

Comparison of oils extracted from *Millettia (Fabaceae)* seeds: *Millettia capuronii* and *M. taolanaroensis*, endemic species of Madagascar versus *M. pinnata*, introduced species

Herizo Randriambanona

Centre National de Recherche sur l'Environnement (CNRE)- BP 1739 Antananarivo, Madagascar



Abstract

Statement of the Problem: Madagascar is widely renowned for its unique biodiversity. Particularly, there are nine species of *Millettia* (Fabaceae) in Madagascar, including one introduced *Millettia pinnata* L. or Karanja, and eight endemic Malagasy species. While *M. pinnata* (Mp) is a famous tree for biodiesel production, no studies have ever been done on Malagasy *Millettia* species. The purpose of this study is to compare the physicochemical characteristics of oils extracted from MP seeds with those of two endemic Malagasy species: *M. capuronii* (Mc) and *M. taolanaroensis* (Mt).

Methodology & Theoretical Orientation: *Millettia* seeds were collected in the eastern part of Madagascar. Solvent extraction was used. Oil refraction indices were determined according to the NF T60-212 standard (AFNOR 1984). ANOVA was used to compare the different parameters.

Findings: The MP oil is canary yellow with an unpleasant smell, the MC oil is pale green and its smells like a passion fruit. Mt oil is orange-yellow with a similar Mc smell. Mc seeds have the highest oil yield ($48.3 \pm 1.39\%$), followed by Mt ($43.8 \pm 0.51\%$) and Mp seeds have the lowest oil yield ($36.2 \pm 0.73\%$), the difference was significant. In terms of density: Mp oil ($D=0.918 \pm 0.0004 \text{ g.cm}^{-3}$) is denser than Mc oil ($0.874 \pm 0.0007 \text{ g.cm}^{-3}$) and Mt oil ($0.864 \pm 0.0008 \text{ g.cm}^{-3}$). A significant difference was observed in the values of the refraction indexes (RI); Mp oil has the highest RI (1.475 ± 0.0003) compared to Mc oil (1.463 ± 0.0015) and Mt (1.46 ± 0.0005). The cetane indices are respectively IC=54.62 for MP, IC=65.41 for Mc and IC=66.36 for Mt which are above the minimum standard required (IC=48) by ASTM D 976. The calorific powers are respectively 40.31 MJ.kg^{-1} for MP, 41.85 MJ.kg^{-1} for Mc and 42.12 MJ.kg^{-1} for Mt.

Conclusion & Significance: These results showed that Malagasy *Millettia* species have characteristics close to biodiesel (gasoil), and have an interesting potential for biofuel production.



Biography:

I have got my PhD in forest ecology and vegetation dynamic at the University of Antananarivo, Madagascar. My PhD investigated the native species regeneration in the natural forest and the artificial plantation forest in the eastern part of Madagascar. I am currently a researcher in the Centre National de Recherches sur l'Environnement (CNRE), where I investigate the valorization of some Malagasy trees species to produce biodiesel and to restore degraded soil in the mine site of Rio Tinto (Taolanaro, Madagascar). I am interested in the role of Arbuscular Mycorrhizal Fungi in facilitating native species and ecological restoration, as well as linking above- and below-ground ecosystem processes. I analyze also how soil ecosystem services (e.g. organic carbon storage, crop production), structure and diversity are affected by different agricultural practices (e.g. tillage practices...). In addition to forest ecology, my research interests focus on the biodiversity informatics.

Speaker Publications:

1. Ashish G., Balwinder S (2018) Karanja Bio Diesel- A Future Alternative Oil with High Efficiency and Improved Performance Parameters with Diesel Blends. *International Journal of Current Engineering and Technology* 8 (6): 1577-1580.
2. Bobade SN, Khyade VB (2012) Detail study on the properties of *Pongamia pinnata* (Karanja) for the production of biofuel. *Research Journal of Chemical Sciences* 2(7): 16-20.
3. Murphy HT, O'Connell DA, Seaton G, Raison RJ, Rodriguez LC, Braid AL., Kriticos DJ, Jovanovic T, Abadi A, Betar M, Brodie H, Lamont M, Mc Kay M, Muirhead G, Plummer J, Arpiwi NL, Ruddle B, Saxena S, Scott PT, Stucley C, Thistlethwaite B, Wheaton B, Wylie P, Gresshoff PM (2012)



A common view of the opportunities, challenges and research actions for Pongamia in Australia. *Bioenergy Research* 5(3): 778-800.

4. Nabi N, Najmul H, Shamim A (2009) Karanja (*Pongamia pinnata*) biodiesel production in Bangladesh, characterization of Karanja biodiesel and its effect on diesel emissions. *Fuel Processing Technology* 90(9):1080-1086.

5. Vigya K, Archana D, Latha R (2010) Physico-chemical characterization and antimicrobial activity from seed oil of *Pongamia pinnata*, a potential biofuel crop. *Biomass and Bioenergy* 34: 108-115.

[15th World Bioenergy Congress and Expo](#); Berlin, Germany- April 20-21, 2020.

Abstract Citation:

Herizo Randriambanona, Comparison of oils extracted from *Millettia* (Fabaceae) seeds: *Millettia capuronii* and *M. taolanaroensis*, endemic species of Madagascar versus *M. pinnata*, introduced species, *Bioenergy* 2020, 15th World Bioenergy Congress and Expo; Berlin, Germany- April 20-21, 2020

(<https://bioenergy.insightconferences.com/speaker/2020/herizo-randriambanona-centre-national-de-recherche-sur-l-environnement-cnre-bp-1739-antananarivo-madagascar>)