

Lipid Extraction

FEEDSTOCK CLASSIFICATION

Plant-based oils; fats, grease & offal

FEEDSTOCK EXAMPLES

- [beef tallow](#)
- [debarking waste](#)
- [edible offal](#)
- [field corn](#)
- [inedible offal](#)
- [rapeseed](#)
- [scrap/spoilage \(meat packing\)](#)
- [soybeans](#)
- [sweet corn](#)
- [waste cooking oil](#)
- [wastewater \(meat packing\)](#)

PROCESS DESCRIPTION

Lipid extraction involves non-destructively removing compounds such as terpenes, esters and triglycerides from the other constituents of an organic feedstock. This is done with solvents, typically alcohols. The desired lipid compounds are dissolved in the solvent for later separation. The process is complicated by the physical nature of the biomass particles from which the lipids are being extracted, as the solvent needs to saturate the particle through its natural pores and pathways to reach the lipids, and then carry the dissolved compounds out the same way. The rate at which the compounds are removed from the biomass is the process bottleneck, and so processes are designed to maximize diffusivity, including heating and pressurizing the solvent, although the lipids may be damaged by prolonged exposure to the heated solvent.^{1 2 3}

An alternative approach, microwave extraction, saves energy by not heating its solvents – specifically, by heating with microwaves and choosing solvents that are not affected by microwaves. The microwaves instead heat only the biomass, rapidly exciting whatever water remains inside. This greatly increases the pressure within the biomass particles and, in turn, expels the desired chemicals, sometimes by exploding cell walls. In these cases, diffusion is no longer the limiting factor. Expelling the chemicals into unheated solvent also preserves them. Additionally, microwave extraction is a single-stage process, greatly reducing overall extraction time.^{3, 4}

Another innovative approach to harvesting lipids has been developed to extract valuable compounds by the University of Minnesota-Duluth Natural Resources Research Institute Chemical Extractives Laboratory. Although the nature of the process has not been disclosed, the group has had success in harvesting triterpenes like and fatty acids from birch bark.

Upon extraction, lipids are often subjected to [esterification](#) or [transesterification](#) to convert them into useful products such as [biodiesel](#).

PRIMARY BIOBASED PRODUCTS

Lipids, edible oils, flavors, fragrances, colorings, pharmaceuticals

MAJOR EQUIPMENT

Mechanical equipment, solvent tank, filtration/separation equipment, microwave cavity (microwave extraction only)

ENERGY REQUIRED

Although the major work being done is a chemical reaction, energy is expended to maximize yield and extraction rates by encouraging diffusivity – most commonly, by heating the solvent. Less energy is required for microwave extraction.

CAPITAL AND OPERATING COST

Unknown. The energy and solvent consumption of microwave extraction should be less than conventional solvent extraction if production rate is important.

COMMERCIALIZATION STATUS

Well established; microwave extraction is commercialized

COMMERCIAL SUPPLIERS

Radiant Technologies Inc.⁵ has licensed the microwave extraction technology from the Canadian government.

The Natural Resources Research Institute⁶ has started a new company, NaturNorth Technologies Corporation⁷, to commercialize its birch bark processing.

REFERENCES

¹ Brown, Robert C. 2003. Biorenewable Resources: Engineering New Products from Agriculture. Iowa State Press, Ames, IA.

² Lipid Extraction. Cyberlipid Center. <http://www.cyberlipid.org/extract/extr0001.htm> (23 April 2004)

³ Foragen Visions. "Radiant Technologies Inc.: Processing Natural Products More Efficiently." Foragen Technology Management Inc. http://www.foragen.com/html/newsletters/visions2_2.pdf (23 April 2004)

⁴ Microwave-Assisted Natural Product Extraction. Radiant Technologies. <http://www.radiantinc.com/technology.htm> (23 April 2004)

⁵ Radiant Technologies, Environment Canada Wastewater Technology Centre, 867 Lakeshore Rd, PO Box 5050, Burlington, ON, Canada L7R 4A6, 905.319.6997 <http://www.radiantinc.com/>

⁶ Chemical Extractives Laboratory, Natural Resources Research Institute, 5013 Miller Trunk Hwy, Duluth, MN 55811, 218.720.4334. <http://www.nrri.umn.edu/cartd/lce/>

⁷ NaturNorth LLC, 5013 Miller Trunk Hwy, Duluth, MN 55811-1142, 218.720.4373. <http://www.naturnorth.com/>