

New Directions in Essential Oil Research

David R. Katerere



Tshwane University
of Technology

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Entrepreneurial the Future Together

The essential oils industry is changing

- Traditional markets have focused on:
 - Fragrance
 - Aromatherapy
 - Cosmetics
 - Food flavourings
- New opportunities :
 - Functional ingredients
 - Nutraceuticals
 - Pharmaceutical applications
 - Green extraction technologies
 - Circular bioeconomy
 - Cannabis and industrial hemp

Global trends driving research

Natural products



Using nature's resources for health and wellness.

Sustainable extraction



Green methods that protect bioactives and the environment.

Clean-label ingredients



- ✓ Natural
- ✓ Pure
- ✓ Safe
- ✓ Transparent

Safe, simple and transparent ingredients consumers trust.

Evidence-based botanical medicines



Science and clinical evidence that prove efficacy and safety.

Low-carbon manufacturing



Reducing carbon footprint through efficient, clean and renewable processes.

African biodiversity



Harnessing Africa's rich plant diversity for global benefit.



Research & policy focus



Bioactive compounds

Identify and characterise the active molecules responsible for health benefits.



Standardisation

Ensure consistent quality, purity and potency across batches.



Clinical evidence

Generate scientific data through well-designed clinical studies.



Metabolomics

Profile the complete chemical fingerprint for deeper understanding and discovery.



AI-assisted phytochemistry

Use artificial intelligence to predict, discover and optimise natural compounds.



Carbon-neutral extraction

Adopt green extraction technologies that reduce emissions and protect the environment.



Traceability

Track the journey from plant to product for transparency and trust.



Traceability in action

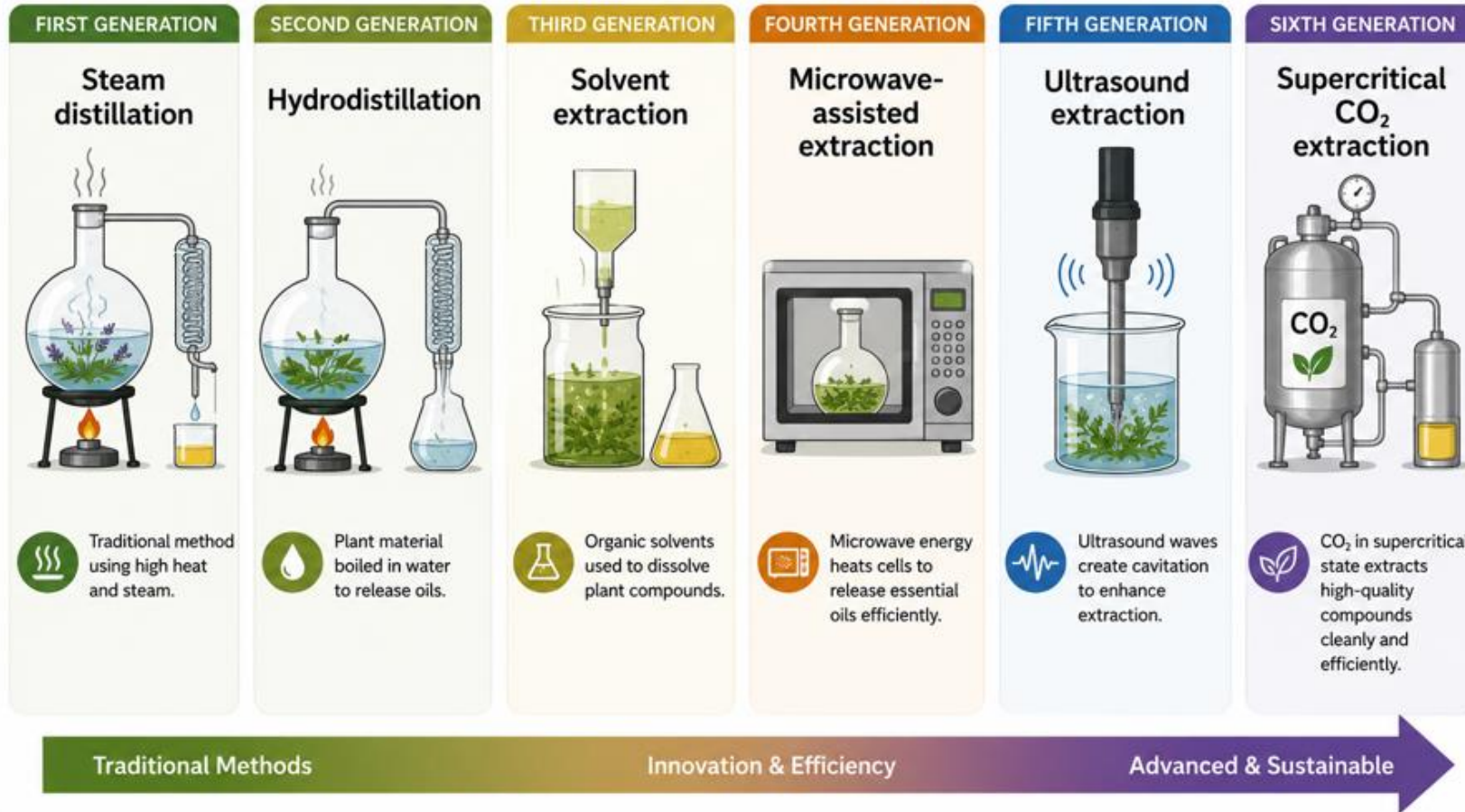
Document origin, cultivation, processing and testing for full supply chain visibility.



Southern Africa's Opportunity

- Exceptional biodiversity
- Indigenous medicinal plants & traditional knowledge
- Commercial essential oil crops
- Increasing cultivation of cannabis and hemp
- Availability of frontier processing technologies & skills

The Evolution of Extraction Technologies



Higher purity
Lower oxidation
Better terpene preservation
No solvent residues
Better environmental performance

Why CO₂ is Transforming Essential Oils

- ✓ No toxic solvents
- ✓ Food-grade process
- ✓ Pharmaceutical quality
- ✓ Lower temperatures preserve delicate compounds
- ✓ Better aroma profile
- ✓ Better colour
- ✓ Longer shelf life
- ✓ Selective extraction
- ✓ Environmentally sustainable

• CO₂ Extraction vs Steam Distillation

Steam

High temperature

Thermal degradation

Limited compounds extracted

Water required

Oxidation

Lower value oils

CO₂

Low temperature

Preserves heat-sensitive compounds

Broad spectrum extraction

Minimal water

Minimal oxidation

Premium extracts

Case study I – Cannabis & Hemp

Home / Special categories / Top stories / TUT and CSIR establish cannabis research hub

Local news

TUT and CSIR establish cannabis research hub

"Hemp and cannabis are included in the scope of the master plan, covering medicinal industrial and recreational use, cosmetics, food and beverages.

July 18, 2022

Tebogo Katsedi 2 minutes read



Cultivation



LU' NAKO & DR M *Case Studies*



BEFORE



FUNGAL INFECTION OF THE FEET
(TINEA PEDIS)

LU' NAKO & DR M *Case Studies*



BEFORE



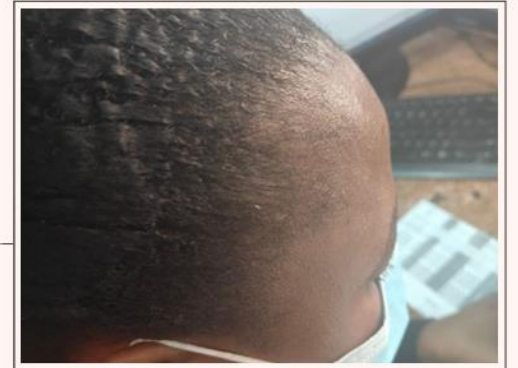
AFTER

HYPERPIGMENTATION

LU' NAKO & DR M *Case Studies*



BEFORE



AFTER

HAIR AND HAIRLINE



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#fromGood2Great

Cannabis as an Essential Oil Crop

- Sesquiterpenes
- Monoterpenes



Case study II – Marula

METRIC	SC-CO ₂	COLD PRESS	HEXANE
Oil recovery	85–95%	60–75%	95–98%
Residual solvent	Nil	Nil	ppm-level
Peroxide value	Low	Moderate (shear / heat)	Low–mod.
Colour / odour	Pale, neutral	Variable	Needs refining
Cake usability	Protein-grade	Protein-grade	Solvent-tainted



Marula Kernel Oil — Supercritical CO₂ Extraction

Sclerocarya birrea · High-oleic cosmetic & nutraceutical oil · Solvent-free, cold-process recovery

FEEDSTOCK & OIL PROFILE

50–60%	70–78%	10–13%	4–7%	<5%
OIL IN KERNEL	OLEIC C18:1	PALMITIC C16:0	LINOLEIC C18:2	FEED MOISTURE

Case study III – Oils from everywhere

SEED / KERNEL	OIL %	OIL PRICE USD/ KG
Prickly pear seed (<i>Opuntia</i>)	5–11%	600–1,200
Pomegranate seed	12–20%	60–150
Strawberry / cranberry / goji seed	15–20%	50–150
Sea buckthorn seed + pulp	8–15%	80–200
Black cumin (<i>Nigella sativa</i>)	30–40%	20–60
Argan kernel	50–55%	25–60
Marula kernel (<i>S. birrea</i>)	50–60%	25–40
Raspberry seed	10–15%	60–120

SEED / KERNEL	OIL %	USD/KG
Tamanu (<i>Calophyllum</i>)	50–70%	30–60
Pine nut	60–68%	30–60
Macadamia	65–75%	20–40
Sacha inchi	45–55%	25–50
Pistachio	45–55%	25–50
Blackcurrant seed	25–30%	40–80
Borage seed	28–38%	25–50
Chia / perilla	30–45%	20–40
Baobab seed kernel	40–45%	20–35
Moringa seed	35–40%	20–40
Styrian pumpkin seed	40–50%	15–30
Kalahari melon seed	30–50%	20–30
Passion fruit seed	25–30%	20–40
Watermelon seed	35–45%	12–25
Evening primrose	20–26%	15–30
Apricot kernel	40–50%	8–15



The results so far

Summary of Extract Yield (%)

Sample Type	n	Mean Yield (%)	Minimum (%)	Maximum (%)
Hemp	18	11.72	4.47	22.40
Cannabis	43	11.14	3.04	22.22
Cannabis Kief	2	10.69	10.30	11.09
Marula seeds	4	12.71	2.50	18.00
Moringa	1	26.92	26.92	26.92
SOYA	1	2.11	2.11	2.11
Terminalia	1	4.00	4.00	4.00
Turmeric	1	2.69	2.69	2.69
Decaffeination	1	0.00	0.00	0.00



Ethnoveterinary Botanical Medicine

Herbal Medicines for Animal Health



Edited by David R. Katerere



Priscilla Mensah
David Katerere
Sopo Hachigonta
Andreas Roodt *Editors*

Systems Analysis Approach for Complex Global Challenges



TRADITIONAL AND INDIGENOUS KNOWLEDGE FOR THE MODERN ERA

A NATURAL AND APPLIED
SCIENCE PERSPECTIVE



EDITED BY
DAVID R. KATERERE • WENDY APPLEQUIST
OLUWASEYI M. ABOYADE • CHAMUNORWA TOGO



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Second Edition



Edited by David R. Katerere, Thomas Brendler,
Ulrich Feiter, Mohamad Fawzi Mahomoodally,
and Lawrance Denzil Phillips



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Thank You
Ke a Leboga
Ngiyabonga
Ndza Khensa

Katereredr@tut.ac.za

061 8696817

Tutcannahub.co.za