Novel Cell Immobilization Method Using Wettable Surface of Carrier

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Despite recent advances in medical supportive therapy, patients with severe fulminant hepatic failure (FHF) have mortality rate approaching 90%. To treat such patients, investigators have attempted to improve neurological status and survival rate by using various extracorporeal bioartificial liver (BAL) systems. The BAL will act as a bridge to provide patients with more time until a donor organ became available for transplantation or until their own liver can be regenerated.(1) Several requirements should be met for the BAL systems: (1) hepatocytes should be cultured in sufficiently high cell density; (2) their metabolic functions should be of sufficiently high level and duration; and (3) the BAL system module should permit scaling-up and aseptic handling. To satisfy a BAL system for clinical use, more than 10% of total human liver cells (about 2×10^{10} cells) are required. Therefore hepatocyte immobilization density should be up to 4×10^{7} cells/ml gel solution.

In the conventional immobilization process utilizing sodium alginate, cells are entrapped as bead type by dropping alginate cell solution into Ca ion solution. If the cells were immobilized with extremely high density, size of the Ca-alginate bead was minimized to prevent central necrosis due to hypoxia.(2)

In this study, we developed novel immobilization method using wettable surface and alginate. Ca-Alginate gel layer was formed on the surface of carrier by dipping the Ca-absorbed wet substrate into alginate solutions with hepatocytes. In this configuration, central hypoxic region was occupied by the carrier materials. Therefore, hepatocytes could be immobilized with higher cell density. In conclusion, this simple immobilization method can offer useful alternatives for the development of hepatocyte bioreactor for BAL system application.

References

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