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Physical recycling of Polypropylene: green strategy of dissolution-precipitation with natural solvents

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Polypropylene (PP) is one of the most widely used thermoplastics thanks to its properties. It is cheap and flexible, it has high temperature resistance and chemical inertness and for these reasons it is optimum for long-term applications.[1] However, polypropylene is a downstream petrochemical product since it results from the polymerization of olefin monomer propylene. Physical recycling, and dissolution–precipitation in particular, makes use of solvents to recover the polymers without degradation or structural modifications, resulting in high quality recycled plastics. Dissolution–precipitation processes allow selective dissolution of a target polymer, also from a mixture of plastics, that can be recovered by precipitation, converting it back to a solid plastic, through the addition of an antisolvent or by lowering the temperature of the system.[2]

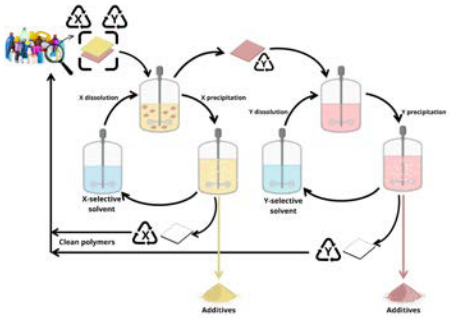

Figure 1: General scheme of a dissolution-precipitation process.[3]

Therefore, in this work a new strategy to recycle different types of PP wastes was developed, using natural solvents for the dissolution, in particular terpenes. The polymer was recovered efficiently, with high quality and maintaining the pristine properties. The solvent was also recovered with high purity, making it a fully circular process.

References:

(1) Maddah, H. A. *American Journal of Polymer Science* 2016, *6* (1), 1–11.
(2) Aparício, S. C.; Castro, P. M.; Ribeiro, B. D.; Marrucho, I. M. *Green Chem.* 2024, *26* (11), 6799–6811.
(3) Aparício, S. C.; Resende, J. V. M.; Ribeiro, B. D.; Marrucho, I. M. *ChemSusChem* 2025, e202500018.

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