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Modeling the Chemical Kinetics of Atmospheric Plasma

김호영[1], 이현우[2], 김규천[3], 이재구[1,2]

[1]Department of Electrical Engineering, Pohang University of Science and Technology, Pohang 790-784, [2]Medipl Corporation, Pohang 790-834, [3]Department of Oral Anatomy and Cell Biology, School of Dentistry, Pusan National University, Pusan 602-739, Korea

Low temperature atmospheric pressure plasmas (APPs) have been known to be effective for living cell inactivation in the water [1]. Many earlier research found that pH level of the solution was changed from neutral to acidic after plasma treatment. The importance of the effect of acidity of the solution for cell treatments has already been reported by many experiments. In addition, several studies have demonstrated that the addition of a small amount of oxygen to pure helium results in higher sterilization efficiency of APPs [2]. However, it is not clear yet which species are key factors for the cell treatment.

To find key factors, we used GMoo simulation. We elucidate the processes through which pH level in the solution is changed from neutral to acidic after plasma exposure and key components with pH and air variation with using GMoo simulation. First, pH level in a liquid solution is changed by He+ and He(21S) radicals. Second, O3 density decreases as pH level in the solution decreases and air concentration decreases. It can be a method of removing O3 that cause chest pain and damage lung tissue when the density is very high. H2O2, HO2 and NO radicals are found to be key factors for cell inactivation in the solution with pH and air variation.

Keywords: He + air plasma, Global modeling, low temperature atmospheric pressure