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Extraction of Lipids and Terpenics from Guayule (*Parthenium argentatum*) Biomass under Supercritical Conditions

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Guayule (*Parthenium argentatum* Gray) is a perennial shrub growing under semi-arid climate that synthesizes polyisoprene, together with other extractible. The properties of Guayule rubber are similar to those of Hevea rubber. Because of the increasing price of the last, and of a possible shortage, Guayule is the most probable alternative source of natural rubber. Several efforts have been made to commercialize Guayule rubber, while paying little attention to the left bagasse making more than 90% dry weight of the periodically harvested biomass. Recently, there have been successful trials for growing Guayule in Southern Europe, under the EU-Pearls project. In parallel Cirad is investigating a ”green” process for extracting valuable compounds from biomass remaining after the water-based extraction of PI as latex (for producing allergy-free gloves).

Here reported results deal with investigating the influence of operating parameters for selectively extracting lipid and terpenic classes. In parallel to acetone-based extraction under pressurized conditions (ASE method, above boiling point), parameters acting on extraction efficiency (yield, selectivity) under supercritical CO_2 are investigated. Special attention is paid to sesquiterpenes and triterpenes (Guayulins, Argentatins), which are known to be ”bio-active”, especially against termites. Ethanol, in comparison to acetone - both used as co-solvent with SC-CO_2 - brings the best extraction efficiency (12.3% total extract relative to biomass dry weight, and 7.0% respectively). Under the limited range of temperature tested because of the low thermal stability of targeted active compounds (35-80°C), this parameter has little effect on yield with acetone, while showing a maximum at 60°C with ethanol (flow rate CO_2 34 g/min, co-solvent 3 mL/min, 250 bar, 1 h). The selectivity in favor of Guayulins -one of the targeted terpenic classes- increases with temperature in the case of ethanol. Although no fully optimized yet, SC-CO_2 shows a higher efficiency compared to the case of acetone used alone in the relevant literature, and as a reference solvent in this work.

Further processing leads to a fraction containing fatty acids (mainly saturated C14 - C22) and di-carboxylic acids; these could be used as industrial feedstock (soap, lubricant, biofuel). p-Anisic acid initially linked to sesquiterpenes can also be recovered. Another work in the team has shown that, in addition to polyisoprene, the extraction of these valuable compounds is required for reaching economic sustainability. This work, part of an undergoing PhD, is aiming at setting a process for advanced extraction and fractionation of lipids and terpenics from Guayule; SC fluids should play a major role.