
Novel cancer treatments based on synthetic approaches of plasma-activated liquids

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Plasma medical science is a novel interdisciplinary field which combines the plasma science and the medical science. We have previously developed the non-thermal atmospheric pressure plasma with a high electron density, and it was applied for cancer treatments. We found that the culture medium irradiated with the plasma exhibited anti-tumor effects on cancer cells, and this medium was denoted as “plasma-activated medium” or PAM. After the discovery of PAM, components which exhibit anti-tumor effects in the PAM have been extensively studied. In addition, functional molecules to enhance the anti-tumor effects have been searched. We have focused on the fullereneol to be introduced into the medium because it is soluble in the water, it has little cytotoxicity, and it can scavenge radicals. It was found that the plasma-treated fullereneol had cytotoxic effects. We also developed various types of plasma-activated solutions. For example, we previously treated Ringer’s lactate solution with the plasma, which was denoted as “plasma-activated Ringer’s lactate solution” or PAL. It was demonstrated that the PAL had strong anti-tumor effects, and only lactate in the four components in Ringer’s lactate solution exhibited anti-tumor effects through activation by the plasma. Anti-tumor factors in the PAL were evaluated using NMR and mass spectrum analyses, and we identified several products which are candidates for the anti-tumor factors