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Bio-based fiber gums from agricultural biomass and their applications in food and beverages

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Bio-based fiber gums (BFGs) are arabinoxylans (Hemicellulose B), isolated from various low value agricultural residues (corn stover, wheat straw, etc.), agricultural processing by-products (corn fiber, wheat bran, rice fiber, sorghum bran, sugar cane bagasse, etc.) and energy crops (switch grass and giant miscanthus) by alkaline treatment. The BFGs, isolated from different agricultural materials are purified and characterized by proximate analysis, carbohydrate compositional analysis and HPSEC to obtain molecular characterization including molecular weights, radius of gyration and other molecular characteristics. Functional assays were conducted to test them for their ability to act as emulsifiers, antioxidants, soluble dietary fibers and other industrial functional ingredients. They appear to have useful properties as emulsifiers, antioxidants, dietary fibers and other food and industrial ingredients. Like corn fiber gum (CFG), these polysaccharides are unique in making low viscosity solutions, even at high concentrations, and have been proposed as good stabilizers for oil-in-water emulsions. Understanding the functional properties of BFGs isolated from several agricultural sources will be beneficial from their commercialization point of view for their use in food and non-food industries.

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Tomato industrial waste applications in sustainable soil pest management and biogas production

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Food, agriculture, and energy are intricately connected. Sustainable agriculture and food processing requires recycling waste streams for beneficial processes such as soil treatment and energy production. Exploiting new energy sources that could reduce the use of fossil fuels is important for a future with sustainable energy. Renewable organic resources such as tomato pomace (TP) can provide low-cost sustainable energy. From the viewpoint of food vs. energy, organic waste can be a high-value energy source that does not impair food production. Additionally, food waste may be utilized for soil amendment to benefit sustainable agriculture. There is an ongoing effort to try to reduce the use of hazardous chemicals in soil pest management, and agricultural waste amendment is one possible solution to the problem. Our results indicate that the soil microorganisms converted TP into different metabolites and heat through cellular respiration. Biosolarization demonstrated 100% weed mortality for mustard and nightshade seeds over 5 days. In the AD study, we enriched the endogenous microbial community in cattle manure to produce biogas from TP in a 30% solids digestion with a 10% organic loading rate. Biosolarization was effective by having a synergistic effect on weeds and soil pathogens by combining solar heating with microbial activity. The exploitation of agri-food waste can lead to energy recovery, soil treatment, and waste management cost reduction.

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