



# publications

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608-238-6001 [ TEL ]

greg@infinitysupercritical.com [ Email ]

Infinity  
Supercritical LLC

## Supercritical CO2 Botanical Extraction Publications Menu Page

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Publications related to supercritical CO2 extraction for hemp, botanical extraction, and Gold mining and recycling from electronic wastes.



PDF Version of the webpage

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<https://infinitysupercritical.com/publications.html>

## Publications on Supercritical CO<sub>2</sub> Extraction

Publications for supercritical CO<sub>2</sub> extraction.

10/10/2021



## Hemp and Supercritical CO2

The most recent research and uploads for hemp processing in the USA. Publications for hemp include full spectrum extraction and harvesting valuable terpenes. Updated on 3/23/2021.

10/10/2021



## Publications on Supercritical CO<sub>2</sub> Recycling and Industrial Waste Precious Metal Mining and Recovery

Gold mining with supercritical CO<sub>2</sub>.

Precious metals including copper, gold, and palladium can be dissolved in supercritical CO<sub>2</sub> by oxidation. This supercritical fluid dissolution technique provides a dry method for recovering precious metals from abandoned electronics and spent catalysts with minimum waste generation.

Currently, increasing amounts of end-of-life (EoL) electronic products are being generated due to their reduced life spans and the unavailability of suitable recycling technologies. In particular, waste printed circuit boards (PCBs) have become of global concern with regard to environmental issues because of their high metal and toxic material contents, which are pollutants. There are many environmental threats owed to the disposal of electronic waste; off-gasses, such as dioxins, furans, polybrominated organic pollutants, and polycyclic aromatic hydrocarbons, can be generated during thermal treatments, which can cause serious health problems if effective off-gas cleaning systems are not developed and improved. Moreover, heavy metals will dissolve, and release into the ground water from the landfill sites. Such waste PCBs contain precious metals which are of monetary value. Therefore, it is beneficial to recover the metal content and protect the environment from pollution. Hydrometallurgy is a successful technique used worldwide for the recovery of precious metals (especially gold and silver) from ores, concentrates, and waste materials. It is generally preferred over other methods because it can offer high recovery rates at a relatively low cost. This article reviews the recent trends and developments with regard to the recycling of precious metals from waste PCBs through hydrometallurgical techniques, such as leaching and recovery.

Supercritical fluids, especially those based on inert substances, are considered as clean solvents, free from the environmental concerns of disposal, handling and toxicity associated with organic solvents. A pure supercritical fluid is a substance above its critical temperature and pressure.

Technological development and intensive marketing support the growth in demand for electrical and electronic equipment (EEE), for which printed circuit boards (PCBs) are vital components. As these devices become obsolete after short periods, waste PCBs present a problem and require recycling. PCBs are composed of ceramics, polymers, and metals, particularly Cu, which is present in highest percentages. The aim of this study was to develop an innovative method to recover Cu from the PCBs of old mobile phones, obtaining faster reaction kinetics by means of leaching with supercritical CO<sub>2</sub> and co solvents.

It is this solvating power that makes supercritical fluids useful in such processes as the decaffeination of coffee and in the extraction of many important industrial chemicals including medicinal compounds, natural oils and flavors and even, organic pollutants.

Recent work at the Bureau of Mines showed some unique and potentially useful results when refractory gold ores were pretreated with supercritical water before standard leaching. This work is described below. Because the work was exploratory, this paper is a status report; much more research is needed to judge whether the technology is commercially feasible.



## Hemp Processing

Publications for hemp processing including full spectrum extraction and harvesting valuable terpenes. Updated on 3/23/2021.

10/10/2021



## Commerical Supercritical CO2 Systems Publications

Industry leader publications regarding Supercritical CO2 extraction.

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## Eco Extraction for Botanical Oil

Eco extraction. Updated on 3/23/2021.

10/10/2021



## CPC | Centrifugal partition chromatography

Centrifugal partition chromatography is a special chromatographic technique where both stationary and mobile phase are liquid, and the stationary phase is immobilized by a strong centrifugal force. Centrifugal partition chromatography consists of a series-connected network of extraction cells, which operates as elemental extractors, and the efficiency is guaranteed by the cascade.

Centrifugal partition chromatography was introduced in Japan in 1982; the first instrument was built at Sanki Eng. Ltd. in Kyoto. The first instrument consisted of twelve cartridges arranged around the rotor of a centrifuge; the inner volume of each cartridge was about 15 mL for 50 channels. In 1999 Kromaton was developed of the first FCPC with Radial Cells. During cell development, the Z cell was completed in 2005 and the twin cell in 2009. In 2017 RotaChrom designed its top performing CPC cells through Computed Fluid Dynamic simulation software.

Centrifugal Partition Chromatography (CPC) is one of the various techniques constituent of Countercurrent Chromatography (CCC).

Centrifugal Partition Chromatography is also known as Hydrostatic Countercurrent Chromatography. This refers to the rotary movement of the column which rotates around one single rotation axis, contrary to Hydrodynamic Countercurrent Chromatography systems that have a planetary rotation movement around two rotating axes.





## Shelf Life of Hemp and Associated Products

Extracts and hemp flower have a shelf life before the components start to degrade, lose effectiveness, or in the case of the raw flower, mold and mildew.

Raw Hemp Flower: Must be dried properly to insure a long shelf life. Time, moisture, and air are the factors which will degrade flower.

Extract: Supercritical CO2 extract is the best method of preserving full spectrum components of the hemp flower, including the terpenes and oil. Ethanol extraction is the worst, since it makes the terpenes go volatile (evaporate) and many fly-by-night ethanol processors filter their extracts with carbon, which filters out the CB.



# Silver Nanoparticle Processing and Manufacturing using the SDR Spinning Disc Reactor.

Uploaded on 3/23/2021.

10/10/2021



## Topics

New to the site are reviews of research topics for the botanical extraction industry.

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## Oil and Water Separation

Separation technologies include oil and water (which we use for the SDR Spinning Disc Reactor) and wax and ethanol (used for winterizing). We have also experimented with Vortex tubes that can separate oil from botanicals. These publications go into detail about the state of art in the field of liquid separation tech.

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