGGTG-3’ |
| BMP-2 | Forward：5’-GCTCCACAAACGAGAAAAGC-3’ |
| Reverse：5’-AGCAAGGGGAAAAGGACACT-3’ |
| VEGF | Forward：5’-GTCCCATGAAGTGATCAAGTTC-3’ |
| Reverse：5’-TCTGCATGGTGATGTTGCTCTCTG-3’ |
| TGFβ1 | Forward：5’-CAGTACAGCAAGGTCCTTGC-3’ |
| Reverse：5’-ACGTAGTAGACGATGGGCAG-3’ |
| TGFβ3 | Forward：5’-CAACACCCTGAACCCAGAG-3’ |
| Reverse：5’-CTTCACCACCATGTTGGACAG-3’ |