

Extracellular Bone Matrix: A Promising Platform Capable of Reshaping the Bone Void Filler Market

Nadia Sharma¹, Timothy Ringeisen¹, Rita Millard¹, Charlene White-Williams¹, Benjamin Kibalo¹, Steven Leonhardt¹
¹DSM Biomedical, Exton, PA, USA
Nadia.Sharma@dsm.com

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INTRODUCTION: More than two million bone grafting procedures are performed annually worldwide, making it the second-most frequent tissue transplant after blood transfusion.¹ Currently, the gold-standard is using autologous bone for reconstruction.² However, reconstructing large bone defects can be a challenge for both patients and surgeons due to limited supply and donor site morbidity.¹ Often, demineralized bone matrix (DBM) is used to address this limitation and to provide an active scaffold that can not only support bone regeneration, but also induce it. DBM is bone from a donor processed to remove the mineral portion, preserving key tissue matrix components essential for bone regeneration.³ While DBM sourced from human cadavers dominates this market, clinical efficacy varies in part due to processing and high donor-to-donor variability.⁴ Additionally, disease risk from allograft DBM is a source of concern.⁵

METHODS: DSM Biomedical has developed a unique biomaterial platform that can address limitations from human DBM. DSM's Extracellular Bone Matrix (EBM) platform has been sourced from young, healthy porcine bone with regenerative potential. EBM must also be compliant with various consensus standards (ISO-22442, ISO-10993, etc.), minimizing the risk of disease transmission and ensuring material safety.

RESULTS & DISCUSSION: The complex ultrastructure and key biochemical components of the native tissue have been preserved using DSM's proprietary method, while effectively removing xenogeneic cells (Image 1). Many features of the material such as surface topography and matrix proteins (glycosaminoglycan, collagen), which are known to play an important role in cell attachment, infiltration, and differentiation, have also been preserved. Upon implantation into the muscle pouch of a rat model, an industry gold-standard test for bone-induction potential, EBM has been shown to induce novel bone formation *in vivo* without the use of exogenous factors (Image 2).

SIGNIFICANCE: With sustainability at the forefront of DSM Biomedical's innovations, this material platform was developed to ensure chemicals of known toxicity and non-biodegradable compounds have no significant negative impact on the environment. Processing times, solution volumes, and treatment steps were also minimized where possible. This flexible EBM platform can be combined with a wide array of other bone grafts to create unique orthopedic implants, potentially disrupting and expanding the applicable market by an estimated \$300 million while improving patient outcomes and quality of life.

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IMAGES AND TABLES:

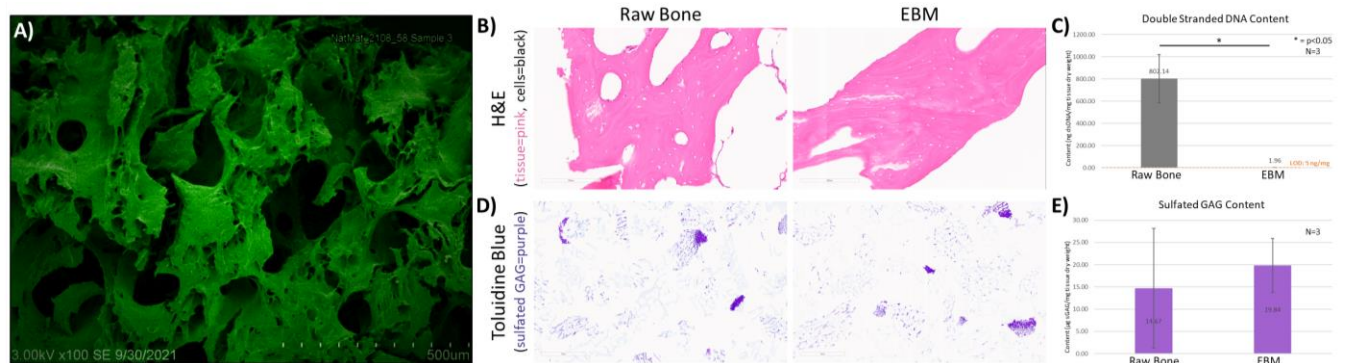


Image 1: Key matrix components of native tissue preserved in EBM while effectively removing detectable xenogeneic cells. **A)** Complex ultrastructure of EBM visualized by SEM (scale bar = 500 μm). **B)** Effective reduction of detectable cells visualized by representative H&E stain (cells = black, tissue structure = pink, scale bars = 200 μm) and **C)** quantified by PicoGreen Assay. **D)** Key matrix component sulfated glycosaminoglycan (sGAG) preserved post-processing as visualized by representative Toluidine Blue stain (sGAG = purple, scale bars = 3 mm) and **E)** quantified by Blyscan Assay. Two-sample t-test performed for biochemical tests (N=3 per group). Data are presented as mean ± SD. * = p<0.05.

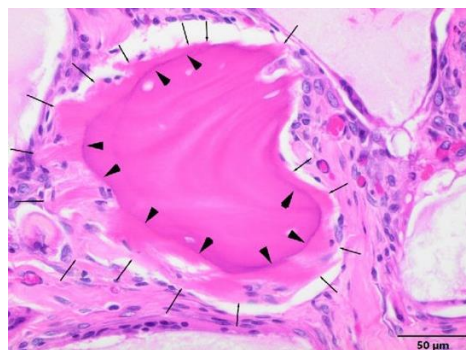


Image 2: Representative H&E stained section of EBM in muscle pouch of a rat model (intramuscular implantation test) at 4 weeks showing novel bone formation. Central "non-viable" lamellar bone with empty lacunae is EBM. Black arrows delineate a rim of new woven bone containing osteocytes and osteoblasts, as noted by independent pathologist. Black arrowheads point to a basophilic cement line between novel bone and EBM. Scale bar = 50 μm.