

Circular Economy in the food industry.

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Abstract

Food is one of the three main pillars of the water-energy-food (WEF) nexus. The links among the three are responsible for the sustainability of society. While this nexus is a current trend analyzed and implemented in the chemical and power industries,¹ food production companies are product oriented,^{2,3} that do not typically work as chemical complexes. However, total site integration⁴ is an example from the chemical industry that can bring benefits allowing energy savings, improving the sustainability and the economics of the facility. By integrating the residues, it is possible not only to produce added value chemicals, but also to reduce the consumption of utilities while managing and valorizing the waste generated in their operation. By reusing the waste, the principles of circular economy are implemented within the food industry.

To illustrate the possibilities of circular economy on the food industry a methodology is developed for the identification of the portfolio of products, based on the development of key performance indexes, KPI, (i.e. economic, process operation and energy, process safety). Next, the process is design following a hybrid heuristic-mathematical optimization approach. After a prescreening of the technologies, a mathematical optimization approach is used to formulate a superstructure. Three representative cases of European interest products are shown such as the oranges⁵, the olive oil⁶ and the coffee⁷ are presented to show the possibilities of obtaining high added value products such as essential oils, antioxidants, extracts and dyes as well as providing a fraction of the power and thermal energy required non only for the section of the facility but to the entire integrated process.

Keywords: Circular Economy; Food industry; Process integration; High added value products

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