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Artisan oil extraction methods for oleaginous cultures of the Santarém District, Pará State, middle Amazon, Brazil.

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Introduction

The western region of the Brazilian federal state of Pará shelters a large amount of unexplored oil crops. Many of them can be used both as vegetable oil source for food production as well as a protein source for live stock feeding or human nutrition. It is expected to use unexplored oil crops as source for Biodiesel production, as part of a program of the Brazilian Federal Government to increase Biodiesel production and use in the country. As part of a larger research project funded by the CNPq (National Science and Research Council, Brazil) the following presentation aims to compare oil yields of different traditional oil extraction methods used by small scale farmers.

← Fig. 1. Tipiti

→ Fig. 2. Wooden mortar

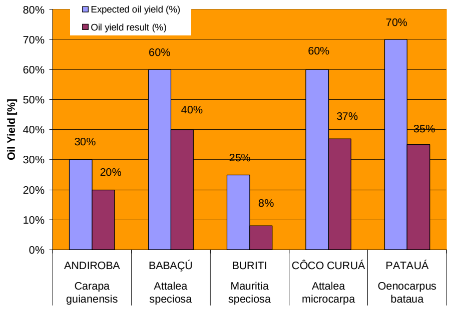
Materials and Methods

Oil extraction was done initially from the seeds and fruits of the following surveyed oil crops: Côco curuá (*Attalea microcarpa),* Babassu (*Attalea speciosa* Mart. Ex Spreng.) Pataua (*Oneocarpus bataua* Mart.), Buriti (*Mauritia flexuosa* L.) and Andiroba (*Carapa guianensis* Aubl.).

For the artisan oil extraction, members of small scale farming families were interviewed for determine the corresponding oil extraction method. These methods were compared afterwards with laboratory methods using manual and hydraulic plate presses. The oil extraction methods used are placed in the following table:

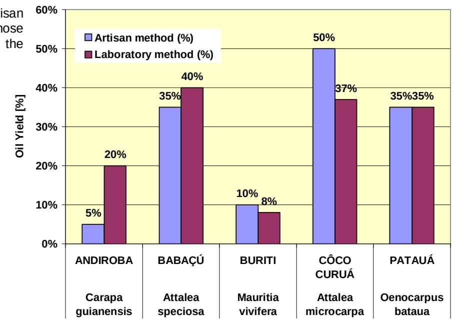
Crop	Artisan Method	Laboratory Method
Andiroba	The seeds are separated from the capsule, put in a aluminum bowl, were they are cooked over a charcoal or wood fireplace until the endosperm turns a thick paste. This paste is left to rest for around 8 days in an open recipient in an aerated and dry place. The so obtained mass is broken and kneaded during several days like a bread paste. The oil flows out of the paste that is put on a sun exposed inclined plate (Silva, 2005).	The seeds, after separation from the hull, are cut in small pieces and dried in a gas oven at 80°C for 60 minutes. Still hot they are put into a plate press. The first extraction delivers only an aqueous solution. The second pressing delivers transparent oil, which is purified with the help of a centrifuge (FANEM, Baby II).
Pataué	Soon after the fruit harvest, pataua seeds are put into a big aluminum bowl, were they are watered during 12 hours. After this period the water is heated until emergence of oil drops. The hot seeds are then removed from the bowl and smashed in a wooden mortar (Fig 2) until separation of the mesocarp from the endocarp. The oil is extracted from the mesocarp with the aid of the *tipiti* (Fig.1) and collected in a jar (Brito, 2005).	Little differences to the artisan methodology. Patauá oil was extracted with the use of the *tipiti* (Fig. 1) after cooking. After first extraction the pulp and cracked seed were cooked in a pressure pan followed by a second oil extraction in the *tipiti*.
Buriti	After harvest, the fruits are put into an aluminum bowl and watered during 24 hours. The saturated fruits are cooked until the mesosperm turns a kneadable mass, which is put into a pillow and smashed until full separation of mesocarp and mesosperm from the endocarp. Water is added and the paste is cooked until oil drops emergence at the surface. Oil separation is done by decantation (FAO, 1995).	Same as artisan method. The separation of oil from water showed to be difficult.
Coco Curuá & Babassu	The fruit endosperm is separated by mechanical cracking from the shells and broken in a wooden mortar (Fig. 2) until formation of a consistent bread-like mass until the oil could be extracted bare handed by pressing of the pulp. At this point the pulp is put into a frying pan with water and heated until full water evaporation, leaving only oil in the pan. The solid residues are separated with the aid of a sieve (Earthscape, 2005).	No changes for Babassu extraction. No changes for babassu oil extraction. With côco curuá several tests were done, from which the following was the most promising: Shell cracking with the aid of an hydraulic press and separation of the endosperm. Cooking of the endosperm in the autoclave with 0,5 kgf/cm² - 1,5 kgf/cm² for 5-10 minutes. The first pressing of the high endosperm pulp in a plate press (developed by R. Yuki, ILES/ULBRA Santarém) only separated the water from the pulp. The second pressing extracted yellow transparent oil with little residues and easy purification with a centrifuge (FANEM Baby II).

Results



← Fig. 3. Comparison of expected oil yields, according to cited literature, and yield results using the methodology described as *laboratory method*.

→ Fig. 4. Oil yields comparing the artisan oil extraction methodology with those resulted after extraction with the laboratory method.



← Fig. 5. Oils of coco curua (*A.. microcarpa*) and Andiroba (*C. guianensis*) after *laboratorial* method. At the bottom (right) can be seen the pulp of *A. microcarpa* and a shell of *B. excelsia.*

↑ Fig. 6. Oil of *Mauritia flexuosa* (buriti), after artisan extraction method.

← Fig. 7. Oil of *O. bataua* (pataua). Left and middle after plate pressing and right following the artisan methodology.

Discussion and Conclusions

The results show that the artisan oil extraction method used for *C. guianensis* is very inefficient and unfeasible for large-scale applications when compared to the laboratory method used in this work. FAO (1992) affirms that "the extraction efficiency is generally low, and problems often occur with the formation of oil-water emulsions, which makes the final separation difficult. In some cases salt is used to break such emulsions". Salt wasn't used in this trial, but we achieved satisfactory results using a centrifuge. The main problem was the loss of oil during the transfer between the different containers. For the artisan method Brito (2005) states, "the resting period for sporadic oil extraction is very long-lasting and tiring. The oil quantity and quality depends from the local of oil extraction, which must be reserved and without public access." This makes the *C. guianensis* oil a very expensive product, used therefore preferably for medicinal purposes. Its artisan oil extraction method isn't, in conclusion, feasible for large-scale extraction, when compared to the laboratory method. Drying of the endosperm before extraction (Howes, 1948, cited by FAO, 1995) might be an alternative to achieve higher oil concentrations during extraction. This will be tried out during further trials.

Buriti (*M. flexuosa*) was found not to be a feasible oil crop for Biodiesel production, due to its low oil concentration (8%) and the timely intensive extraction method. It could be used in the cosmetic or pharmaceutical industry, demanding a further study of its oil properties. Local population uses its pulp to make a tasteful drink, called "buriti wine".

The main problem of *A. speciosa* oil extraction is the cracking of the nuts, which make its economic exploration unfeasible in the research region. Unlike other regions of Brasil, nutcrackers don't exist in Santarém, so that it will be necessary to develop special equipment for the nut cracking. As a consequence the oil yield could be increased. The weed palm *A. microcarpa* could be leaving its bad reputation due to the high oil concentration in its seeds, which could improve the income of small scale farming communities. The artisan method applied for the extraction of the *O. bataua* oil wasn't altered much in the laboratory. Both yields were equal and surprisingly high independent of the method. The oil quality, indeed, was lower with the artisan method, than with the direct plate press extraction used in the laboratory. This reduces the market value of the pataua oil, which shows similar properties of olive oil (Clay & Clement, 1993), so that a laboratorial method with less oil contamination should be preferred.

Further studies will be done with these and other cultures, due to the extent of the initially mentioned research project.

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