

Recycling of Waste Oils: Technology and Application

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Reducing the impact of human activity on the environment and, in general, on Earth, represents the most challenging target of the next years. It is mandatory to promote a sustainable development, able to cope from one side with the increasing demand of goods, and from the other with the availability of raw materials while preserving our ecosystems.

In particular, increasing industrial production at any level is stressing the pool of available raw materials, turning many elements into critical.

Many efforts toward a sustainable development have been conducted by experts in different fields, including academic, industry, politics, and non-governmental organizations. As a general and transversal trend, the conversion of processes based on linear economy into circular one has been object of intensive work during the last years, and it represents one of the main targets of the next future. For implementing circular processes, it is mandatory to convert the term “waste” into “raw material”. Nevertheless, this important change in common thinking should be accompanied by a specific progress in the available technologies which would allow to transform by-products into valuable goods. Furthermore, the conversion of these new raw materials in added-value products should be achieved in a sustainable way, both in terms of economics and environmental pollution.

In this context, a big family of potential raw materials it is represented by waste oils. These are typically generated from the lubricant chain (mineral waste oils), from the food chain (vegetable used oils), and from some industrial processes as the pyrolysis of plastics or from the extraction industry. The possibility to develop new and improved ways to recycle these products attracts the interest of many stakeholders from public and private sectors.

In this Special Issue, a collection of recent studies about the recycling of oils are presented. The main topics here represented include:

- The waste generated from the prickly pear industry [1] and recovering and transformation of used vegetable oils (UVOs) [2].
- The exploitation of the oil produced from pyrolysis of plastic wastes [3].
- Some recent advances in polymer flooding technique for the enhanced oil recovery [4].

As the more representative topic is represented by the processing of UVOs, an overview about the technology currently available for its transformation [2], and the recently updated European Union legislation related to UVOs employment as raw materials [5], are also provided. The importance of this topic is due to the specific chemical composition of UVOs which, despite the waste nature of the product, is quite similar to the edible parent oil, basically composed by a mixture of glycerol-derived fatty acids. Fatty acids are known to be important raw materials as they can be easily converted into biodiesel, lubricants, and solvents. As the specific chemical composition of the collected UVOs can influence their destination, fast and low-invasive techniques of analysis are needed. In this regard, the application of several Nuclear Magnetic Resonance (NMR) techniques to the characterization of the fatty acid profile of UVOs is of high interest, as described by Di Pietro and coworkers in their review paper [6].

Apart from NMR-based techniques, which are able to furnish relevant information about the chemical composition of an oil, important insights about the properties of the



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minor components present in the raw material can be achieved by the analysis of the volatile fraction, as well as by the determination of the in vitro antioxidant activity or by the analysis of the total phenolic content [1].

In the end, the challenge to turn into sustainable and low impacting many processes which involve the employment of waste oils as raw materials is still open, and the progresses reached to date represents the basis for the milestones of the future.

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