Resource recovery and biorefinery potential of apple waste towards to circular bioeconomy

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Apple is among the most consumed fruits in the world and the expansion of their processing is increasing the generation of waste such as apple pomace. It finds some applications in food and feed systems, anaerobic digestion, and composting; however it most ends in landfills or in informal disposal. Therefore, waste management strategies that address this waste accumulation need to be explored. This review provides a state-of-art of valorization strategies adopted for recovery of value added products from apple processing-derived waste and discusses on their development stage. The research community has laid most of its efforts on incorporation of apple pomace into feed and food systems and in the development of pectin- and phenolics-extraction methods. Incorporation of apple pomace in feed and food systems is still negligible due to its low protein and high fiber contents. Therefore, coupling apple pomace with microbial conversion for nutritional upgrade could change this scenario. Some environmentally-friendly techniques have been developed for extraction of pectin and phenolics, but major developments are needed on their integration to attain tailored extraction of several compounds. Recovery of value added routes of apple pomace towards production of bio-chemicals are characterized by lack of deep research studies and of a holistic approach. Integrated approach with techno-economic analysis, life-cycle assessment, and inter-sectorial initiatives will possibly reveal the most promising valorization routes.

Keywords: Apple pomace, Biochemicals, Biorefineries, Value-added products, Waste management