Plasma Synergy with Conventional Therapies for Cancer and Wound Sterilization

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Ambient gas plasmas are cytotoxic to cancer cells and bacteria at least in part because they create reactive oxygen and reactive nitrogen species (RONS). It is known that these reactive species can also play important roles in conventional therapies, including cancer chemotherapy and antibiotics. For example, anti-tumor synergy between NO-donating compounds and some redox-active chemotherapeutics has been documented [1]. We therefore explored the possibility that plasma-generated RONS could act synergistically against cancer and bacteria with conventional chemotherapeutic agents and antibiotics, respectively.

Treatment of MCF7 breast cancer cells by indirect dielectric barrier discharge and subsequent flow cytometry shows that cytotoxicity correlates with an increase in intracellular reactive oxygen species. Additionally, plasma treatment acidifies the culture medium, and creates nitrates, nitrites, hydrogen peroxide and/or ozone. These species are known to have anti-cancer activity. Plasma treatment of cancerous cells with and without mutant p53 is compared, as well as non-cancerous cells, both immortalized and non-immortalized.

Air plasma antibacterial effects include not only direct killing but also inactivation of pyrogenic bacterial compounds such as lipopolysaccharide (LPS) and lipid A. Since many antibiotics are known to act via ROS [2], we investigated plasma treatment combined with antibiotics to test for possible synergy in this application as well.

References

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