The physical and chemical characteristics of non-thermal plasma treated solution-mist spray: a first step toward optimization in disinfection process

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There are lots of food-borne disease outbreaks such as Listeria and Norovirus in various food products. A non-thermal plasma treatment to solution could be considered to solve these problems since it is known as non-chemical and non-thermal sanitizer. Due to this reason, there are some reports dealing with water activation using underwater and water-surface plasma discharge. Recently, the use of water droplet is highlighted in plasma treatment process. Without external gas injection, plasma treated solution-mist spray may have some features. i) there is negligible generation of reactive nitrogen species. ii) there is no pH drop, and iii) large-area could be covered because of spray process. Therefore, plasma treated solution-mist spray could be efficient for removing microorganisms and impurities in food processing. Nevertheless, there is only few report dealing with plasma treated solution-mist spray.

In this study, one plasma treated solution-mist spray system is tested to determine its potential application. Two electrodes consist of titanium cylindrical plates and solution flows perpendicular to electrodes. The flow rate of solution was maintained using liquid mass flow controller and pump, and no external gas was injected to this system. I-V curve was used to determine electrical properties during plasma generation. The size and distribution of plasma treated solution-mist spray were measured using laser diffraction system. Spectrophotometric methods was employed to determine the concentration of hydrogen peroxide by collecting 5 mL of spray. Plasma generation was identified by I-V curve. A large amount of micron-sized plasma treated solution-mist spray was observed, indicating a tremendous specific surface area. The concentration of H2O2 was approximately 20 mg/L. Specific results will be shown at ICMAP 2018. Based on our results, plasma treated solution-mist spray could be used effectively in food washing process.

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