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Nanofiltration-enabled *in situ* solvent recovery and recycle

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Sustainable manufacturing is one of the grand challenges of the 21st century. It has recently been realized that conventional downstream separation processes are unsustainable because they can account for as much as 80% of the total manufacturing costs and eventually contribute to 50% of the industrial energy usage. With profit margins growing thin, there is an imperative drive for minimizing both the cost and environmental impact via process intensification (PI). PI through minimizing solvent and raw material consumption, as well as utilizing waste, can make a significant difference towards environmentally benign and economically viable chemical production. As effective PI tools, nanofiltration and molecular imprinting technologies are getting recognized as emerging technologies that provide green process engineering. The presentation covers the development of sustainable separation processes based on nanofiltration and imprinted materials. Examples and industrial case studies for solvent recovery and recycling, yield enhancement, purity improvement, valorization of agricultural waste are discussed. Imprinted materials offer unique separations including three-way fractionation of solutes in organic media. Synergistic coupling of imprinting and nanofiltration technologies for hybrid processes will be demonstrated. Examples will demonstrate that separation processes based on nanofiltration and molecular imprinting can reduce carbon footprint by 90% and process mass intensity by 99%.

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