Technology to combat adulteration in the indigenous oil industry

PhytoTrade Africa

ABioSA GUIDE

MAY 2025

Testing ensures quality and integrity of Marula and Baobab oil

forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

THE ABS CAPACITY DEVELOPMENT INITIATIVE

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Economic Affairs SECO

This guide is part of a series of knowledge products produced by ABioSA. These knowledge products and other biotrade resources can be found at www.abs-biotrade.info/projects/abiosa/resources.

A glossary of biotrade terms can be found at www.abs-biotrade.info/resources.

This guide was developed by the botanicals Trusted and Authenticated Fingerprinting (b-TAF) project and Precision Oil Laboratory on behalf of ABioSA.

ABioSA is funded by the Swiss State Secretariat for Economic Affairs (SECO), integrated in the governance structure of the ABS Initiative, and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Although every effort has been made to provide complete and accurate information, GIZ and SECO make no representations or warranties, express or implied, as to its accuracy at the time of use.

Adrie El Mohamadi
Component Manager
The ABS Capacity Development Initiative
(ABS Compliant Biotrade in Southern Africa)
Center for Cooperation with the Private Sector (CCPS)

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH
+27 12 423 7955 | +27 82 902 4083
adrie.elmohamadi@giz.de
www.giz.de & www.abs-biotrade.info

Mathilda Mostert
Chief Executive
Precision Oils Laboratory
mathilda@precisionoils.co.za

b-TAF PROJECT
BOTANICALS TRUSTED AND AUTHENTICATED FINGERPRINTING

PRECISION OIL LABORATORIES

The ABS Initiative is funded by

Federal Ministry for Economic Cooperation and Development

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Economic Affairs SECO

and implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Introduction

This is a guide to ensuring the quality of indigenous natural vegetable oils in the sub-Saharan African biotrade with specific reference to Marula and Baobab oils.

It is based on work by the botanicals Trusted and Authenticated Fingerprinting (b-TAF) project conducted in 2023 and 2024 by the team at Precision Oil Laboratory on behalf of ABioSA.

Project details can be found at https://b-taf.org/.

The project worked in partnership with African Baobab Alliance (ABA), Namibia Network of the Cosmetics industry (NANCi), the Marula Chamber of the Southern African Essential Oil Producers Association (SAEOPA), University of Pretoria and Tshwane University of Science and Technology.


GIZ/ABioSA/Jonathon Rees


GIZ/ABioSA/Jonathon Rees

The challenge of adulterated oils

The indigenous oil industry is facing significant challenges due to the widespread adulteration of oils through dilution with low-cost commodity oils. This malpractice not only erodes consumer trust but forces genuine producers out of the market.

Adulteration affects local communities relying on the Marula and Baobab oil trade for livelihoods. There is a need for stronger collaboration between researchers, governments and the private sector to address these concerns.

The Marula (*Sclerocarya birrea*) and Baobab (*Adansonia digitata*) sector development plans supported by ABioSA between 2019 and 2022 highlighted the lack of testing labs as growing international demand for indigenous oils increased the risk of adulteration.

Concerns around adulteration are associated with the largescale import of commodity natural oils such as sunflower, which can be procured on the open market more cheaply, and to the non-specialist have similar properties to Marula and Baobab oil.

This threatens the sustainability and commercial viability of indigenous natural oils in the biotrade. The sector plans also confirmed a lack of baseline data to standardise the commercial use of Marula and Baobab oil.

The indigenous oil industry is facing significant challenges due to the widespread adulteration of oils through dilution with low-cost commodity oils.

The b-TAF project

The b-TAF project, funded by ABioSA and Precision Oil Laboratory, was a pioneering initiative to establish baseline data for authentic Marula and Baobab oils.

The project ran from November 2022 to December 2024. The b-TAF work helps to facilitate compliance with national technical standards developed by the SA Bureau of Standards and adopted in South Africa in 2022 for Baobab oil and in 2023 for Marula oil. GQSP-SA and SAEOPA initiated and participated in the development of these national standards.

b-TAF collected information on the provenance and traditional use of oils, harvesting and processing rituals, growing conditions, seasonality, efficacy, consumer and market trends, and novel uses for these oils.

Precision Oils analysed 33 Baobab oil samples, 11 Baobab seed samples, 60 Marula oil samples and 27 Marula nut samples from producers and traders of crude Marula and Baobab oil across sub-Saharan Africa.

Samples were provided in-kind by 24 sector association members from Angola, Ghana, Senegal, Mozambique, Namibia, South Africa, Zambia and Zimbabwe. Testing of the samples led to the creation of a database for producers and traders of Baobab and Marula oil to determine the authenticity of their product.

The b-TAF project was a pioneering initiative to establish baseline data for authentic Marula and Baobab oils.

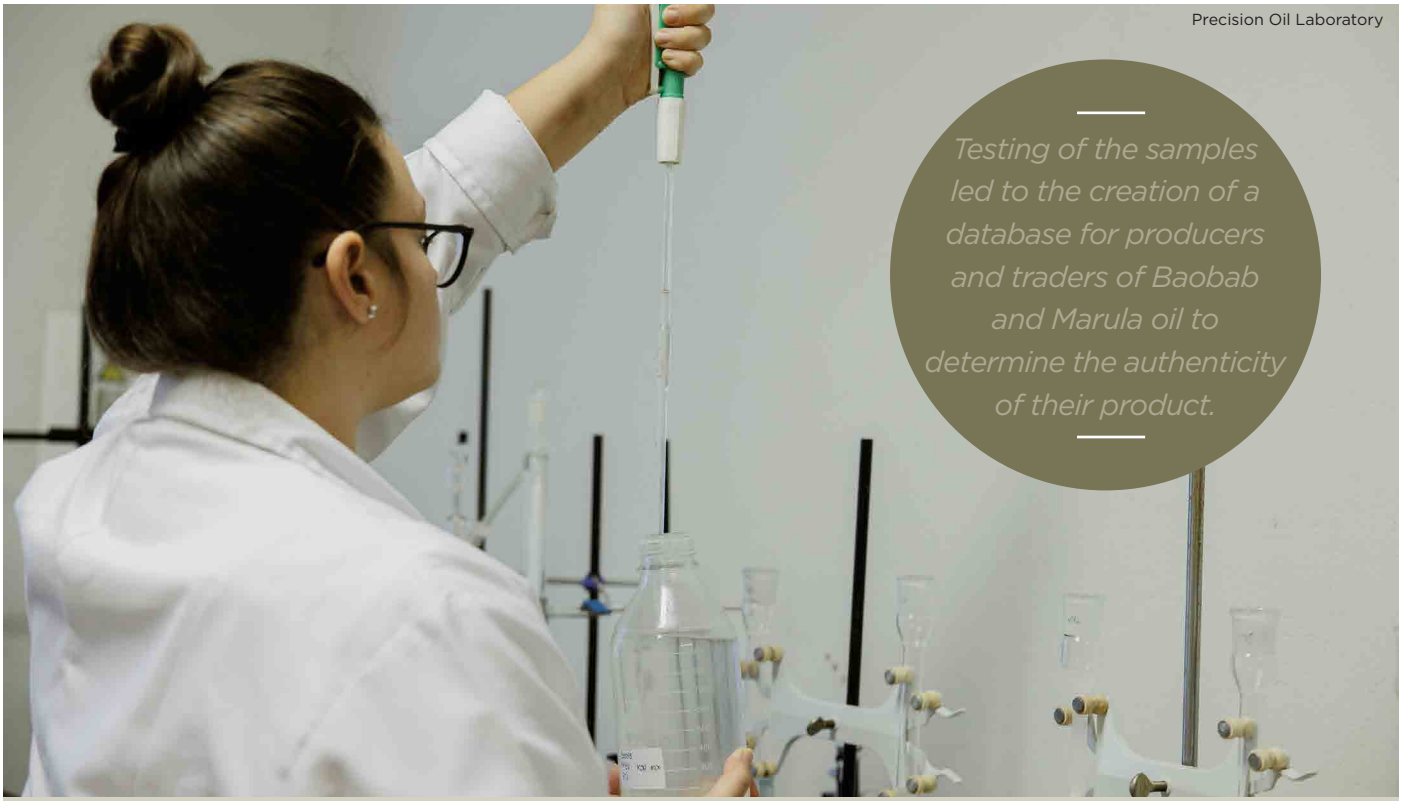
Precision Oil Laboratory

Testing of authenticity was based on fatty acid profile, tocopherol and sterols, which are considered the unique identifiers of oils, creating a database of oil fingerprints. The interpretation of results enables a conclusive decision on authenticity of a natural oil.

Once authenticity was established, the data points become part of the data set for oils received from producers. A database was established to ascertain authenticity of third-party oils on a comparative basis.

b-TAF provides transparency and assurance by using standardised authentication methods to maintain trust and integrity in the industry.

While b-TAF does not directly combat fraud or adulteration, it contributes by ensuring the authenticity of indigenous oils to protect African economic development and cultural heritage, and to safeguard livelihoods and the competitiveness of African economies.



Precision Oil Laboratory

Testing of the samples led to the creation of a database for producers and traders of Baobab and Marula oil to determine the authenticity of their product.

Quality data collected during the project included:

- Peroxide value
- Free fatty acid value
- Anisidine value

Compositional testing (to establish authenticity) included:

- Fatty acid profile including iodine value
- Sterols determination
- Tocopherols determination
- Colour characteristics

b-TAF contributes by ensuring the authenticity of indigenous oils to protect African economic development and cultural heritage, and to safeguard livelihoods and the competitiveness of African economies.

A powerful resource to drive quality and authenticity

The b-TAF database can now be used publicly via an interface on the b-TAF webpage to test Marula and Baobab oil for authenticity.

With online checks and balances performed by the user of the website, the b-TAF model can predict adulteration with 95% certainty.

Clear distinctions can now be made between oil from different regions, and between cold pressed and solvent-extracted oil.

Accuracy in predicting adulteration
The project improved the accuracy of detecting adulteration. Current methods predict adulteration with 60-70% accuracy using only the fatty acid profile. By including sterols and tocopherols in the analysis, the b-TAF project targeted an 80-90% accuracy rate, but was able to establish a 95% accuracy rate.

Codex Alimentarius standards
The standards set by the Codex Alimentarius for commodity fats and oils in general formed the basis of the b-TAF research. This includes standards for fatty acid profiles, sterol composition, and tocopherol content.

Composition and quality testing
b-TAF research focused on both macro-components (fatty acids) and micro-components (sterols and tocopherols) to determine the quality and composition of oils. The project used advanced analytical techniques to provide accurate and reliable results.

Authenticity testing prototype
The b-TAF methodology for oil authentication involved detailed statistical analysis and the establishment of critical cut-off points for various compositional characteristics. These tests helped to identify adulteration with high accuracy, ensuring that only authentic oils reach the market.

These tests were conducted to establish a reliable baseline for Marula and Baobab oils, confirming their authenticity. The data gathered serves as a reference point, enabling the identification of adulteration with high accuracy, ensuring that only genuine oils reach the market.

Fatty acid profile testing
Analysing the fatty acid profile of the oils alone provides a 60-70% accuracy rate in predicting adulteration. Fatty acid profiles are essential as they reflect the fundamental composition of the oil, making it possible to identify deviations from expected standards.

Inclusion of sterol composition
By adding the analysis of sterol composition to the testing protocol, the accuracy of detecting adulteration increases. Sterols are minor components of oils, but their specific composition and concentration can provide additional markers for authenticity.

Tocopherol content analysis
Further enhancement in accuracy is achieved by including tocopherol content analysis. Tocopherols, which are a group of organic compounds with antioxidant properties, collectively known as vitamin E, vary significantly between different oils. Analysing both the composition and concentration of tocopherols adds another layer of verification, further increasing the reliability of the test results.

Research target
The b-TAF project exceeded its research target and achieved 95% accuracy in detecting adulteration by analysing fatty acid profiles, sterol composition, and tocopherol content.

The combination of advanced testing methods not only provides a more comprehensive understanding of the oil's composition but also enhances the ability to detect adulteration with higher accuracy.

This multi-faceted approach ensures greater transparency and assurance for producers and consumers in the botanical oils industry.

The b-TAF model can predict adulteration with 95% certainty.

GIZ/ABioSA/Jonathon Rees

Quality assurance factors in plant oils

- Ensure good hygiene practices whilst extracting the oil.
- Press oil as soon as possible after the extraction of the nuts/kernels.
- Make sure that the equipment used during extraction is cleaned each day.
- Store the oil in dark containers with no headspace and keep it in a cool environment to maintain optimal quality.
- Quality control is very important during the extraction process.
- Test oils for quality and composition at an accredited lab if possible.

It is necessary to test more oil samples and expand the database to continuously increase effectivity of the authenticity model and enhance the protection of the indigenous oils industry against adulteration.

Future potential actions

- Further research may incorporate more geographical variation and seasons in oil samples being tested. Variation in fatty acid profile, sterol and tocopherol composition occurs due to location, soil types, rainfall, variation in temperature and other climate conditions.
- It is necessary to test more oil samples and expand the database to continuously increase effectivity of the authenticity model and enhance the protection of the indigenous oils industry against adulteration.