SEPISMART™ SR

It is time to release your creativity

SEPPIC

Ingredients that inspire

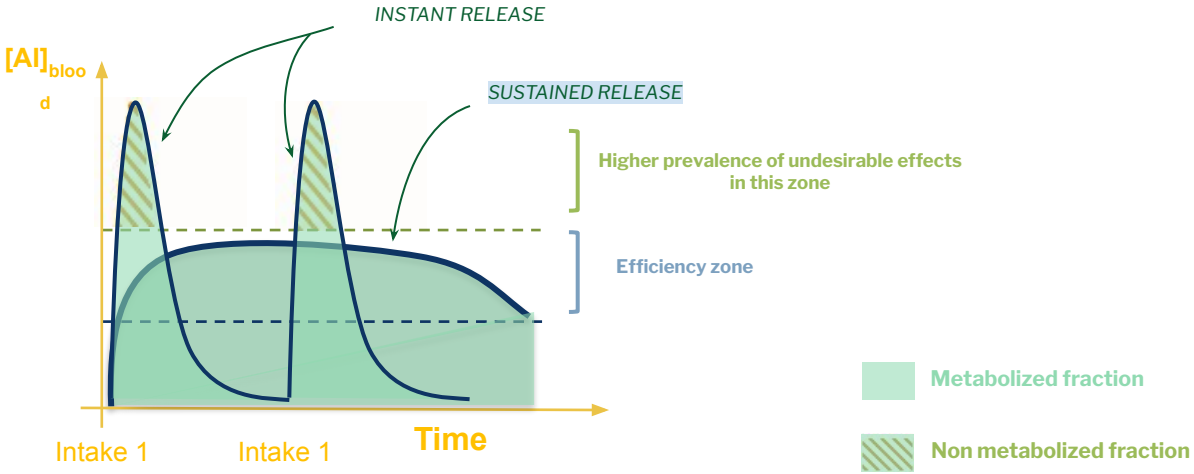
Sustained release for Nutrition

Benefits for Nutrition

The sustained release technology provides the release of an effective amount of active ingredient over time and at a continuous rate

→ Enhancing **absorption**

→ Avoiding **potential undesirable** effects



Benefits for formulator and consumers

Sustained release formulations can be used to help

Formulator

Optimize the dosage of active ingredients by providing benefits over several hours
⇒ *more specifically for ingredients with slow absorption rate*

Provide high-value solutions and marketing differentiation

Consumer

Reduce daily intakes and enhance the consumer compliance

Improve the efficiency of the treatment (uniform delivery of active over time)

Decrease potential side effects due to the peak of active ingredients

Discover

SEPISMART™ SR

A natural solution for sustained release dietary supplements

What is it ?

SEPISMART™ SR is a synergistic co-granulated combination of Xanthan and Acacia gums **from natural origin**, processed **without solvents.**

Polysaccharide used for its viscosity properties providing the **sustained release** effect

Polysaccharide with a good behavior to **direct compression** giving good hardness tablet

An international patent application has been filled and a patent has already been granted in France and Japan

A sustainable sourcing of acacia gum

Reasoned & sustainable harvest

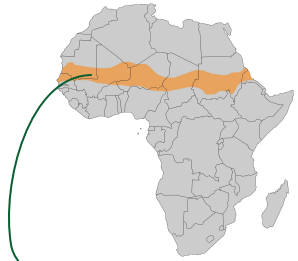
- Protection of acacia trees to ensure a sustainable development of gum acacia
- Use of improved cook stoves which consume less wood
- Harvesters : formation on good environmental practices

Improvement of the harvesters' living conditions

- Give access to safe drinking water
- Ensure food security
- Help to diversify income

Strengthening of the acacia gum industry

- Improvement of the quality of the gum
- Better integration of the producers in the industry network
- Sustainable growth of the local industry



A secure sourcing in the acacia gum belt *(17 countries)*

Gum processed in France

Xanthan gum, a thickener from natural origin

A polysaccharide gum derived from *Xanthomonas campestris*

Fermentation of carbohydrates containing raw materials like :

- Glucose syrup from maize

- Sugar from sugar beet

- Sugar from sugar cane

Non GMO

Gum processed in Europe

General properties

Appearance

White or slight yellowish microgranules

Physical properties

Particle size	> 500µm : 4% max > 80µm : 65-90%
Density	bulk: 0.45 ±0.05 g/mL tapped : 0.58± 0.05 g/mL

2 years
shelf life

Chemical properties

pH (1% dispersion)	6 – 7.5
Viscosity at 2% *in buffer solution at pH 7,2 at 25°C*	3000 – 3100 cP

Good viscosity properties!

Technical performance

SEPISMART™ SR

An optimized performance

SEPISMART™ SR has been extensively tested to ensure an optimized performance

- Sustained release effect tested with different active ingredients : caffeine and magnesium carbonate
- An alternative to cellulosic derivatives with a similar level of performance
- Excellent flowability
- Excellent effect on compression behavior
- An adjustable release profile depending on % Sepismart ™ SR

Easy to use in various delivery form

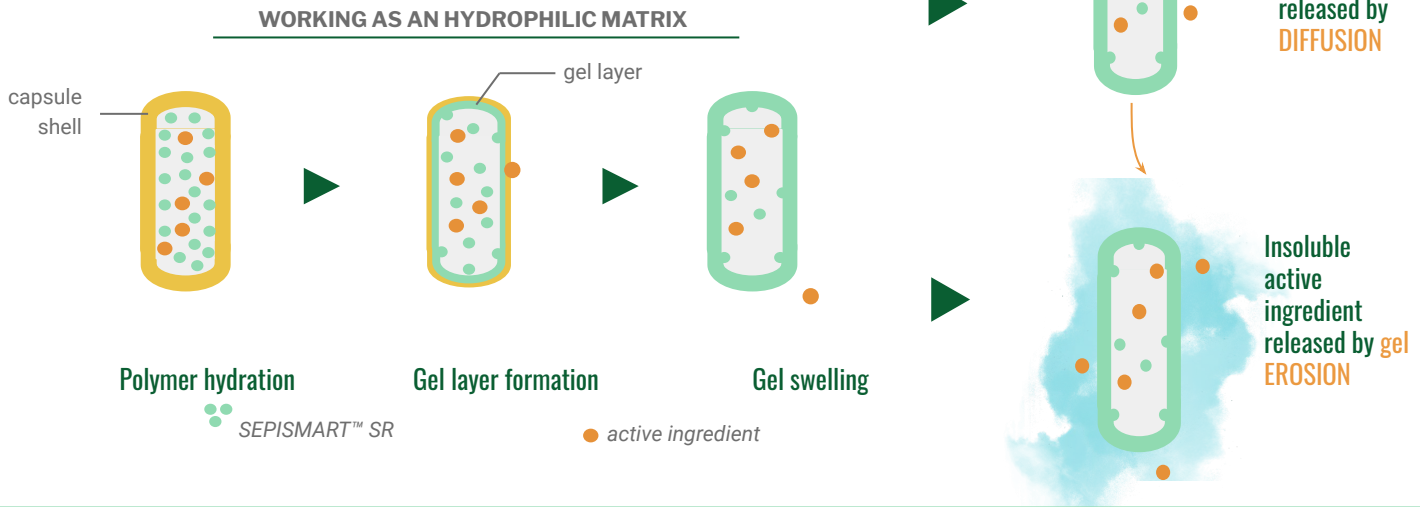
- Use in tablets (compatible with coated tablets)
- Use in hard capsules

SEPISMART ™ SR

in capsules

Mechanism of action

- **How does it work ?**



same mechanism of action **with tablets**

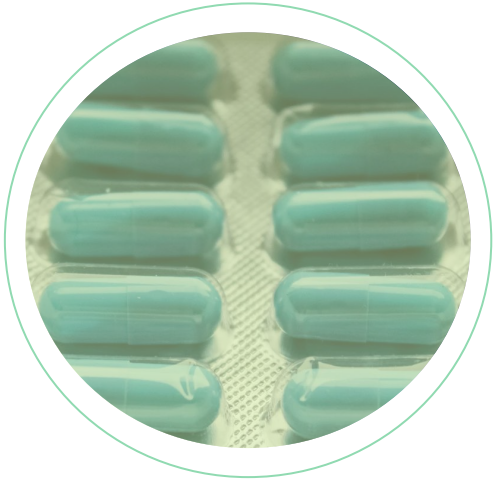
When ingested, the capsule starts disintegrating and the SEPISMART™ SR inside starts its hydration ; **the result is the formation of a gel**.

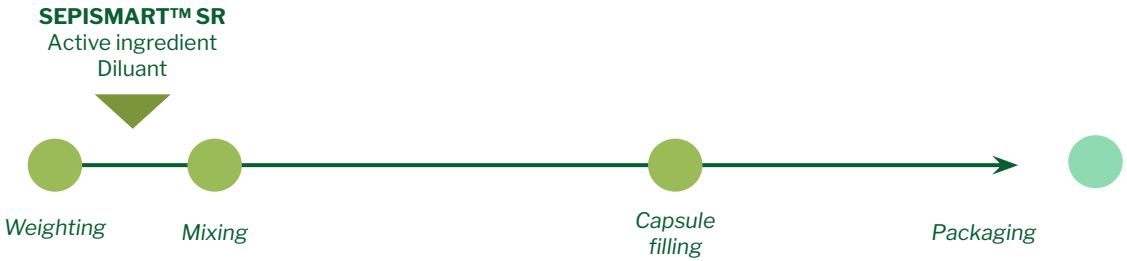
The capsule wall serves as a support for the gel formation, creating a gel layer all against the capsule body, similar to when the gel forms a layer all around the tablet.

Easy-to-use

25 - 30%
Recommended level of use

- **How to use it ?**





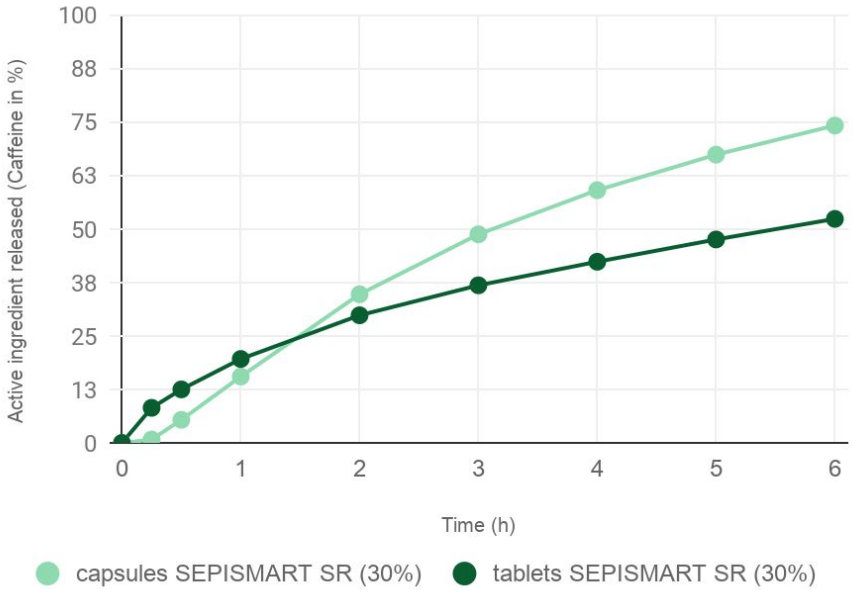
During the mixing step, it is recommended to use a shaker-mixer rather than a high shear mixer.

At lab scale, all ingredients were blended in a Turbula mixer. In order to obtain a stable homogeneous blend, the mix was then processed on a rotary press.

*recommended dosage of Sepismart™ SR depends on the active

Use in hard capsule

SEPISMART™ SR is compatible with use **in hard capsules.** By optimizing the ratio of excipient, it is possible to get a sustained release effect similar to the one obtained with tablets.

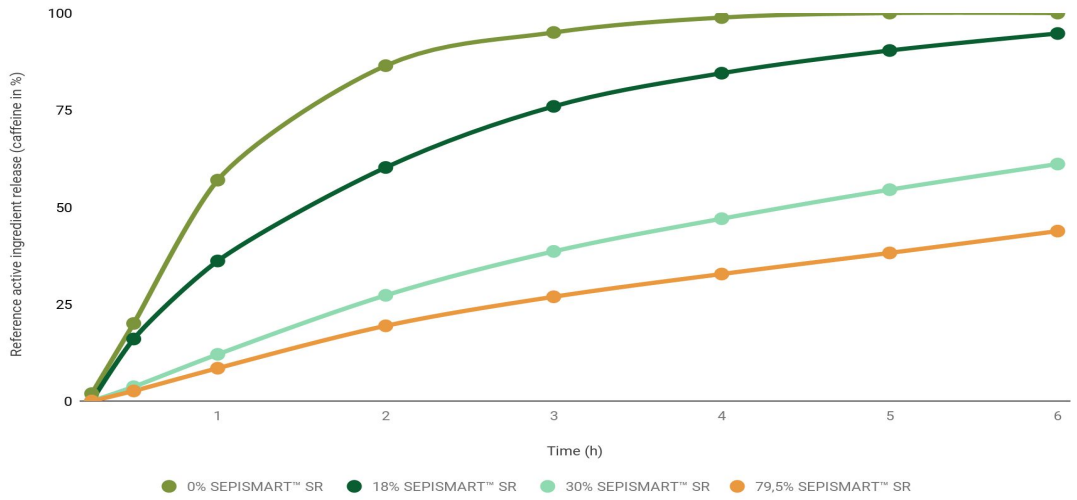


By comparing the dissolution profiles of capsules and tablets, both with 30 % of SEPISMART SR and 20 % of caffeine we see that **the sustained release kinetics show similar trends.**

However, we observed a slower active dissolution for tablets forms. That is because the SEPISMART SR forms a stronger gel around the solid core of the tablet and thereby will take longer to dissolve. In capsule forms, the gel strength is much less important, with no support as soon as the capsule wall is dissolved.

Fine tuning the release profile

The sustained release profile can be adapted by using a different percentage of SEPISMART™ SR. It will also strongly depend on the nature of the active ingredient.



The release profile will depend on the formula and nature of the active ingredient.

**at ≤ 20%, the forming gel layer may not be homogenous, giving an instant release*

By comparing capsules with 30 % and capsules with 80 % of SEPISMART SR, we see that **the release dynamics are very close**. The SEPISMART SR can then be used Quantum satis **as a delaying and a filler agent.**

25 - 30%

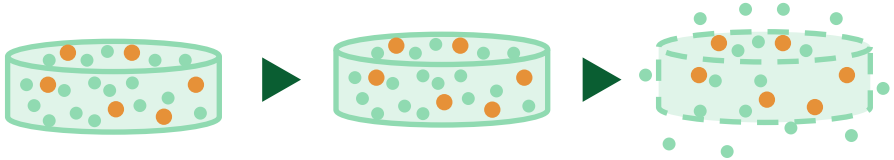
Recommended level of use

SEPISMART ™ SR
in tablets

Mechanism of action

- **How does it work ?**

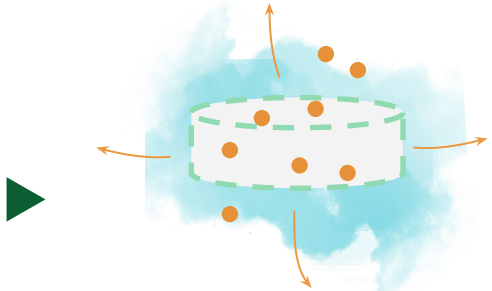
HYDROPHILIC MATRIX CONCEPT



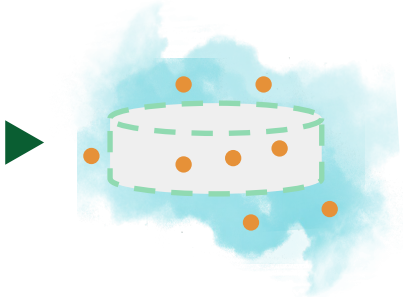
Polymer hydration

Gel layer formation

Gel swelling



Soluble active ingredient released by DIFFUSION



Insoluble active ingredient released by tablet EROSION

same mechanism of action than **with capsules**

SEPISMART™ SR

active ingredient

Mechanism of action

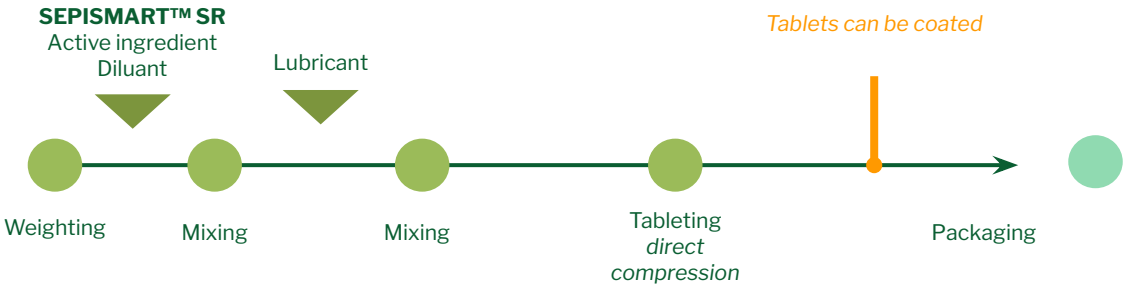
- **How does it look like for real ?**

Let's see
with a sample of a colored tablet containing **SEPISMART™ SR**

Easy-to-use

25 - 30%
Recommended level of use *

- **How to use it in direct compression ?**



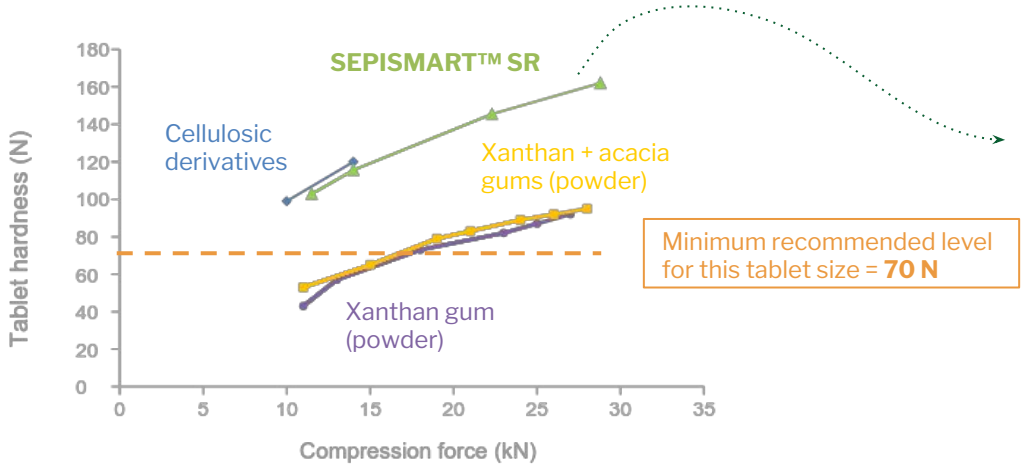
During the mixing step, it is recommended to use a shaker-mixer rather than a high shear mixer.

At lab scale, all ingredients were blended in a Turbula mixer. In order to obtain a stable homogeneous blend, the mix was processed on a rotary press.

*recommended dosage of Sepismart™ SR depends on the active

No compromise on compression behavior

Tablets formulated with SEPISMART™ SR have an excellent hardness at **low compression forces**.
They behave as well as cellulosic matrices and better than powder mix of xanthan & acacia gums.



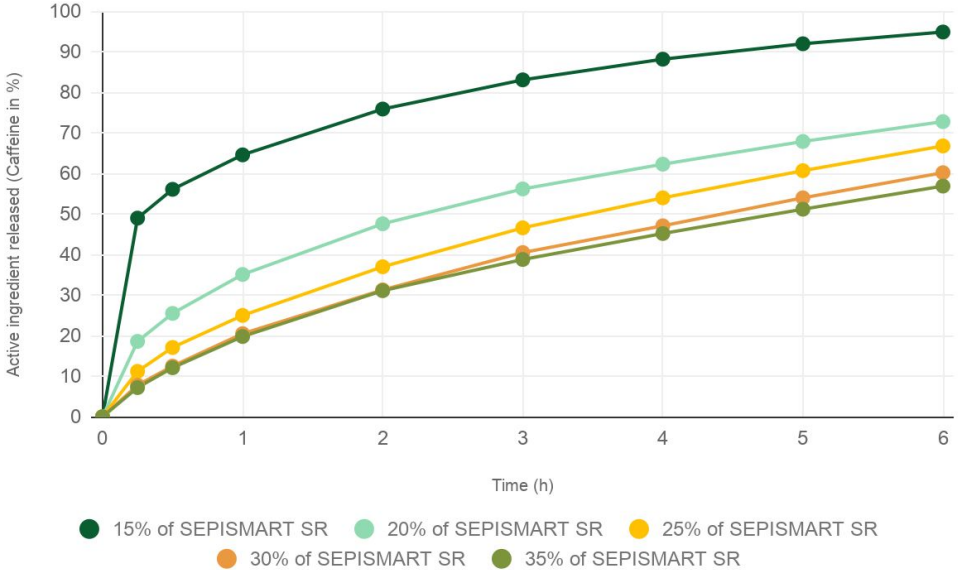
The **co-granulation** process gives excellent properties for compression to the combination of xanthan and acacia.

Fine tune release profile

The sustained release profile can be adapted by using a different percentage of SEPISMART™ SR. It will also strongly **depend on the formula and the nature of the active ingredient.**

25 - 30%

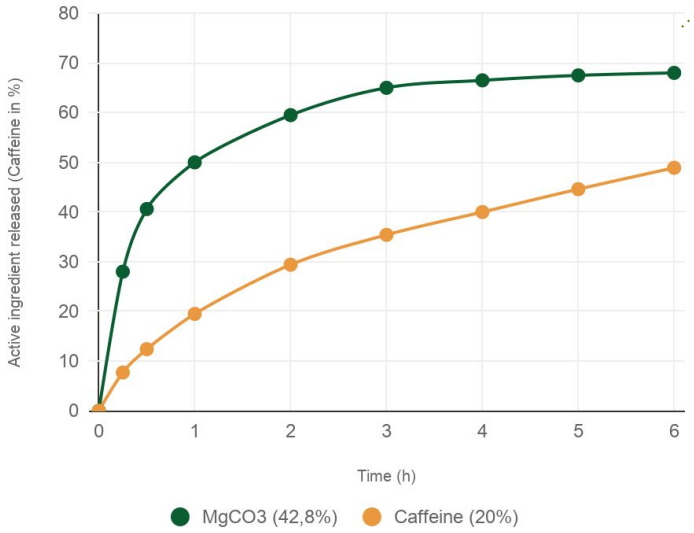
Recommended level of use *



**at ≤ 20%, the forming gel layer may not be homogenous giving an instant release*

Slow release magnesium carbonate tablets

SEPISMART™ SR can be used for sustained release with both water soluble or insoluble active ingredients. Tablets containing Magnesium carbonate have been studied to evaluate the release profile using SEPISMART™ SR with a **weakly soluble active ingredient.**



$MgCO_3$ is released quickly released compared to caffeine while it is less soluble in water.

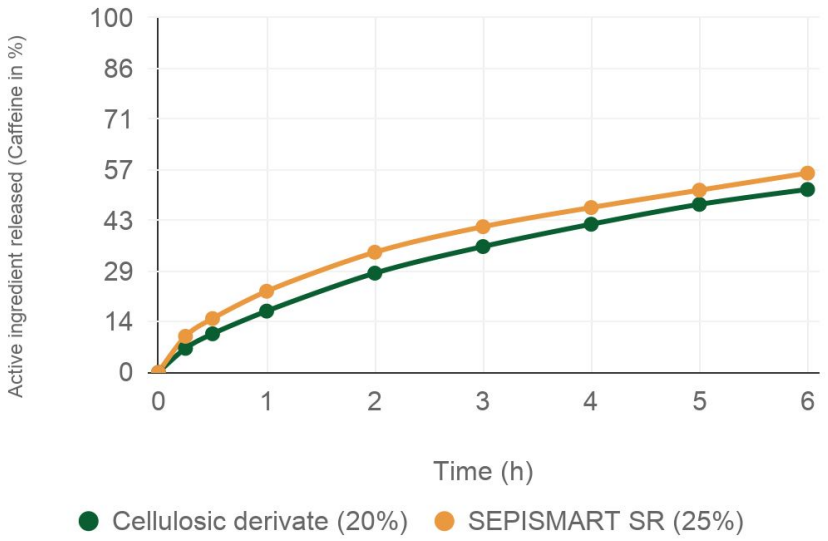
That shows that the active ingredient behaviour cannot be predicted only based on its solubility. In order to obtained an optimal dissolution profile, differents characteristics need to be taken in account (molecular weight, solubility, concentration in the formula, other excipients etc.).

Tablets of 500mg were made with 30% of SEPISMART SR and 42.8% of $MgCO_3$ (26.3% of pure Mg).

Solubility of caffeine: 21,7 g/L (water, 25 °C) & solubility of $MgCO_3$: 0,106 g/L (water, 20 °C)

An alternative to cellulosic derivatives

Tablets containing SEPISMART™ SR show similar performance in terms of tablets **hardness**, **friability** and **release** of the active ingredient, compared to tablets made with high molecular weight cellulosic derivatives.

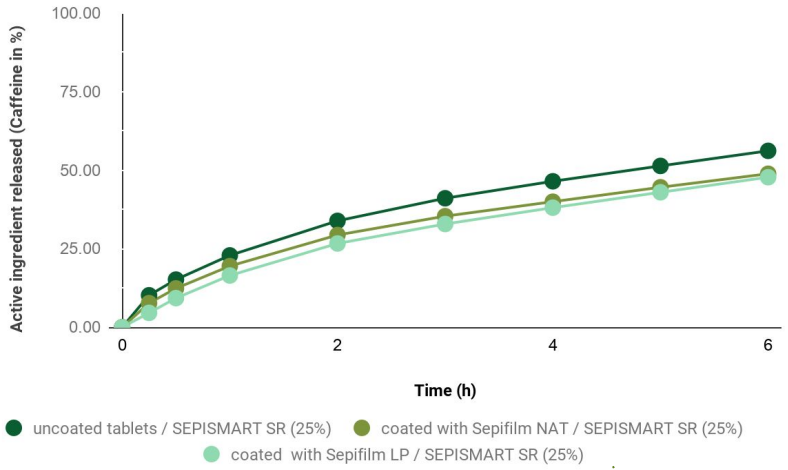


Tablet properties	Cellulosic derivative (20%)	SEPISMART™ SR (25%)
Tablet weight (mg)	518,8 ± 7,9	512,6 ± 3,7
Compression force (kN)	7.5	13
Hardness (N) >70N	102 ± 9	103 ± 3
Friability (%) <1%	0.0	0.1
Flowability Glass funnel Inox funnel (10mm)	 ∞ ∞	 5,2 s 21,03 s

Excellent flowability properties compared to cellulosic derivatives

Compatible with tablet coating

Tablets formulated with SEPISMART™ SR in direct compression can then **be coated** if needed without altering the sustained release properties.



It is **fully compatible** with:

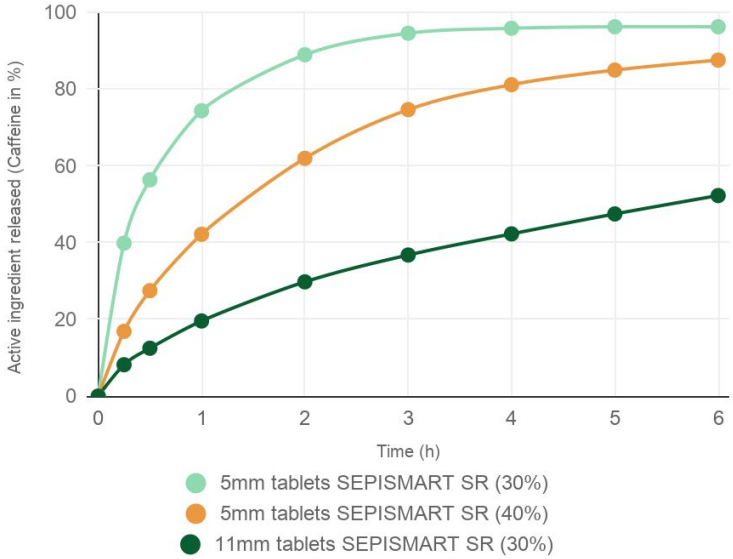
- **functional coating agents** such as *SEPIFILM™ LP* when the active ingredient requires moisture protection
- **aesthetic coating agents** such as *SEPIFILM NAT™ COL* giving bright, stable and natural colors to the tablets

Coated tablets were made using:

- *100% Sepifilm™ NAT Blue - 15% solid content - 4% weight gain*
- *60% Sepifilm™ LP 014 / 40% Sepisperse™ dry Blue - 12% solid content - 5% weight gain*

Impact of tablets size

SEPISMART™ SR has been tested in direct compression on Ø5mm tablets in comparison with tablets of classic size (Ø11mm), a slow release effect is observed and its kinetic is modulable by adjusting the % of SEPISMART™ SR.



- **A slow release profile is obtained in 5mm tablets**: about 90% of the caffeine is released in 2h
- The slow release effect in small-sized tablets can be enhanced by increasing the amount of SEPISMART SR at 40%

Benefits of SEPISMART™ SR

Why try SEPISMART™ SR ?

Advantages of using SEPISMART™ SR

- Well-known **gums from natural origin** widely used in food and dietary supplements applications
- A **candidate** to :
  - ✓ overcome formulation difficulties
  - ✓ bring added-value to a new product
  - ✓ re-launch an existing formula
- Easy to use:
  - ✓ Synergistic effect between the gums for an optimized **aptitude to compression**
  - ✓ Excellent **flowability**
- 1st solution for **delayed release capsule**

Manufactured in an ISO 22000 certified facility

Suitable for vegetarian and vegan formulations

Kosher certified

Halal certified

Accelerate innovation

"activate your ingredient at optimum interval"

CONCEPTS IDEA

Multivitamins

with both **instant** and **sustained releases**

Energy

for continuous **energy** to help **fight fatigue** all day long

- Magnesium
- Caffeine
- Vitamin C
- Iron
- L-Theanine
- Guarana

Sleep

to help maintain **good sleep quality** all night long

- Melatonin
- Passiflore
- Tryptophan

Sport

in sports supplements to **enhance performance** during training

- Amino Acid
- Plant extracts

Stress

to **relax the body** and increase **energy levels**

- CBD
- 5-HTP
- Ayurvedic
- Adaptogens
- Vitamins/Minerals
- Other extracts

Digestive Health

to combine **probiotics & prebiotics**

FROM NATURAL ORIGIN
CLEAN LABEL
CONSUMER FRIENDLY

*SEPISMART™ SR can also be used as a **thickener** thanks to its viscosity*

Benefits of SEPISMART™ SR

Concept n°1

fall asleep faster, sleep longer

Melatonin & SEPISMART™ SR
(mini tablets or granule)

Passion Flower

Sepismart's action

Release of Melatonin all over the night (sustained release) + **natural relaxing action of Passiflore** (immediate release)

Claims

→ Melatonin helps to reduce the time it takes to fall asleep (1 mg melatonin/portion)
→ Melatonin contributes to the alleviation of subjective feelings of jet lag (>0.5 mg melatonin/portion)

Ingredients: Sepismart™ SR, Melatonin, Passion Flower Extract, Maltodextrin, Vegetarien capsule (HPMC)

Dose : 2 caps (1 mg melatonin)

For continuous **energy** to help **fight fatigue** all day long

Benefits of SEPISMART™ SR

Concept n°2

Vitamin C & SEPISMART™ SR

Ingredients: Sepismart™ SR, Vitamin C, Maltodextrin, Vegetarien capsule (HPMC)

Dose : 2 caps (1 mg vitamin C))

Context

Vitamin C is largely used as food supplements for its multiple effects on the body such as the energy levels support. But as it cannot be accumulated in the body, an **excess intake causes a lost of vitamin C which is eliminated through the urine**.

Sepismart's action

Release of vitamin C gradually all over the day **(slow release)** ensuring a steady supply of vitamin up until 8 hours

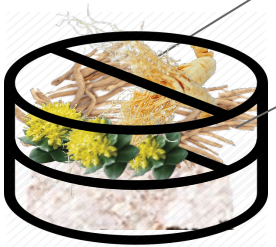
Claims

→ Vitamin C helps to increase the energy level during exercise, by taking part of the carnitine's production. Carnitine facilitates the burning of fat which bring energy.

Concept n°3

Stress

To **relax the body** and increase **energy levels**



Adaptogen plants (rhodiola, ashwagandha & ginseng) & SEPISMART™ SR

Marine magnesium and/or B6 and/or L-theanine

Ingredients: Sepismart™ SR, Marine Magnesium, L-Theanine, Adapatogen mix (*rhodiola, ashwagandha, ginseng*), Maltodextrin, Vegetarian capsule (HPMC), vitamin B6

Dose : 1 caps

Sepismart's action

Immediate release Mg, B6, L-theanine for fatigue and mental health care
Sustained release adaptogen plant extract to better handle stress

Claims

→ Magnesium contributes to a reduction of tiredness and fatigue (>15% NRV)
→ Vitamin B6 contributes to the reduction of tiredness and fatigue (>15% NRV)

Concept n°4

Sport

in sports supplements to **enhance performance** during training

Amino acid (BCAA) & SEPISMART™ SR

Marine Magnesium and/or vitamin C and/or plant extract rich in Vit C (ginger/turmeric)

Sepismart's action

Benefices are immediate release antioxidant and Mg^{2+}
Extended release BCAA to promote recovery, muscle growth and repair

Claims

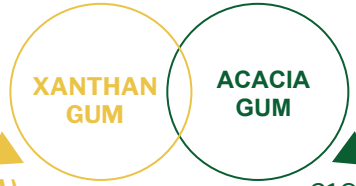
→ Magnesium contributes to normal muscle function (> 15 % NRV)
→ Vitamin C contributes to normal energy-yielding metabolism(> 15 % NRV)

Ingredients: Sepismart™ SR, BCAA, Magnesium, Vitamin C, ginger, turmeric, sweetener, coloring agent

Dose : 1 sachet

Regulatory and quality package

It is fully compliant with **EU*** and **US** food supplements regulations



E 415 ***(UE)***
21CFR172.695 ***(USA)***

E 414 ***(UE)***
21CFR184.1330 ***(USA)***

RECOMMENDED LABELING FOR USE IN FOOD SUPPLEMENT

✓ in the **EU**

Carrier: Xanthan Gum, Acacia Gum
or
Carrier: E415, E414

✓ in the **US**

Carrier: Xanthan Gum, Acacia Gum

SEPISMART™ SR is compliant with the label ***"natural-origin"***

*Reg 231/2012/EU & 133/2008/EU Annex III

Guaranteed on **SEPISMART™ SR**

Heavy metals[1]

Pb ≤ 2ppm
Cd ≤ 1ppm
As ≤ 3ppm
Hg ≤ 1ppm

Microbiological analysis[2]

[1] *tested on a statistical basis on raw material*
[2] *tested on each batch*

Packaging, storage and transportation

✓ Packaging

Net weight	20 kg
Primary packaging	Thermosealed PE bags
Secondary packaging	Sewed kraft paper bag
Pallet	100x120x150cm / 800kg

✓ Samples

Standard size	500 g

✓ Storage and transportation

Shelf life	2 years
Storage conditions	Store in well closed containers in a clean and dry environment.
Transport	Not concerned by transport regulations

SEPISMART SR at a glance

recommended level of use : **25% to 30%***

An excipient for sustained release

Designed for Nutrition applications

For tablet, hard capsule and granule

Excellent flowability

From **natural origin**

A synergetic combination of acacia and xanthan gums

Eco-friendly processed (w/o solvents)

Easy to use excipient

Manufactured in France

Safe and consumer friendly
No GMO / No additives and preservatives / Vegan / Kosher and Halal certified

Compliant with EU and US food supplements regulations

* recommended use depends on the active

Thank you!

SEPPIC

Air Liquide HEALTHCARE

Contacts

Nota

The analytical specifications warranted are only those mentioned on the certificate of analysis supplied with each delivery of the product.
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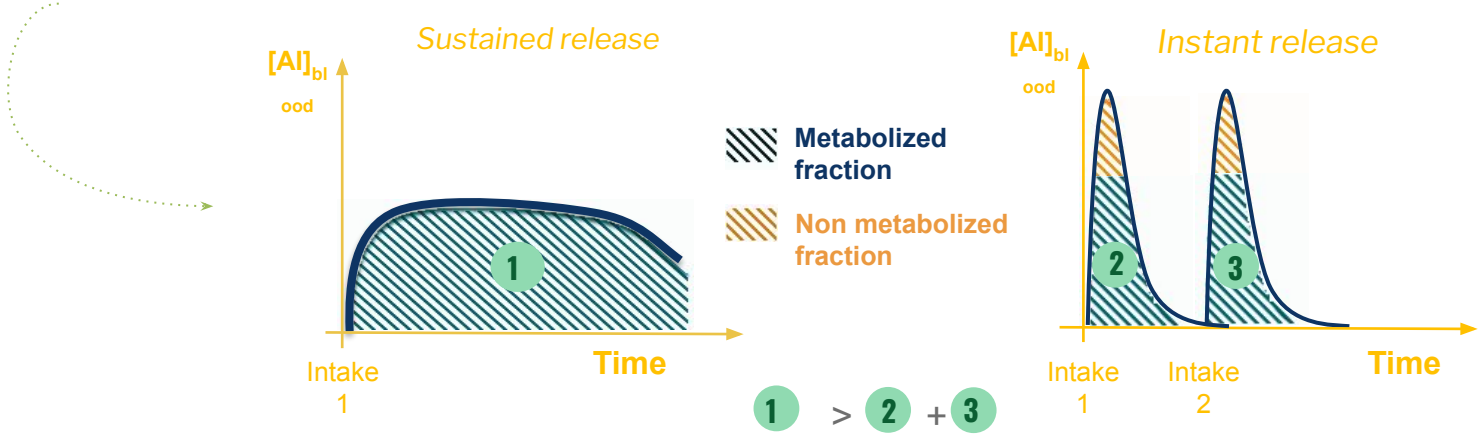
Benefits for Nutrition

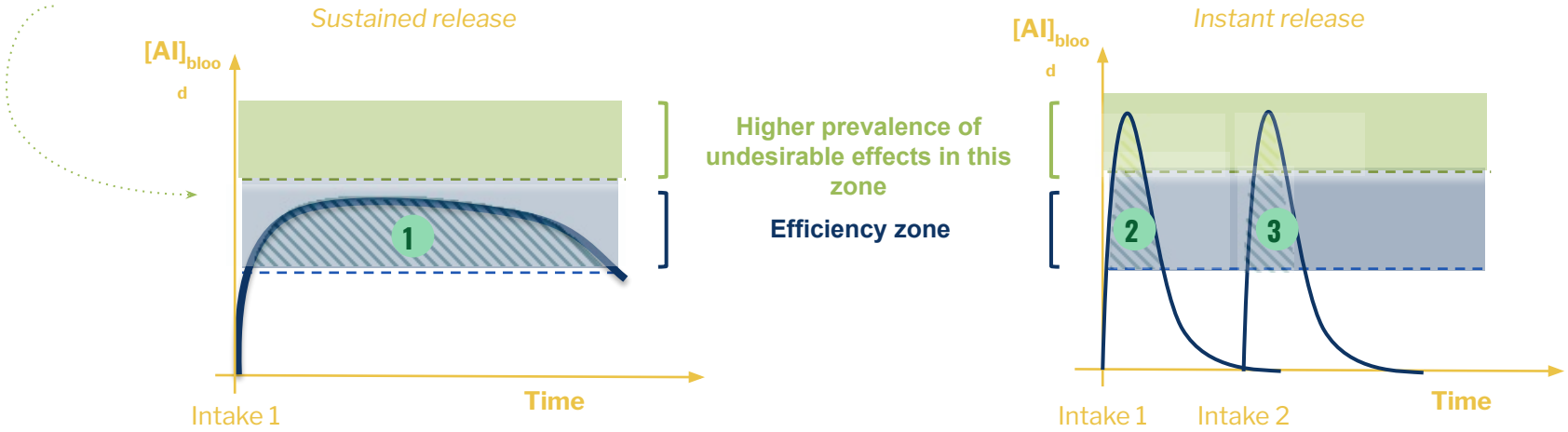
The sustained release technology provides the release of an effective amount of active ingredient over time and at a continuous rate

Example 1: enhancing absorption



Benefits for Nutrition

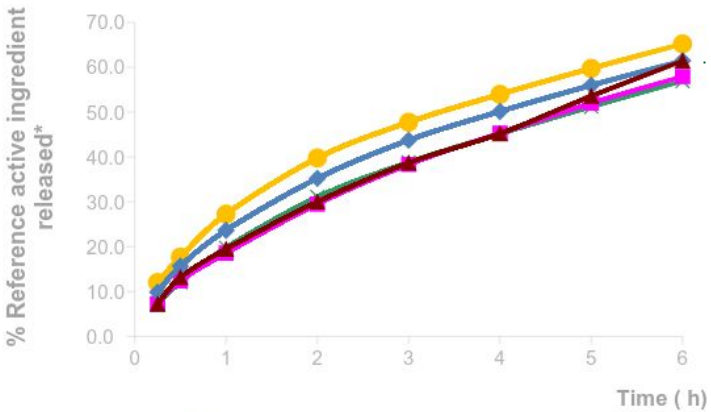
Example 2: avoiding potential undesirable effects



1 > 2 + 3

No compromise on compression behavior

The release of the active ingredient is **independent of tablet hardness**. It allows to use a low compression force when manufacturing the tablets.



Tablets hardness:

- 80 N
- 116 N
- 146 N
- 103 N
- 130 N

Sustained release profiles obtained are quite similar for tablets with an hardness **from 80 N to 150 N.**