

The use of TisXell system for MSC expansion

Advantages of TisXell system

Due to its unique biaxial rotation movement and consistent perfusion flow, TisXell system possesses a more homogenous flow pattern with less shear stress as compared to uniaxial rotating bioreactor system (including the spinner flask). Our previous computational fluid dynamics (CFD) analysis demonstrated that the TisXell system can combine the rotational effect from both axes and achieve better fluid transport and distribution than uniaxial rotation bioreactor (Figure 1). With this unique feature, TisXell system can be very helpful for micro-carrier based stem cell expansion, in terms of cellular distribution, proliferation and maintenance of MSC characteristics.

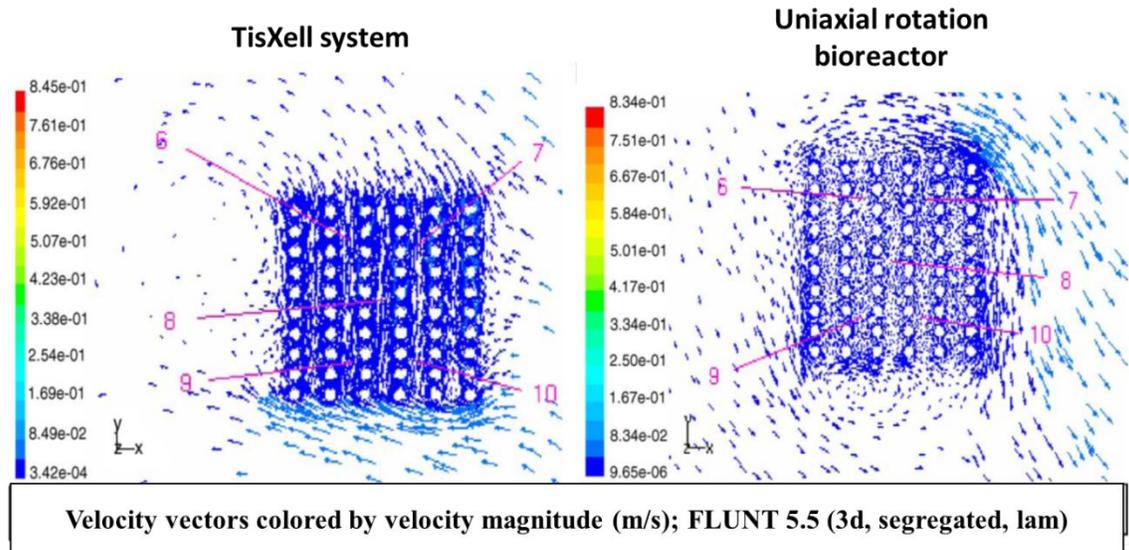


Figure 1 CFD analysis of the flow pattern of TisXell system as compared to uniaxial rotation bioreactor.

Preliminary study of TisXell system for MSC expansion

Screening suitable microcarrier system

In order to find out a favorable microcarrier for MSC expansion in the TisXell system, we screened for four different types of microcarriers as follows:

- Cytodex 1 (Positively charged surface)
- Cytodex 3 (Denatured collagen surface)
- Cultispher GL (Porous gelatin matrix)
- HyQSpheres P102-L (cross-linked polystyrene) □

Cytodex 3 was selected for the following study, because of its favorable surface for MSC adhesion (Figure 2) and least amount of microcarrier aggregation (Figure 3)

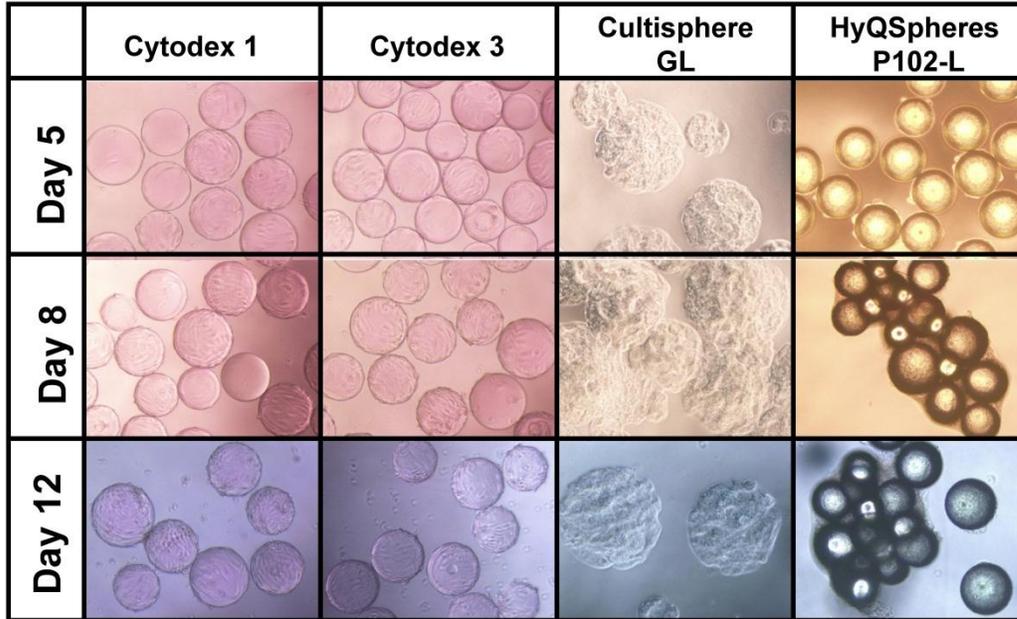


Figure 2 Cell adhesion onto different microcarriers

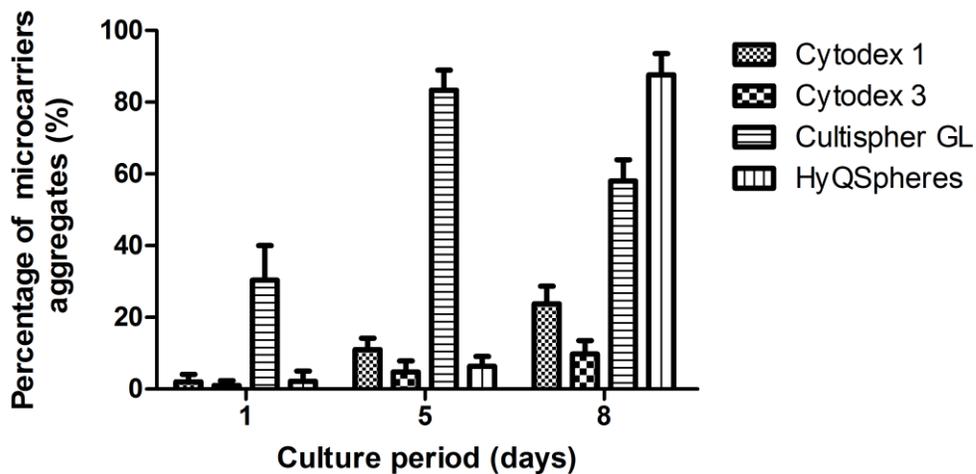


Figure 3 Percentage of microcarrier aggregation during the culture.

Comparison of TisXell system with Spinner Flask

After 7 days of expansion, TisXell expansion resulted in a more homogenous cellular growth on the microcarrier, where cells were homogenous distributed on every microcarrier and each microcarrier showed a similar confluence of cells; on the contrary, the spinner flask expansion led to the uneven cellular proliferation: a number of empty microcarriers were spotted (indicated by the red arrow head, Figure 4), while some microcarrier are saturated with cells. The homogenous cellular distribution and growth is critical to ensure the high yield of cellular expansion (making full use of surface area of microcarrier) as well as the high quality of cells after expansion (overconfluence of the cells may jeopardize their differentiation and proliferative potential).

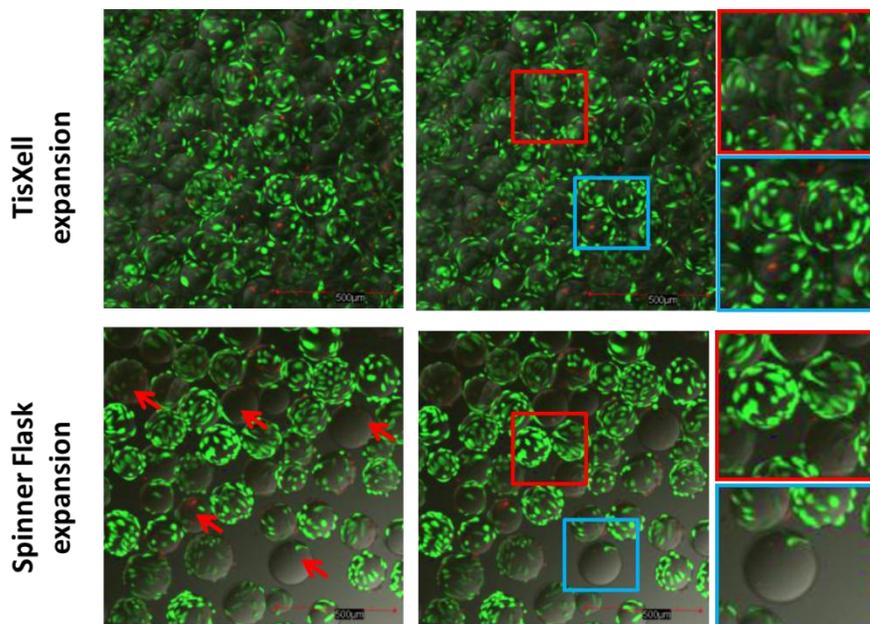


Figure 4 Comparison of cellular distribution on microcarrier