The biorefinery of household food waste

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Abstract

The introduction of the Circular Economy Package in 2015 determined the need for a shift from a linear to a circular economy model for European society. In this context, the package defined the update of the Waste Framework Directive of 2008: the new Directive, just introduced, sets new targets regarding the share of municipal waste prepared for reuse and recycling to be met by 2025 (60%) and 2030 (65%) and to ensure the separate collection of bio-waste for all Member states where technically, environmentally and economically practicable.

The setting of these new targets for municipal waste implies the necessity to improve the separate collection schemes for segregate household food waste: in the EU food waste accounts for 89 million tons, or 180 kg per person per year.

The separate collection of this stream of waste, especially through the door-by-door system allows for the recovery of large amount of material characterised by interesting features like: high BOD and COD content and biodegradability, a low content of inert material (typically < 5% non compostable material), presence of interesting compounds (cellulose, proteins, fats..), ubiquitous… (see figure 1).

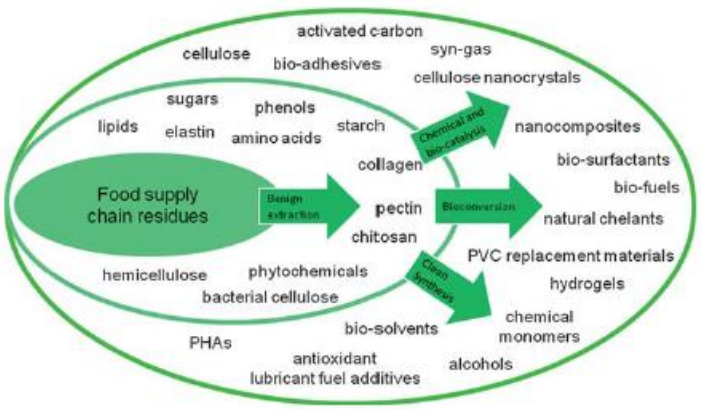

Figure 1 - Components present in food waste and routes of conversion (in Lin et al 2013).

Today, when not massively disposed of via landfilling or incineration, this material is valorised via anaerobic digestion and composting but, because of its specific characteristics, it can be considered a renewable source for the production of interesting building blocks and other biomolecules of interest of the chemical industry.

So, the future efforts of researchers will be to increase the added value of compounds recovered form household food waste.

In particular, short chain fatty acids can be easily produced in anaerobic conditions via biological fermentation. These molecules are linear short-chain aliphatic mono-carboxylate compounds, having from two (acetic acid) to six (caproic acid) carbon atoms. Due to their functional groups, VFAs are extremely useful for the chemical industry: carboxyilic acids are precursors of reduced chemicals and derivatives (esters, ketones, aldehydes, alcohols and alkanes) in conventional organic chemistry. Moreover, they are also well known substrates for the production of biofuels like methane and hydrogen as well as biopolymers, such as polyhydroxyalkanoates (PHAs) (Raganati et al., 2014 and Domingos et al., 2017).

Figure 2 gives a visual sketch of the ongoing research activities in the field of anaerobic fermentation of household food waste for SC-VFA production (Strazzera et al., 2018).

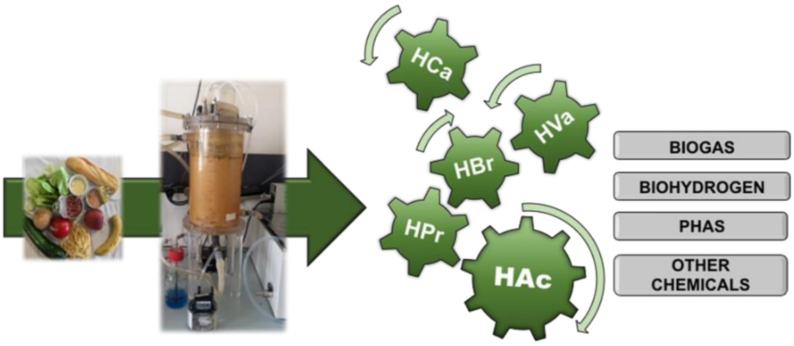

Figure 2 – Conversion of food waste into short chain volatile fatty acids and derived chemicals

References

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