Effects of cell density on liver functions of pig hepatocytes in Ca-alginate bead for the application of the BAL system

Ji-Hyun Lee[1], Doo-Hoon Lee[2], Ryu-Jae Nam[2], Shi-Yeon Kim[1], Kyue-Yim Lee[1], Doo-Hee Jung[3], Jung-Keug Park[3], Sung-Koo Kim[4], Young-Jin Kim[2], Kwang-Woong Lee[5], Suk-Koo Lee[5]

[1]Samsung Biomedical Research Center, [2]Life Cord Co. Ltd., [3]*Dept. of Chem. Eng.* Dongguk University, [4]*Dept. of Biotech. Bioeng.* Pukyong National University, [5]Samsung Medical Center

TEL: +82-2-3410-3679, FAX: +82-2-3410-3669

Abstract

To treat fulminant hepatic failure patients, various extracorporeal bioartificial liver (BAL) systems have been developed. Several requirements should be met for the development of BAL systems: (1) hepatocytes should be cultured in sufficiently high density; (2) their metabolic functions should be of sufficiently high level and duration; and (3) the BAL systems module should permit scaling-up and aseptic handling.[1,2]

One of the important factors for the design of the BAL system is the amount of liver tissue required for adequate bioactive support to the patient. For a device with a clinical reality, it must be scaled to a size that provides effective therapy. [2]

In this study, the urea secretion rate of encapsulated pig hepatocytes with Ca-alginate bead were determined to evaluate the optimum cell density for the application of BAL system. The urea synthesis rates were stable with cell density of 4×10^7 cells/ml in bead without oxygen and nutrient diffusion limitation. Thus, to satisfy a BAL system for clinical human use, 500mL of encapsulated hepatocytes with 4×10^7 cells/ml are required (more than 10% of total human liver cells).

References

1. Nagamori S., S. Hasumura, T. Matsuura, H. Aizaki, and M. Kawada. Developments in bioartificial liver research: concepts, performance, and applications, 2000. *J. Gastroenterol.* 35: 493-503.
2. Lee JH., DH Lee, JH Son, JK Park, SK Kim. Optimization of chitosan-alginate encapsulated process using pig hepatocytes for development of bioartificial liver, 2005. *J. Microbiol. Biotechnol.* 15(1): 7-13.