

Influence of Electric Field Variation on Intracellular K⁺ Ion Variations and Its Implication on Electrochemical Treatment

H. B. Kim¹, S. B. Sim², S. Y. Ahn^{1,3}, W. Chang⁴, J.-H. Li⁴, and Y.-L. Xin⁴

¹Solco Biomedical Institute, Korea

²Catholic University, Korea

³Coll. Nat. Sci. of Seoul National University, Korea

⁴China-Japan Hospitality Hospital, China

Electrochemical Treatment(EchT) has been applied clinically to patients with diseases of hemangioma, lung and liver tumors, and so on.

In EchT, high electric field induces damage in the cells, first on the membrane than any other cell organelles due to higher resistance of the phospholipid bilayers in the cell. The field-induced voltage drop mainly occurs on the membrane. Moreover, because the cell dimension is a few orders of magnitude larger than the thickness of the cell membrane, the strength of the induced electric field within the membrane is hundred to thousand times higher than the apparent strength of the applied field. Such electric field may result in damage of the membrane phospholipid bilayer and membrane proteins, and thus change the potential of voltage-gated ion channels, especially potassium channels. In this study, we present the study on the variation of intracellular potassium ions via the confocal microscopy, and by increasing the strength of applied electric field from 5 V and up between two electrodes 5 mm apart.