**Functionality modification of arrowroot starch by atmospheric pressure pin-to-plate**

**cold plasma: powder flow, functional, rheological, thermal, and structural properties**

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**Abstract**

The study focusses to alter the functional properties of [arrowroot starch](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/arrowroot-starch)  by a novel and green technology based atmospheric pressure pin-to-plate cold plasma. The plasma set up consists of two electrodes, the top [electrode](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/electrodes) possess multiple pins for showering of corona discharge of electrons to provide adequate modification. Arrowroot starch (10 g) was exposed to the cold plasma and subjected to three different input voltages (190, 210, 230 V) for a time duration of 5–15 min and studied for the changes in intrinsic viscosity average molecular weight , powder flow properties, functional (water and oil binding capacity, pH, gel hydration, turbidity), rheological (pasting and steady shear flow), thermal (DSC) and structural (FTIR, [XRD](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/x-ray-diffraction), SEM) properties. With cold plasma treatment, molecular weight of the starch was observed to have increased evincing the cross-linking phenomenon which has also been observed in increase in peak viscosity of the starch pastes (4.33%–11.98%). The steady shear viscosity measured at 50 s−1 of the plasma-treated starch also enhanced greatly (15.44%–223.83%) than the untreated. Introduction of acidic and hydrophilic functionalities confirmed by FTIR along with surface etching phenomena under SEM have resulted in the pH minimization (from 5.41 ± 0.03 to 4.01 ± 0.01), rise in water (22.5% rise in 230–15) and oil binding (8.46% in 230–15), swelling volume (50% rise) and solubility index (240% rise), increase in paste clarity. The increase in % of crystallinity in the plasma-treated arrowroot starch was correlated with the increase in gelatinization enthalpy showing the thermal stability of plasma-induced crosslinking of arrowroot starch. This evinces that cold plasma can be a potential green modification technology to enhance different properties of starch making them clear, highly viscous, more hydrating, shear, and thermally stable starches.

**Keywords:** Arrowroot starch, Cold plasma, Cross-linking, Enthalpy, Molecular weight, Stable gel.