



Formulation et vectorisation de molécules bioactives

Encapsulation par l'alginate pour l'agriculture durable, la nutrition humaine & animale

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KAPSERA

Unlocking a sustainable future

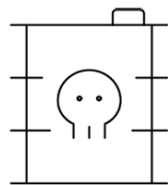
Looking for a sustainable food chain...

Consumers' top 3 concerns



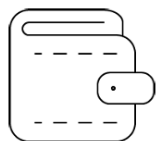
Nutritious & healthy

41%



Little or no use of pesticides

32%



Affordability of food for all

29%

Farm to Fork conference 2020, K.G. Grunert
MAPP – Research on value creation in the food sector

Politics

The Guardian, Apr. 22

EU unveils plan for 'largest ever ban' on dangerous chemicals

European microplastic regulation

ECHA's proposed restriction

In January 2019, ECHA proposed a wide-ranging restriction on microplastics in products placed on the EU/EEA market to avoid or reduce their release to the environment. A consultation on the restriction proposal was organized from March to September 2019. ECHA received 477 individual comments. Details of the consultation, including non-confidential responses, are available on ECHA's website.

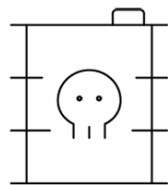
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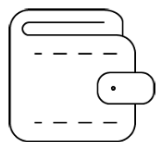
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Industries is facing challenges to use natural ingredients

High fragility

Poor reliability

Higher cost

A new era of sustainable food chain...

Kapsera enables a new era

Industries is facing challenges to use natural ingredients



High fragility

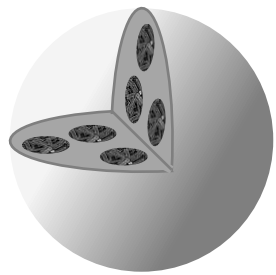
Poor reliability

Higher cost

We offer a technology combining **performance & sustainability** for more natural products.

Kapsera makes microcapsules...not microbeads

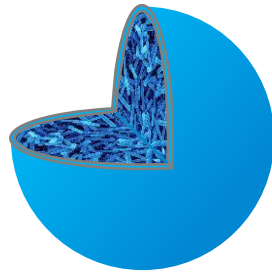
Microbeads



Extrusion

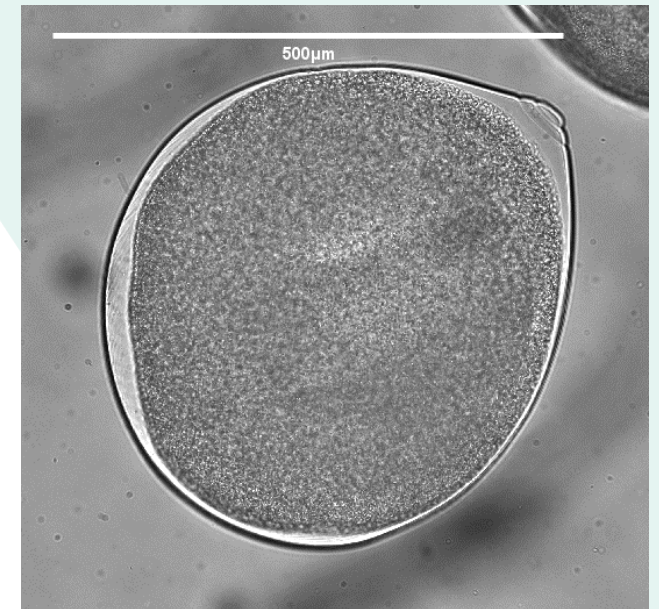
- Initial mix of alginate and active ingredients
- Low load of active ingredients
- No optimization of inner core :
 - Limited adding of ingredients
 - Local and slow growth for microbials
- Slow/no release:
 - Very slow diffusion
 - No physical/chemical trig

Microcapsules



Co-extrusion

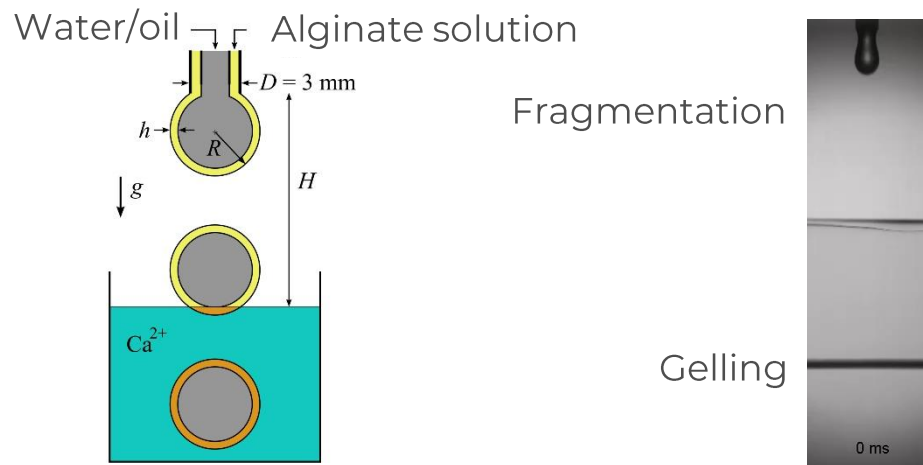
- Process starts with 2 independent solutions
- High load of active ingredient
- Inner core easily optimized:
 - For composition and concentration
 - For growth (microbials)
- Controlled release
 - Controlled and customized passive diffusion
 - Physical/chemical trig



Coextrusion: dripping or jetting?

Dripping

Bremond *et al.*, *Soft Matter*, 2010



Fragmentation

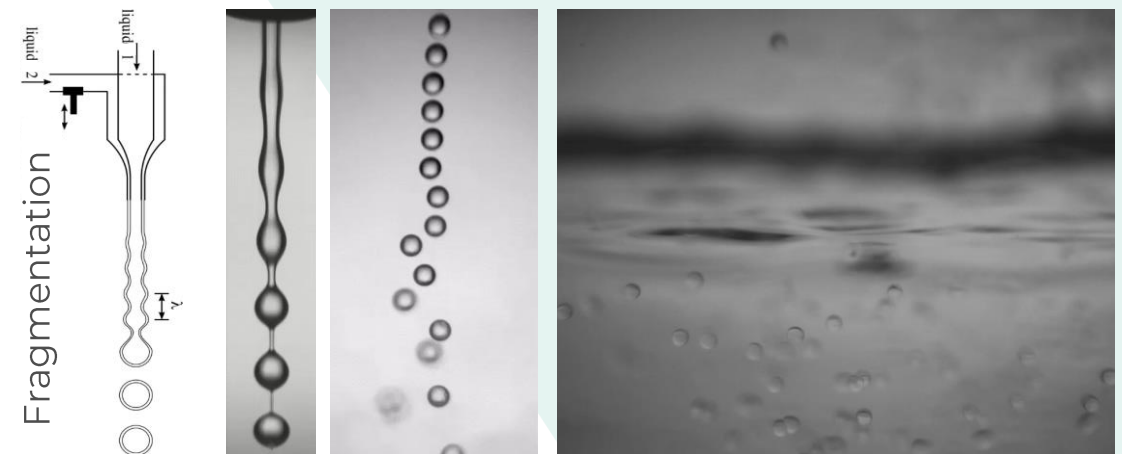
Gelling

Dripping mode
mm size capsules
Low flow rate
Thick shell

Easy process

Jetting

Doméjean *et al.*, *Phys. Rev. Fluids*, 2016



Flight

Gelling

Jetting mode
Down to 50 μm size capsules
High flow rate
Controlled shell thickness

Challenging process

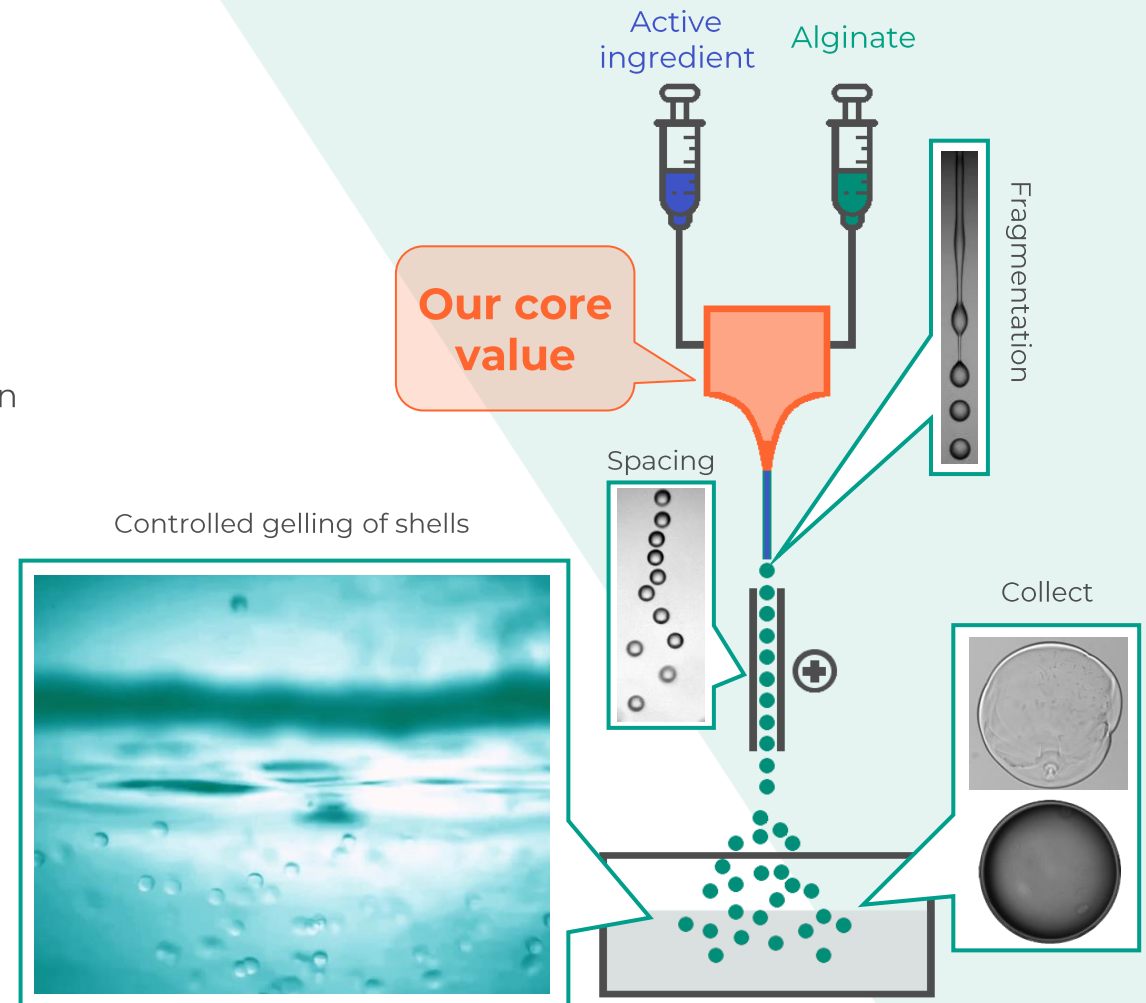
Sustainable microcapsules & scalable process

KAPSERA's microcapsules features

- Based on **alginate: natural & edible** materials
- Reversible gelling process (**no chemical** alteration of the alginate)
- **Liquid core** allowing formulation of **any active ingredient** in solution
- Semi-porous shell for **controlled release** of active ingredients
- Wide-range of size from **< 100 µm to > 1 mm**

Patented and scalable technology

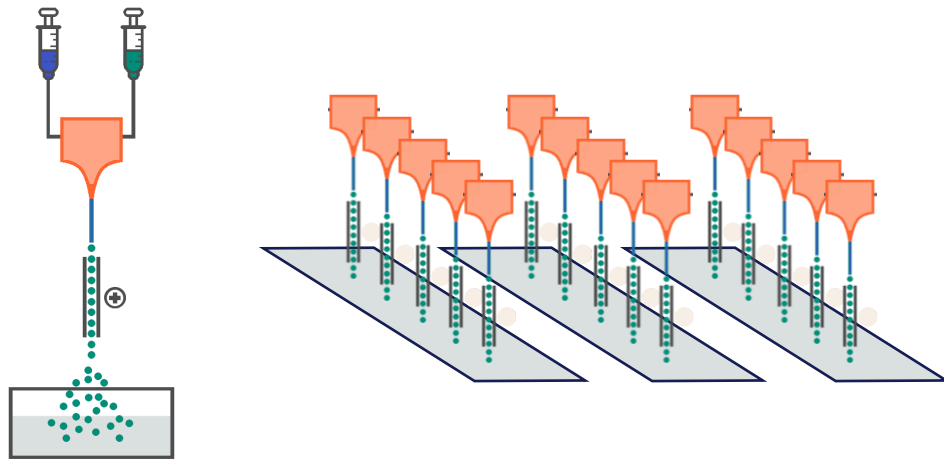
- Based on unique and **proprietary microinjectors**
- **8 patent families** covering the process and the capsules portfolio
- **Scalability** based on the **parallelization of injectors**



We shape our capsules on demand

We developed scalable microfluidic injector

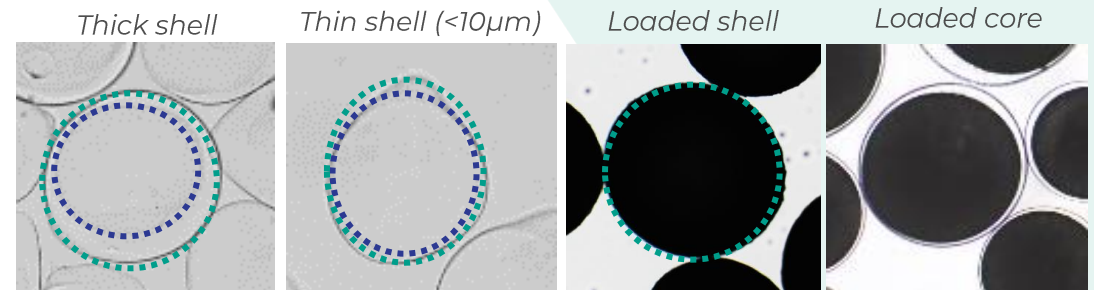
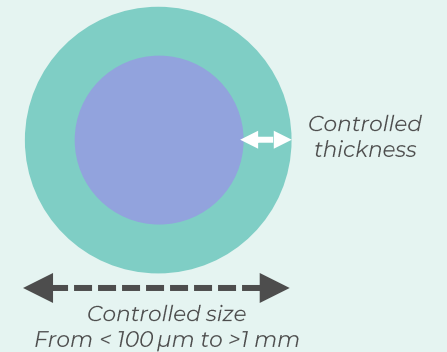
- Food-grade compatible
- Reliable and flexible
- Scalable by high parallelization
- Proprietary design and knowhow



We master alginate properties to customize capsule's design on demand

Controlled of shell properties by adding other(s) ingredient(s) into the alginate gel = **innovative function(s)**

Independant formulation of the liquid core = **high concentration** of active ingredients



Tailor made formulations

Protect

From various stresses



UV protection in field

pH protection in stomach

Combine

To create polyvalent products



Alive microbe with synthetic fungicide

Use of microbials in harsh processes

Deliver

At the right time



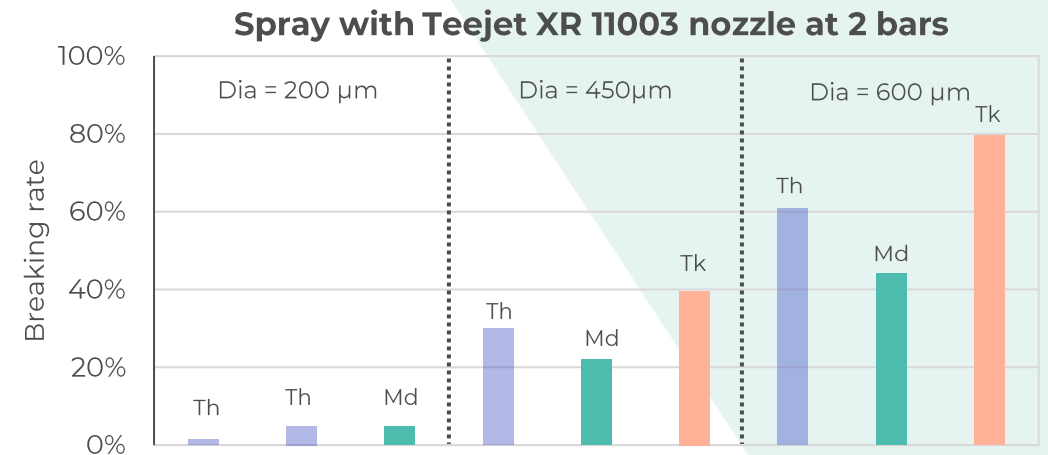
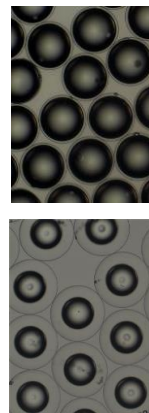
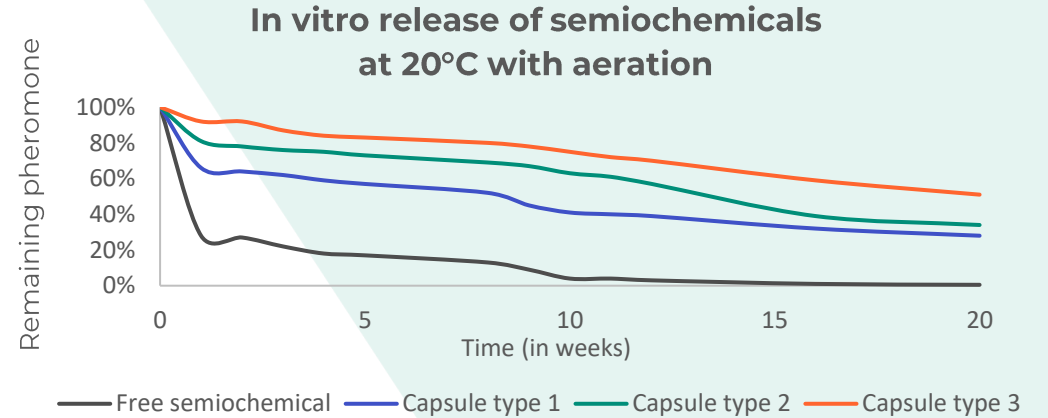
Sprayable pheromone

Targeted release in gut

Sprayable pheromone

From laboratory

- Diffusion profile validation
 - In vitro
 - In vivo on insects : indoor & outdoor
- Sprayability of capsules
 - Density matching
 - Mechanical resistance ajustement



Sprayable pheromone

From laboratory

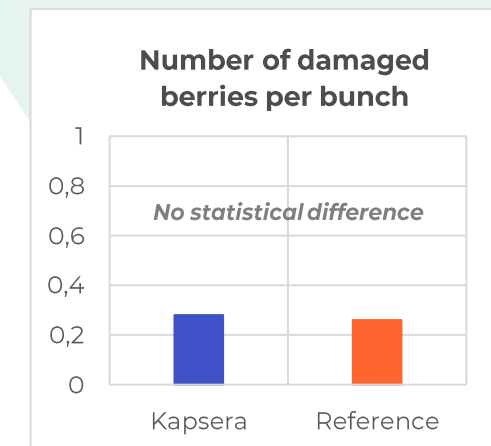
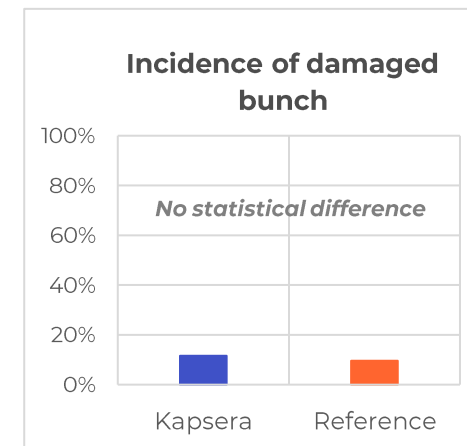
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to field

- Production scale up
- GEP trial

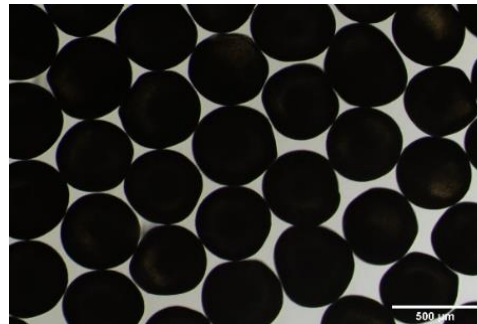
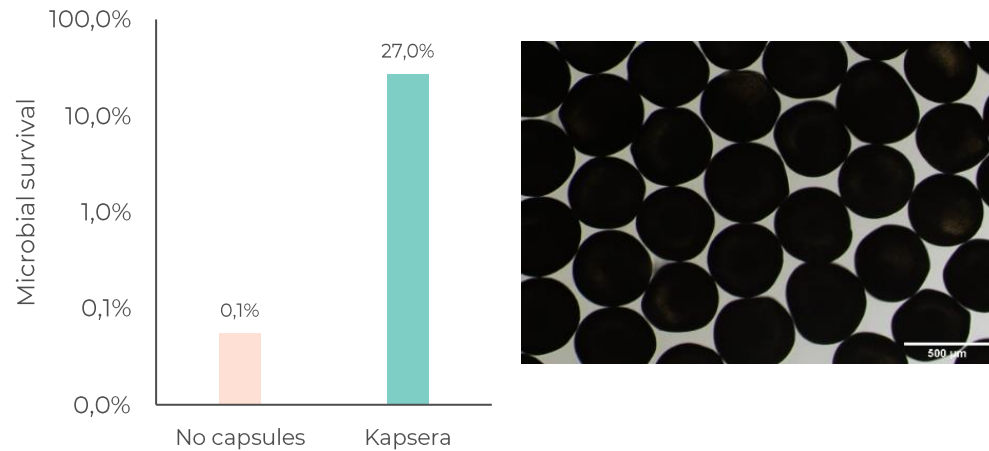
**Efficient and sprayable product
based on natural microcapsules**



Active ingredients protection

UV protection

- On any active ingredient
- Based on natural UV protectant
- Loading of protection into the shell
- Protection is stable over time



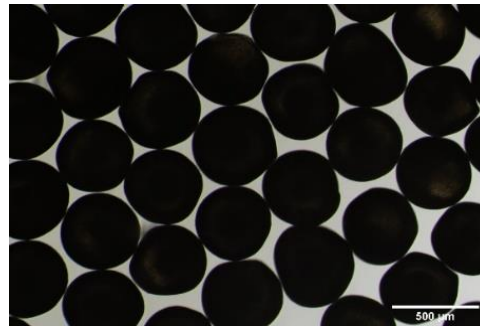
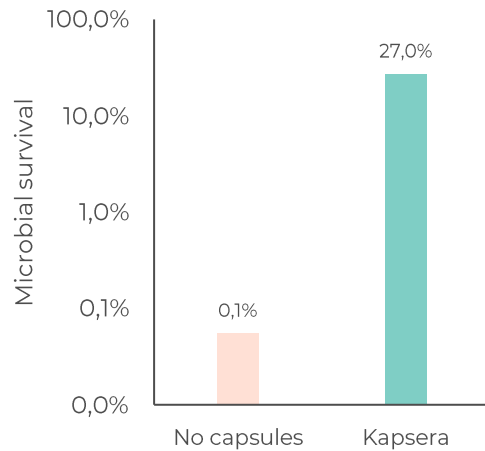
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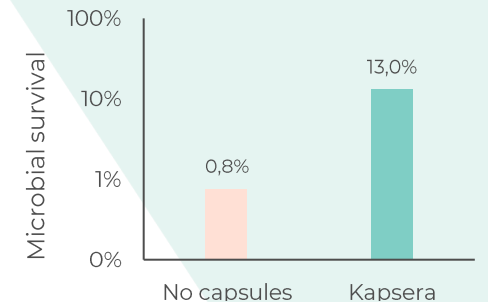
pH protection

- On any active ingredient
- Based on specific capsule design and composition
- Laboratory validation



Formulation	Survival in stomach (in vitro test)	Release rate in duodenum (in vitro test)
Probiotic suspension	< 5%	< 1% at 30 min
Encapsulated probiotic	> 50%	100% in < 5 min

**Biostimulants in liquid fertilizers
pH 2,5 - 20% NPK
2 days**



Wide expertise around our microcapsules

Based in Bordeaux

- 20 people (4 PhD, 7 M.Sc.)
- Fully equipped laboratory (250 m²)
- Office (200 m²)
- Industrial pilot coming (550 m²)

Expertise

- Microbiology
- Physical chemistry & soft matter science
- DSP process

Probiotics
Biostimulants Virus Fungi
Enzymes Vitamins Fertilizers
Pheromone Flavors
Bacteria PGPR Yeast Fragrance



CONCLUSION

Your partner to develop and manufacture sustainable products

Fully sustainable

100% biosourced and biodegradable, **non microplastic**

Compatible with various active

Oily core, aqueous core, emulsion core

Microbials, pheromones, fertilizers, vitamins, particles suspension...

High concentration and high stability

Limited by active ingredient properties (solubility and stability)

Easy & safe to use

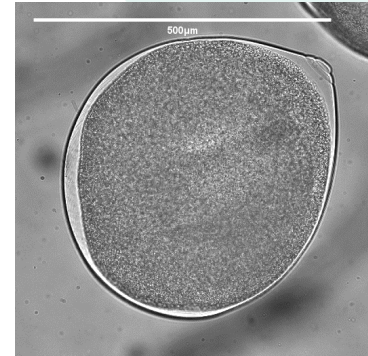
Wet and dry capsules are easily resuspendable

No fine dust

Compatible with various processes

Relevant size and product forms for Seed, soil or foliar treatment

Relevant size and product forms for coating, extrusion, drying, mixing...





Thank you

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