Control of ROS and RNS productions in liquid in atmospheric pressure plasma-jet system\textsuperscript{1} GIICHIRO UCHIDA, TAIKI ITO, KOSUKE TAKENAKA, JUNICHIRO IKEDA, YUICHI SETSUHARA, Osaka University — Non-thermal plasma jets are of current interest in biomedical applications such as wound disinfection and even treatment of cancer tumors. Beneficial therapeutic effects in medical applications are attributed to excited species of oxygen and nitrogen from air. However, to control the production of these species in the plasma jet is difficult because their production is strongly dependent on concentration of nitrogen and oxygen from ambient air into the plasma jet. In this study, we analyze the discharge characteristics and the ROS and RNS productions in liquid in low- and high-frequency plasma-jet systems. Our experiments demonstrated the marked effects of surrounding gas near the plasma jet on ROS and RNS productions in liquid. By controlling the surround gas, the O\textsubscript{2} and N\textsubscript{2} main plasma jets are selectively produced even in open air. We also show that the concentration ratio of NO\textsubscript{2} to H\textsubscript{2}O\textsubscript{2} in liquid is precisely tuned from 0 to 0.18 in deionized water by changing N\textsubscript{2} gas ratio (N\textsubscript{2}/(N\textsubscript{2} + O\textsubscript{2})) in the main discharge gas, where high NO\textsubscript{2} \textsuperscript{-} ratio is obtained at N\textsubscript{2} gas ratio at N\textsubscript{2}/(N\textsubscript{2} + O\textsubscript{2}) = 0.8. The low-frequency plasma jet with controlled surrounding gas is an effective plasma source for ROS and RNS productions in liquid, and can be a useful tool for biomedical applications.

\textsuperscript{1}This study was partly supported by a Grant-in-Aid for Scientific Research on Innovative Areas Plasma Medical Innovation (24108003) from the Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT).

Giichiro Uchida
Osaka University

Date submitted: 09 Jun 2016

Electronic form version 1.4