Release, Recovery and Functionalization of Pectic Hydrocolloids from Citrus Juice Processing Biomass

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Commercial pectin production currently relies heavily on citrus peel. Extraction and isolation of food grade pectin is a complicated process involving a large number of unit operations which contribute to the relatively high product cost. Less expensive recovery technologies are required if non-food applications are to be enabled. Pectic hydrocolloids are highly functional molecules having the ability to modify the rheology of aqueous systems, to serve as ion capture agents and to act in hydration control. They are complex polysaccharides composed of two dominant regions. The homogalacturonan region, a linear polymer of galacturonic acid, is flanked by rhamnogalacturonan I regions in which rhamnose serves as a branch point for galactans and arabinans. Charged and neutral domains found within the homogalacturonan regions are major contributors to pectin’s biological and technological functionality. Worldwide citrus processing biomass was projected to be 4.2 × 109 kg (dry) for the 2013 – 2014 harvesting season, containing potentially 840 Mkg of pectic hydrocolloids. The United States citrus processing biomass for the 2012 – 2013 harvesting season was 550 dried Mkg that could be used to produce 110 Mkg of pectic hydrocolloids (nearly two times the world’s annual pectin production). To facilitate the release and recovery of the pectic hydrocolloids from their intracellular entrapment within juice extracted citrus peel we have developed a continuous, pilot-scale steam-explosion process. By injecting steam into the flow of citrus peel through a pipe at 150 °C their subsequent recovery using a simple water wash was enabled. Over multiple seasons an average of 72% of the pectic hydrocolloids present in the peel were recovered with a water wash. Their composition and macromolecular properties were determined. Multiple subpopulations could be identified by SEC-MALS chromatography. Their viscosifying properties following cold, alkaline demethylesterification also were determined.