

Influence of cold plasma treatment on corn starch

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Plasma technology is considered one of the new green technologies available for food and materials processing. Starch, a polysaccharide of plant origin, with a structure composed of amylose and amylopectin molecules has great nutritional and industrial importance. The objective of this work was to improve corn starch's chemical and structural properties by applying dielectric barrier discharge (DBD) plasma treatment.

The effects of DBD plasma treatment on corn starch composition, crystallinity, solubility, turbidity, water absorption, and morphology were evaluated by varying the plasma excitation frequency (100 to 300 Hz) and processing time (10 to 20 min) at a constant electrical potential difference (20 kV). Analysis of amylose content, solubility, water absorption index (WAI), turbidity, FTIR, contact angle, and Scanning Electron Microscopy (SEM) were performed to characterize the material before and after treatment.

The highest change in most starch properties occurred when applying an excitation frequency of 200 Hz after 20 min of treatment at 20 kV. Amylopectin content increased by 8% (from 76 to 82% w/w) due to internal branching reactions that occurred on amylose. The chemical changes induced a lower starch solubility and higher hydrophobicity which improved the film formation ability of this starch.

Water absorption index and turbidity remained stable after plasma treatment. The FTIR 1045/1022 cm⁻¹ and 1022/995 cm⁻¹ bands ratio indicated a change in the ordered structure in the external region of the starch and higher crystallinity. The morphology of the starch granules showed that plasma treatment created some cracks and pores in the granules but did not affect their integrity.

These changes facilitate the gelatinization of corn starch which is interesting for several applications. The lower amylose content may improve digestibility which can be interesting for some food products.