

Chemically reactive species in liquids generated by atmospheric-pressure plasmas and their roles in plasma medicine

Satoshi Hamaguchi

*Center for Atomic and Molecular Technologies, Graduate School of Engineering, Osaka University,
2-1 Yamadaoka, Suita 565-0871, Japan*

Abstract. Plasmas whose gas temperatures are close to room temperature may be generated in ambient air or a gas at atmospheric pressure with the use of low-frequency high voltage or low-power radio-frequency (RF) or microwave power applied to electrodes. Such plasmas can serve as a powerful source of free radicals and/or chemically reactive species that arise from atoms and molecules of the ambient gas. Recently use of such plasmas for medical purposes has attracted much attention as they can be implemented in possible medical devices that can cause blood coagulation, heal wounds, facilitate angiogenesis, sterilize surgical devices as well as living tissues without harming healthy animal cells, and selectively inactivate cancer cells. Especially of interest among reactive species generated by atmospheric-pressure plasmas (APP) are reactive oxygen species (ROS) and reactive nitrogen species (RNS) that are generated in liquid phase. Since most living tissues and cells are immersed in liquids (such as blood or culture media), reactive species generated by APPs in the gas phase are transported to the liquid phase and possibly converted to different types of reactive species therein before causing some influence on the tissues or cells. In this study, we solve rate equations to evaluate concentrations of various reactive species in pure water that are originated by plasma reactions in atmosphere and discuss possible effects of such species (including ROS/RNS) on living tissues and cells.