Evaluation of novel cold plasma treatment to reduce surface fungal colonization of sugar beet roots to improve postharvest storage

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Sugar beet (Beta vulgaris L) is one of the major sources of sugar in the United States of America. It is a major crop grown in Minnesota and North Dakota. Sugar beets are prone to attack by various fungi including *Botrytis, Penicillium,* and *Phoma Betae.* An increase in the respiration rate and accumulation of undesirable invert sugars during storage deteriorates sugar quality and sucrose extraction efficiency. This leads to economic losses during sugar extraction. Approximately 30 lbs. of sugar per ton is lost due to challenges faced during post-harvest storage. To combat fungal infestation, fungicide application is a common mode of operation. However, rising consumer awareness regarding “clean label”, an increase of pesticide and chemical residues in the environment, development of resistant fungal strains has necessitated the usage of novel and sustainable nonthermal technologies. Cold plasma is one such emerging technology. It can offer a non-fungicide approach by deactivating surface colonies of fungal species. Cold plasma involves the generation of plasma (a cocktail of electrons, protons, atoms, and molecules in a metastable state) at lower/ambient temperatures with gases like Argon, carbon dioxide, and nitrogen to create surface modificati capabilities without causing major changes in the bulk composition. Plasma has the potential to degrade mycotoxins, damage DNA, and disrupt cellular machinery. Several advantages of this technology include low energy consumption with a reduced energy footprint, applicability at in-line treatments, and being environmentally friendly. This project seeks to evaluate the potential of atmospheric pressure jet plasma and plasma-activated water in decontaminating fungal colonies on the surface of sugar beets at different intensities and periods of exposure. This research will help us analyze the effect of cold plasma on sucrose quality and invert sugar concentration. The treatment could be used either at the farm level after harvest or on a commercial scale where millions of sugar beets are stored after harvest for processing. Since the sugar beet farmers receive a premium based on the sugar content in the beets, this could help the growers and processors improve their profit margin. This will not only boost productivity but also significantly minimize post-harvest losses.