A NOVEL, 3D PRINTED BIOREACTOR FOR EXPANSION OF MESENCHYMAL STEM CELLS COMPARED TO THE PBS MINI

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The increased popularity of cell-based therapies has driven the custom-scale manufacturing of anchorage dependent cells such as mesenchymal stem cells. Existing bioreactors offer limited options for scalability, and most often differ from the traditional 2D cultures adding extra steps to the manufacturing process such as costly protein coatings to enhance cell adhesion. Southwest Research Institute® (SwRI®) has developed a novel bioreactor to propagate cells using a 3D printed, single-use, scalable device. SwRI's patented bioreactor **(Figure 1)** features tightly packed interconnected spherical voids providing a large surface-to-volume ratio for cell proliferation under perfusion flow. To assess the efficiency of bone marrow mesenchymal stem cell (BM-MSC) propagation, cells were seeded at 5000 cells/ cm^2 in the 3D printed bioreactor and compared to the PBS Mini (0.5L) using Synthemax II microcarriers. The total cell yield per cm^2 was equivalent for both bioreactors (43.60 $x10^3$ ± 1.36 cells per cm^2 in the SwRI bioreactor vs 38.37 $x10^3$ ± 1.71 cells per cm^2 in the PBS Mini, p=ns). The fold expansion for the SwRI bioreactor was 8 ± 0.33 compared to 9 ± 0.38 in the PBS Mini (p=ns), and the population doubling time for both bioreactors was equivalent (40 ± 1.71 hours in the SwRI bioreactor compared to 39 ± 0.34 hours for the PBS Mini). Cell viability post-harvest for both systems was also comparable at 95%. The manufacturing efficiencies from using the SwRI bioreactor included not having to separate the microcarriers from the cells during harvest which can lead to loss of product, and media utilization was decreased by 24% during the culture period decreasing material utilization and costs. Overall, the data indicates that the 3D printed bioreactor is a suitable option for BM-MSC expansion yielding similar cell yields and viability to the PBS Mini.

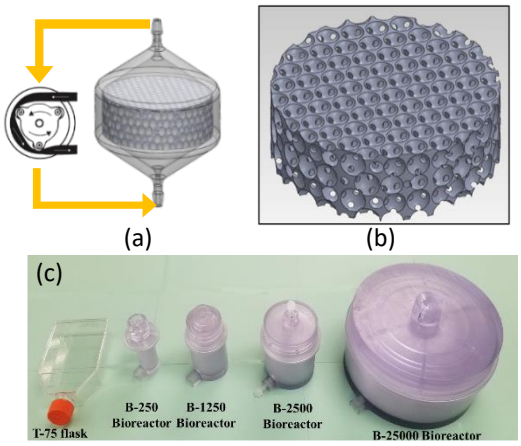

***Figure 1**: (a) Pump driven continuous perfusion bioreactor, with large surface-to-volume cell culture matrix (b). (c) The bioreactor is easy to scale to different sizes using additive manufacturing.*