Assessing the Viability of Using Spent Coffee Grounds To Make Cellulose-Based Biodegradable Food Packaging Films

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Plastics pose a major environmental problem to the planet as they take around 700 years to degrade completely. Consequently, the demand for alternate and environment-friendly materials is rising. Cellulose extract from bio-waste is one for combating plastic perils, and spent coffee grounds (SCGs) stand out as a promising, sustainable, and inexpensive bio-waste material. SCGs are the residue of the ground coffee obtained after the beverage preparation, with an estimated annual production of 8 million tons considered waste and discarded. Our project assesses the viability of extracting cellulose from SCGs to develop biodegradable and plastic-replacing films. Methods: Films were made by adding varying amounts of SCGs extract to microcrystalline cellulose Avicel, solubilizing in zinc chloride, and crosslinking with calcium chloride. Results: The Avicel films are transparent. However, with increasing the SCGs extract, their darkness increases, and light transmittance decreases but with enhanced blocking of UV radiation. The films with a tensile strength above 10 MPa are stronger than the commercial low-density polyethylene films but biodegrade within 15 days at 24% soil moisture content. Conclusion: The extracted fraction from the spent coffee grounds yields biodegradable films crucial for designing and developing non-plastic packaging materials.

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