Transformation of Leather Industry Bio-Wastes into High-Value Multifunctional Materials

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Abstract
Massive growth of industrial production to support the booming world population is intimately linked to the rapid exhaustion of natural resources, a grand challenge facing humanity today. One such challenge is environmental sustainability and pollution mitigation, which have received considerable attention in several industries including leather. Leather industry produces huge quantities of bio-waste that can be used as a precursor for the bulk synthesis of composite, bio- and nano-materials. In this context, our research group has developed a range of multifunctional novel materials such as a) flexible composite sheets\textsuperscript{1-3}, b) hybrid biodegradable films\textsuperscript{4,5}, c) hybrid biofibers\textsuperscript{6}, d) self-doped carbon nanomaterials\textsuperscript{7}, e) conducting nanobiocomposites\textsuperscript{8}, f) chromium-carbon core-shell nanomaterials\textsuperscript{9} and g) magnetic nanobiocomposites\textsuperscript{10} by utilizing the collagen based wastes generated from leather industries. The developed multifunctional materials exhibit outstanding properties such as biodegradability, biocompatibility, flexibility, electrical conductivity, magnetism and luminescence. The derived materials were demonstrated as an efficient candidate in high-value applications such as Li-ion batteries, catalysts in organic reactions, electromagnetic interference shielding, tissue engineering and also as a proficient absorbent towards oil contamination and toxic dyes. These approaches highlight new avenues for converting industrial bio-wastes into useful multifunctional materials in scalable and inexpensive ways thereby minimizing pollution and enhancing environmental sustainability.

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References


