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Cold Atmospheric Pressure Plasmas for Food Applications

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ABSTRACT

Successfully distributing shelf food requires treatment to eliminate microorganisms. Current chemical methods, such as chlorine wash, can alter food quality while only being effective for a limited time. Cold atmospheric pressure plasmas (CAPs) can eradicate the microorganisms responsible for food spoilage and foodborne illness. Optimizing CAP treatments requires understanding the reactive species generated and relating them to eradication efficiency. Recent studies have used optical emission spectroscopy (OES) to determine the species generated in a sealed package that would hold food. In this study, we supplement the OES results with optical absorption spectroscopy (OAS) using the same gases (helium, nitrogen, compressed air, humid air) to elucidate plasma chemistry and temperature. We first reproduce previous results using a new setup while assessing the impact of the package and surrounding box on the plasma spectrum. A UV-Vis light source is emitted through a series of lenses placed next to the plasma. Analysis using SpecAir software allows the identification of absorbed peaks and the calculation of rotational, vibrational, and electron temperatures. Results show that the air plasma produces a primary absorbance peak at a wavelength of ~260 nm, demonstrating the diagnostic capability of this technique. Species generation declined dramatically during the first two minutes of treatment with the effect leveling off thereafter. These findings elucidate reactive species generation within the plasma to optimize CAP systems for microorganism decontamination.

KEYWORDS

Cold plasmas, food sterilization, optical absorption spectroscopy, dielectric barrier discharge, high voltage