Title Evaluation of chemical and photochemical oxidation processes for postharvest processing of lowbush blueberries (*Vaccinium angustifolium*)

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Abstract

Lowbush blueberries (*Vaccinium angustifolium*) indigenous to the state of Maine are commercially processed prior to freezing and marketing as an IQF (individually quick frozen) product. Chlorinated water sprays are typically relied upon to improve the microbiological quality of blueberries; however, chlorine-alternatives are receiving increased attention for application in postharvest processing due to the limited effectiveness of chlorine and public health and environmental concerns over toxic byproduct production. The primary objectives of this research were to isolate and identify predominant bacterial flora on lowbush blueberries, to comparatively evaluate the antimicrobial effectiveness and pesticide degradation capacity of single treatment methods (H_2O_2, UV, Cl_2, O_3) versus advanced oxidation processes (AOPs) (H_2O_2/UV, Cl_2/UV, O_3/H_2O_2/UV), and to determine the effects of these oxidation treatments on quality parameters such as anthocyanin content and blueberry color. In addition to these objectives, the predominant bacterial species isolated from lowbush blueberries were evaluated for their role in enhanced biodegradation of phosmet on blueberries and in aqueous media supplemented with phosmet.

Enterobacter agglomerans and *Pseudomonas fluorescens* were the most frequently isolated bacteria on lowbush blueberries. In comparison of single processes versus AOPs, 1% hydrogen peroxide and 1 ppm ozone yielded dynamic reductions in the population of common spoilage bacter while maintaining the quality of lowbush blueberries. Improvement in chemical safety of blueberries was achieved by application of UV or aqueous ozone which resulted in reduction in phosmet residues without inducing oxidation of phosmet to phosmet oxon. Compared to the current industry standard, ozone represents the most efficacious, environmentally-benign postharvest treatment capable of improving the microbial quality and chemical safety of Maine wild blueberries without negatively affecting the quality as defined by anthocyanin content and pigment retention.

Isolates of *E. agglomerans* and *P. fluorescens* proved capable of degrading phosmet on blueberry fruit and in aqueous systems through substrate utilization as a carbon source. Microbial mineralization lessened the toxicity of residues by degrading phosmet to secondary and tertiary metabolites. According to experimental results, mineralization by these isolates represents an active metabolic pathway for phosmet degradation pre- and post-harvest which is critical to understanding the environmental synergy between blueberries and indigenous microflora.