

Opuntia (Cactaceae) As Sustainable Feedstock For Ecological And Green Materials

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Abstract:

Bio-based materials from biomass resources generated a wide use of industrial crops in recent years, and have received potential applications in several sectors, due to the human desire to consume sustainable and ecological products. *Opuntia* (Cactaceae), were mainly studied as cellulosic resources for their sustainability and cellulose content richness. Cellulosic fibres from *Opuntia* feedstock was exploited for value-added applications such as (i) fibrous-network reinforcement in composites and paper manufacturing (ii). A green process for cellulosic fibrous-network extraction was used and their morphology, fundamental properties, chemical and structural compositions, was studied. The obtained fibrous-networks were incorporated into PVOH and SBR thermoplastic polymers; their properties towards enhancement, swelling and biodegradability have been studied.

Opuntia was used also for paper manufacturing as non-woody fibers by applying two different pulping processes. The first procedure is based on the utilization of semi-chemical treatment using a soft operation of chemical delignification in soda-hydrogen peroxide (soda-HP) mixture and mechanical

grinding for fiber deliberation. The second procedure is a chemical treatment with soda-anthraquinone mixture (soda-AQ). The investigations of the obtained bio-based crops show the suitability of *Opuntia* (Cactaceae) for the new trend in ecological and green materials.

Opuntia (Cactaceae) is a cactus (non-forest and perennial plant) from tropical, subtropical, arid, and semiarid regions, which exists in the form of a shrub or a tree and has an original-look/unique morphology with a height of up to 5 m and produces a sturdy trunk as it ages. This particular species exhibits extraordinary water storage capacity and is known for their drought-tolerant characteristics (xerophytic). A wide variety of this species and subspecies has been developed, distinguished by spiny or spineless cladodes, cladode shape, branching, fruit color, pulp color, epicuticle wax morphology, and many other properties. Cactaceae is a great tree-like cactus formed by numerous up-flat branches (cladodes) [8, 9]. In branches, cellulosic fibrous tissues are slowly grown and arranged in parallel and fuse laterally with neighboring ones, forming a flat net-like structure [10], strongly similar to the cellular structure of *Luffa* cylindrical fibers.