

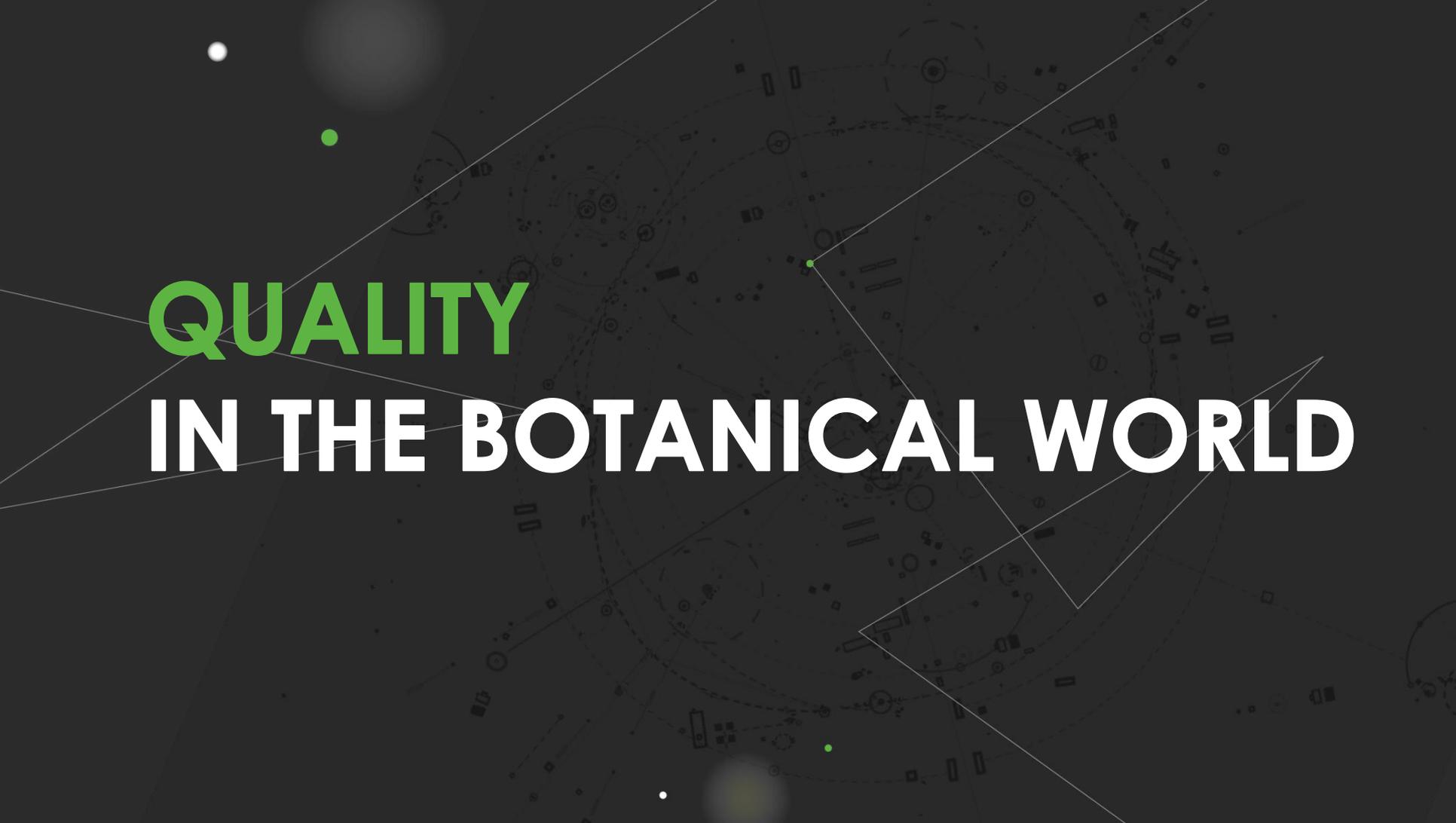


# DNA BARCODING

Pioneering  
Complete Authenticity  
at **Indena**

# OUTLINE

- **QUALITY IN THE BOTANICAL WORLD**
- **INDENA QUALITY UNIQUENESS**
- **DNA TESTING OF PLANTS**
- **DNA TESTING OF EXTRACTS**



**QUALITY**

**IN THE BOTANICAL WORLD**

# QUALITY OF BOTANICALS

- Given the very complex nature of herbal ingredients, namely extracts of plant origin, the **QUALITY** and reproducibility of their composition present a constant challenge to manufacturers.



- Consistent quality of herbal preparation depends on:
  - **AUTHENTICITY/TRACEABILITY OF VEGETABLE MATERIAL**
  - **MANUFACTURING PROCESS**
  - **QUALITY ATTRIBUTES**



**AUTHENTICITY AND  
TRACEABILITY:  
KEY QUALITY PARAMETERS**

# AUTHENTICITY AND TRACEABILITY THROUGH PLANTS PRODUCTION PATHWAY

- Consistent physiological **Activity of the Plants and their derivatives** depends on the **consistency of the composition of their constituents**, which are **affected by the following main factors** through their cultivation and handling:

- Plant genus/species** (possible plant variety/cultivar/chemotype/part)
- Geographical origin** (where plants are collected, if wild or cultivated)
- Cultivation–Harvesting**
- Processing** (drying, grinding)
- Storage/freezing**
- Transportation**



# | AUTHENTICITY

Up to **30%** of plant derived materials sold for human consumption **ARE NOT** what is declared on the label.

1. Soon J.M., Manning L., *Developing anti-counterfeiting measures: the role of smart packaging*, 2019
2. Scuderi A., Timpanaro G., *The supply chain value of POD and PGI food products through the application of blockchain*, 2019
3. UIBM, Italian Ministry for Economic Development, *No to fake – The counterfeiting of cosmetics*, 2013

# THE **FUTURE** IS IN THE **QUALITY** OF EXTRACTS USED.

- 1** | Healthy properties are correlated to botanical extracts' quality.
- 2** | Products must reliably meet consumers' needs and expectations.

# GENERAL LABEL? NOT ENOUGH.

Technological improvement and leaps forward in R&D lead to stronger demand for multiple certifications.

**INDENA IS HERE RIGHT NOW!**



**INDENA QUALITY**  
**UNIQUENESS**  
**BOTANICAL ID CHRONICLES.**

# INDENA QUALITY SYSTEM

- **INDENA** guarantees the **QUALITY** and the **CONSISTENCY** of extracts composition throughout a **process** which deeply touches all stages of the production, **from cultivation to the finished product**.
- In addition, the Indena's quality system comprises **DNA ANALYSIS**, being **genomic identification** part of its own **DNA**, for which the company is **pioneering identification research**.

# PLANT IDENTIFICATION

- The first step in **QUALITY CONTROL** of botanical preparations is ensuring the **CORRECT IDENTIFICATION OF THE PLANTS** used.

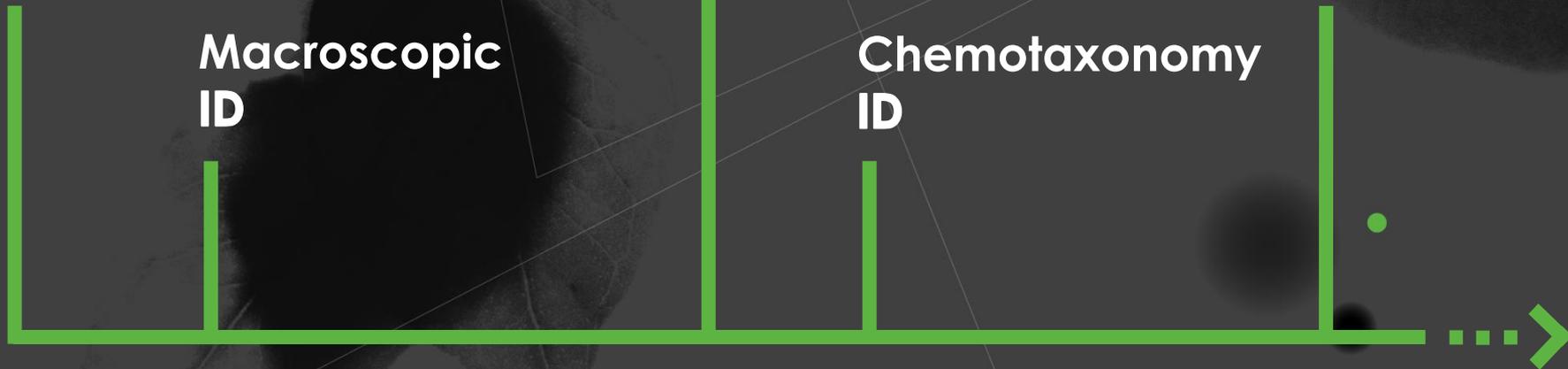
Plant  
taxonomy

Macroscopic  
ID

Microscopic  
ID

Chemotaxonomy  
ID

Genomic  
ID



# GENOMIC IDENTIFICATION

DNA  
barcoding

DNA  
fingerprinting

PCR-based

DNA-NGS

GENERAL

DETAILED





**DNA TESTING OF PLANTS**  
**THE FIRST CHALLENGE.**

# BOTANICAL DNA IDENTIFICATION

For plants there is **no universal DNA barcoding methodology**: each plant needs a dedicated method, developed on its own genome.



## DNA SEQUENCING-BASED TESTS:

1. are emerging as **highly reliable and powerful tools to authenticate botanicals**, to identify the species and varieties of medicinal plants;
2. play an **important role inside the dietary supplement industry, since adulteration is a serious concern.**

# DNA TESTING

In some cases it is necessary to resort to **DNA-BASED METHODOLOGIES** to precisely define and identify species or variety levels, through a **3-STAGE DNA TESTING:**

## 1. EXTRACTION

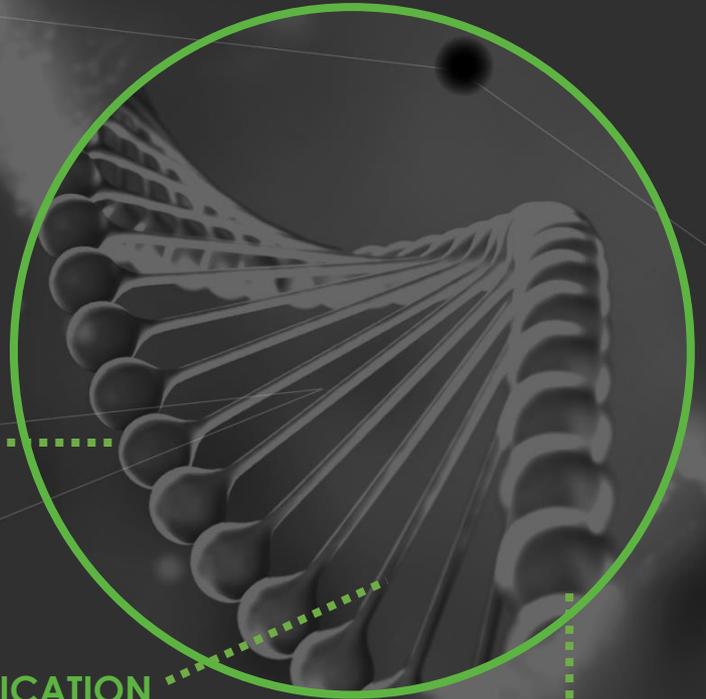
through a standard protocol to extract the DNA

## 2. AMPLIFICATION

usually made through PCR (Polymerase Chain Reaction) to have a consistent amount of specific DNA to be analyzed

## 3. MEASUREMENT

by analysis of DNA sequences



# INDENA'S APPROACH TO GENOMIC IDENTIFICATION

- 📄 DNA barcoding is **orthogonal**: one single technique may not be enough
- 📄 **Botanical background** to structure the DNA methodologies
- 📄 **Ability to use** the **whole range of DNA available techniques**
- 📄 **Availability of authenticated plant material** to develop highly reliable DNA tests
- 📄 Where, when and how to collect the **reference species to be used as “certified” controls to validate DNA methods**
- 📄 **Ability to identify unknown species**

INDENA CAN **GENETICALLY**  
**CERTIFY THE PLANTS IT USES.**

The first challenge: **Plant DNA testing**



**GOAL ACHIEVED**



**QUALITY**

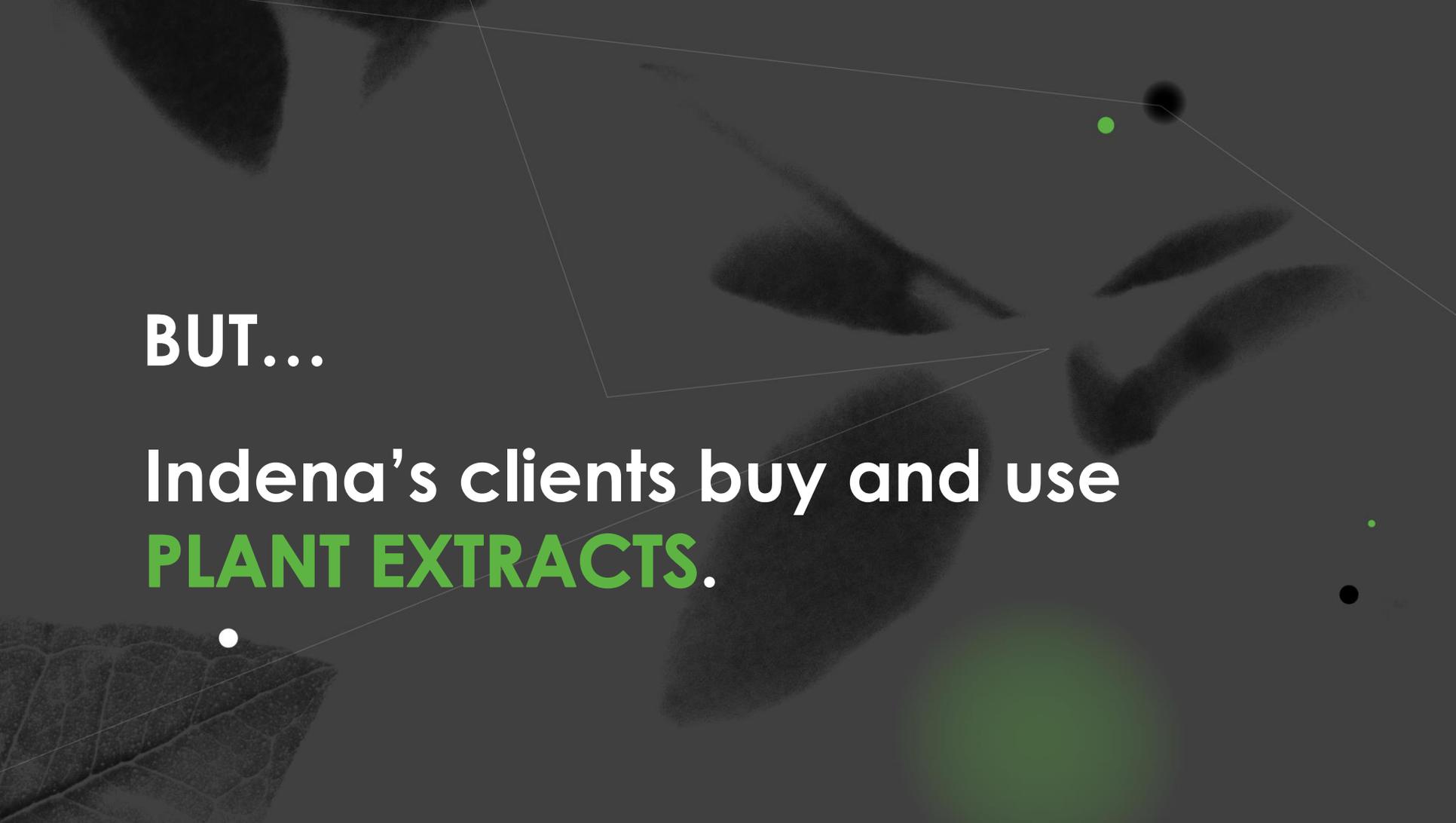
**TRACEABILITY**

**AUTHENTICITY**

In consideration of the importance of the **plant DNA testing** within Indena quality system and in order to make the communication of such analysis more immediate and easily usable by clients, **Indena developed a new logo...**

**OUR  
CERTIFICATION  
TRADEMARK**





**BUT...**

**Indena's clients buy and use  
PLANT EXTRACTS.**



**DNA TESTING OF EXTRACTS**  
**THE NEXT CHALLENGE.**



**TAKES UP THE CHALLENGE...**  
**AND SUCCEEDS!**

First application:

**M**IRTOSELECT<sup>®</sup> - Bilberry Extract

# WHY ANALYZE MIRTOSELECT<sup>®</sup>'S DNA?

MIRTOSELECT<sup>®</sup> IS **UNIQUE**:

**Effectiveness + Authenticity = Reliable**

proven by  
clinical studies

additional  
verification  
by DNA  
extract testing

action

# HOW DOES OUR DNA METHOD WORK?

1 | EXTRACTION

2 | PURIFICATION

3 | AMPLIFICATION

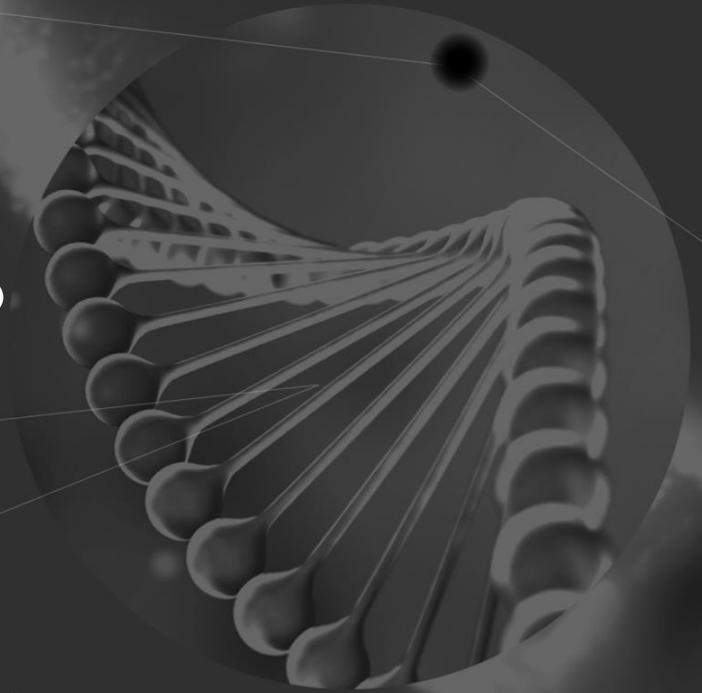
4 | IDENTIFICATION

= *Vaccinium myrtillus*



# THE **KEY** TO OUR **METHOD'S SUCCESS?**

The amplified region  
must be univocal  
for *Vaccinium myrtillus*.



Indena's clients have now the possibility to use **Indena certification logo** also for **extracts**, in line with the one for plants, and they can choose one or both of them according to their specific needs:

# OUR CERTIFICATION TRADEMARK



# BUT **INDENA** WANTS TO GO FURTHER...



Clients have now the opportunity to experience themselves absolute certainty about the quality of plants and extracts.



**ON SITE ANALYSIS:  
THE FUTURE IS NOW!**

# EXCLUSIVE PARTNERSHIP

- Through an exclusive agreement with Hyris Ltd, and drawing on the solid Indena database of reference compiled over decades, **DNA fingerprint analysis on plant samples can be carried out in the field even by unskilled personnel.**
- **INDENA HOLDS PREFERENTIAL ACCESS TO THIS BREAKTHROUGH TECHNOLOGY FOR ON-SITE IDENTIFICATION OF BOTANICAL SPECIES, EXCLUSIVELY FOR THE DIETARY SUPPLEMENT INGREDIENT INDUSTRY.**
- The device that makes this possible is the **bCUBE<sup>®</sup>**, made by Hyris



**bCUBE®** by  **HYRIS**  
GLOBAL DIAGNOSTICS

## 1 | ON SITE ANALYSIS

As small as a coffee mug, the bCUBE can analyze starting material straight from the field in roughly an hour.

## 2 | CLOUD STORAGE

Even when carried out thousands of miles away from the Indena labs, the test results can be shared on a proprietary cloudbased platform in real time.

## 3 | PERFECT TRACING

The GPS data can be recorded to enable perfect tracing.



# WHAT MAKES MIRTOSELECT® SO SPECIAL?

**DNA TESTING ON  
EXTRACTS'  
FIRST APPLICATION**



**DNA VERIFICATION  
ANYWHERE  
YOU ARE**



# LOVE INDENA'S DNA?



**SHARE** THIS OPPORTUNITY  
WITH THE WORLD AND STAY TUNED  
FOR FURTHER ACTIVITIES' NEWS!

