The rambutan program: Organic feedstocks, sourced sustainably

Dr. David Hérault
Global Research & Development Director
Cosmetic Bioactives

We collect thousands of raw materials from nature worldwide. These raw materials include tree bark, leaves, roots, seeds, fruits, pericarps. Every year, we evaluate >150 new raw materials.

We screen extracts of those materials for their potential, e.g., to rejuvenate the cells of the skin. We create effective products for consumers all over the world addressing anti-aging, skin hydration, pollution damages, etc.

We supply the leading and most innovative players in the cosmetic industry. You find our ingredients in many skin and hair care products. You may have used our products today!

We are the cosmetic active ingredient business of BASF, a world leader in its field.
Our customers and consumers are looking for new products focusing on claims and sustainability with novel ingredients.

Most important new product launches 2018

<table>
<thead>
<tr>
<th>Feature</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green, clean and natural features or characteristics</td>
<td>40%</td>
</tr>
<tr>
<td>Health-inspired positioning</td>
<td>30%</td>
</tr>
<tr>
<td>New ingredients</td>
<td>20%</td>
</tr>
<tr>
<td>Sustainable/green features or characteristics</td>
<td>20%</td>
</tr>
<tr>
<td>Digital beauty marketing (e.g., app, online analysis)</td>
<td>20%</td>
</tr>
<tr>
<td>Targeting a specific consumer generation/demographic</td>
<td>20%</td>
</tr>
<tr>
<td>New formulations</td>
<td>20%</td>
</tr>
<tr>
<td>Personalized products or custom solutions</td>
<td>20%</td>
</tr>
<tr>
<td>Ethical or sustainable features or characteristics</td>
<td>20%</td>
</tr>
<tr>
<td>Changing textures</td>
<td>20%</td>
</tr>
<tr>
<td>Products to be used as part of a regimen/routine</td>
<td>20%</td>
</tr>
<tr>
<td>Personalized experiences</td>
<td>20%</td>
</tr>
<tr>
<td>Product portability (e.g., easy to bring during travel)</td>
<td>20%</td>
</tr>
<tr>
<td>New distribution channel</td>
<td>20%</td>
</tr>
<tr>
<td>New packaging functionality</td>
<td>20%</td>
</tr>
<tr>
<td>New packaging sizes</td>
<td>20%</td>
</tr>
<tr>
<td>DIY/homemade</td>
<td>20%</td>
</tr>
</tbody>
</table>

We deliver clinically proven efficacy – naturally and sustainably.

Our high-tech research activities allow us …

Examples of R&D capabilities:
- DNA array
- Immunolabelling
- 3D aggregates
- Dermal papillae
- Mimeskin®
- 3D bioprinted skin
- Microbiome
- 3D imaging
- Sebaceous gland

… to find the biologically active fractions among millions of plant materials!
Introducing rambutan – the hairy superfruit from Vietnam

Humid tropics
Family: Sapindaceae
Species: *Nephelium lappaceum* L.
Origin: Vietnam

Present in Southeast Asian countries such as Vietnam, Thailand and China.

- 22 – 30 degrees Celsius
- Sunny places, except for young trees
- 2000 – 5000 mm

The fruits are collected mainly from July to September on domesticated trees in the south of Vietnam. Then the fruits are manually opened to separate the different parts.

---

A superfruit: exploring its hidden bioactive ingredients

The leaf...
... strengthens the collagen and elastin network
... visibly reduces the appearance of wrinkles
... improves skin elasticity

The pericarp...
... strengthens the skin barrier function
... improves skin hydration
... re-energizes skin cells

The seed...
... protects the scalp from pollution
... moisturizes scalp skin
... refreshes hair strands
The leaves rejuvenate mature skin

Impact on dermal genes

- ≈ 400 genes in our chromosome are known "dermal genes"
- 88 of these dermal genes are most relevant for bioactives
- Rambutan leaves activate 6 dermal genes according to PCR array tests

Statistics:
Mean +/- SEM, n=4
Student test vs untreated control,
(*) p<0.05
scale shows fold increase of gene activity due to bioactive from 4 experiments

"Evergreen leaves for ever-young skin"

Pronounced elasticity and firmness effects confirmed

Mode of action:
An aqueous extract of leaves acts on the creation of new collagen and elastin fibers and improved 3D assembly of the fibers.

Target genes:
- COL1A2: Collagen Type I Alpha 2 Chain
- P4HA1: Prolyl 4-Hydroxylase Subunit Alpha 1
- P4HA2: Prolyl 4-Hydroxylase Subunit Alpha 2
- CYR61 (CCN1): Cysteine-Rich Angiogenic Inducer 61
- FBLN5: Fibulin-5
- ELN: Elastin

The pericarps protect skin from dehydration

**In vitro** impact on epidermal biology

1. Stronger stratum corneum
2. Increased cell energy
3. Increased cell moisture

**In vivo**:
**MoistureMap® method** (darker pixel = more hydrated)

Placebo
D0
D14
D28
Extract of pericarps

Result: skin hydration ➔ +7% vs. baseline

The extract protects the skin from drying out as the peel preserves the juicy rambutan fruit from dehydration.
The seeds provide a breath of fresh air for your hair

Just as the seed provides energy to rambutan’s fruit for its development, an aqueous extract of seeds revitalizes the hair from root to tip.

“ATP” = Adenosine-triphosphate → energy that the hair bulb cells can use to increase cellular activity and make the hair grow

B[a]P = Benzo[a]pyrene → model substance to study pollution

Beyond biochemistry: the ambition of the rambutan program

Commitment to ensure sustainable sourcing of rambutan in Vietnam.
Our partners

- Organic certification
- Management & farmers’ support
- Garden maintenance
- Harvest and processing
- Supply chain supportive actions
- A network of farmers
- Landowners
- Local management
- Fruit canning
- Third parties
- Identification of main sustainability challenges
- Proposition of measures
- Yearly audit
- Trusted local supplier
- The rambutan-dedicated field workers

Partnerships ensure social and quality standards and a reliable supply chain.

In 2017, we reinitiated the cultivation of two rambutan gardens …

1. 1st Organic rambutan gardens in Vietnam
   - 1 hectare – 47 Java trees
   - 25 – 30 years
   - Dong Nai province

2. 2 hectares – 150 Java trees
   - 25 – 30 years
   - Dong Nai province

… this year, we harvested the organic fruits for the cosmetic market.
Benefits for the local dedicated rambutan field workers …

<table>
<thead>
<tr>
<th>Labor conditions</th>
<th>Incomes</th>
<th>Fringe benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthened safety-related working conditions: access to individual and collective protection equipment</td>
<td>Incomes above local practices, including bonus</td>
<td>Health &amp; safety insurance</td>
</tr>
<tr>
<td>Dedicated training</td>
<td>Gender equity</td>
<td>Free meals</td>
</tr>
<tr>
<td>Formalized work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

… thanks to the local partners’ & BASF’s commitments.

BASF’s rambutan program at a glance

Upcycling different parts of the tree combined with perfect traceability

A set of new solutions with multiple benefits for skin care and hair care

Innovative ingredients to answer the growing trend of responsible beauty.
The rambutan program

Next steps

Ensure the social and commercial success of the rambutan range and initiate further sustainable programs.