28 – 30 OCTOBER 2020
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Multiple use of Chitosan Biopolymer Complexes in hygiene and cosmetics

Substitution of the particular "Hard" quats and microplastics through the targeted use of biopolymers

KRAEBER & CO GMBH
pharmaceutical and cosmetic substances
Est. 1980

Preamble

Chitosan as a biopolymer is a widely available raw material which is obtained from chitin as a basic natural substance. Marine chitin will be obtained from the exoskeleton of crustaceans, such as shrimp or squid or crab.

The current global production of shrimp is around 6 million tons per year, with Asia accounting for the largest share.

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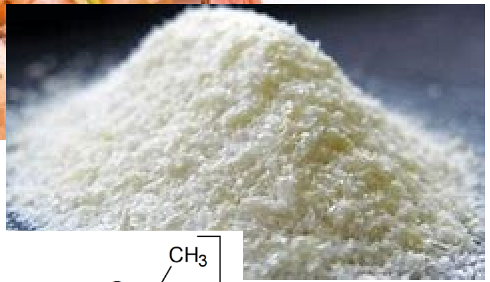

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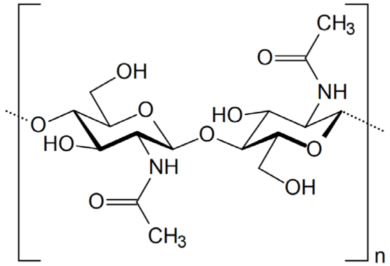

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Preamble

A significant part of the shrimp mass is waste, since depending on the species, 25 - 37% of the raw weight is made up of chitin-rich by-products such as outer shell of head, tail and body.

Alternatively, chitosan can be obtained from mushrooms (aspergillus niger). Disadvantages such as odor and color can now be compensated for.

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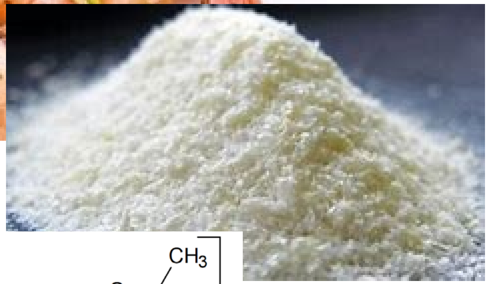

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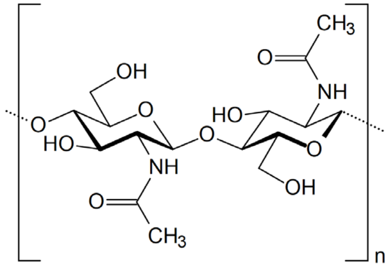

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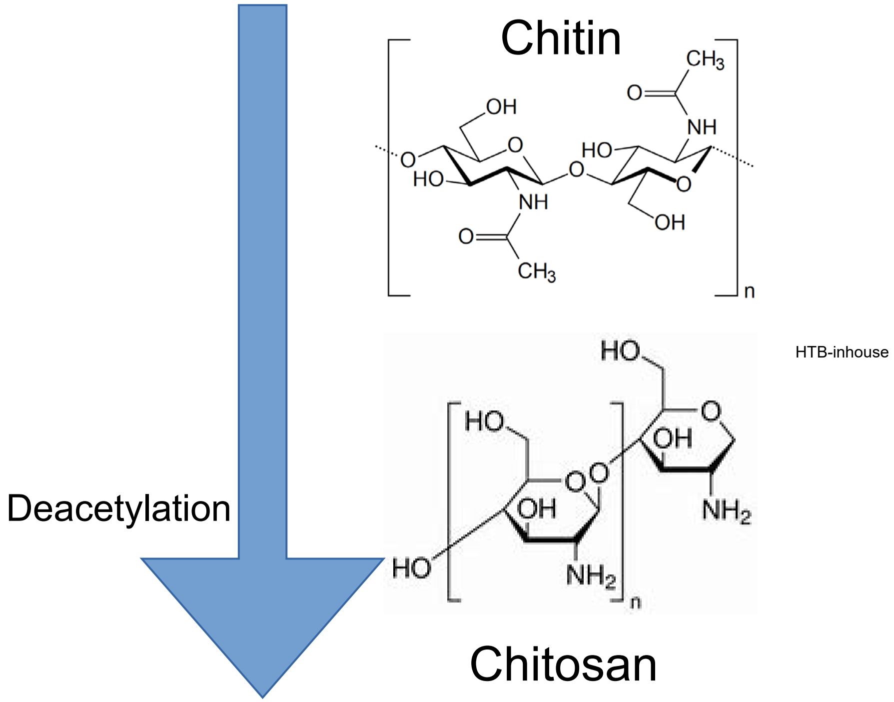
Preamble

Chitosan is a non-toxic linear cationic polymer obtained from chitin by N-deacetylation.

Depending on the degree of purity and quality, which significantly influence the specific structure, there are many different possible uses for chitin or chitosan in the fields of medicine, pharmacy, cosmetics, food technology, agriculture, biotechnology, chemistry and technology.



Preamble

With regard to all applications, one of the crucial points is to make the chitosan available.

Chitosan is insoluble in water.

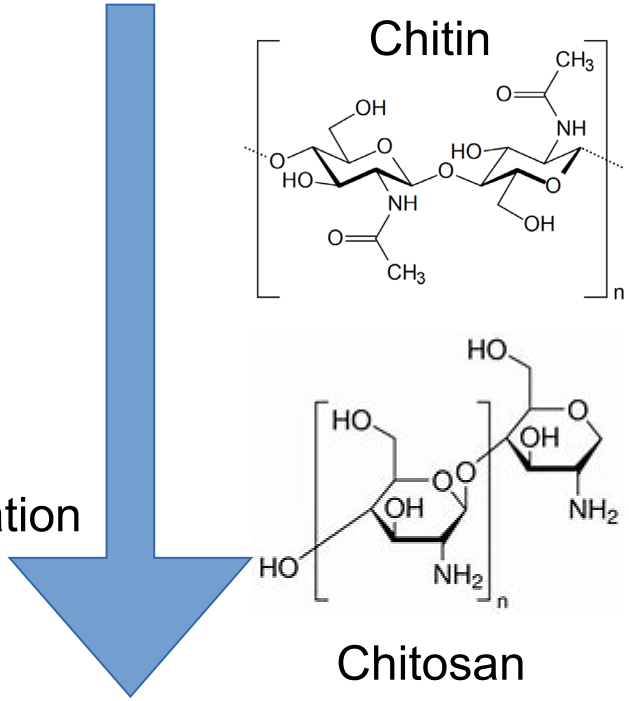
The properties of the natural raw material:

- Antimicrobial properties
- Antibacterial properties
- Antifungal properties
- Film formation properties

Are decisive of the availability and thus of the solubility of the natural base material dependent.

Deacetylation

Chitin



Chitosan

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Preamble

This availability is therefore an important requirement in order to be able to present the following approaches:

- Replacement of microplastics with biopolymer complexes
- Replacement of preservatives by biopolymer complexes e.g. in the food sector
- Replacement of micro- and nano-encapsulation technologies with biopolymer complexes regarding hair, skin and homecare
- Use of biopolymer complexes in hygiene formulations for better skin tolerance and more lasting effectiveness

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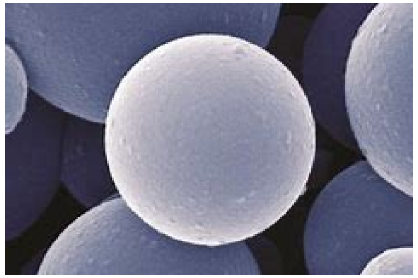

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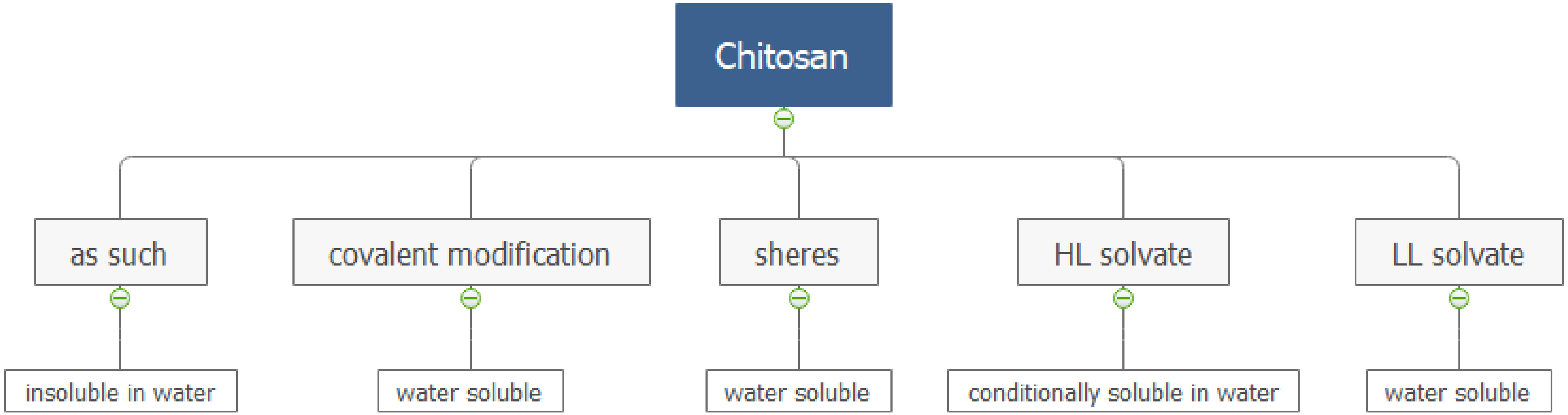
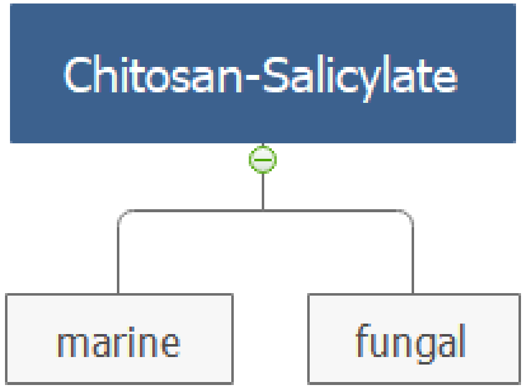
Availability of chitosan



Availability of chitosan



Availability of chitosan

The covalent modification of the chitosan leads to better availability - the chitosan molecule is consequently changed - but the film formation property of the derivative is usually suboptimal.

The encapsulation of the chitosan as spheres leads to the carrier function being achieved. Encapsulation of chitosan itself or as part of the capsule can be implemented on a nano and micro scale.

Solvate formation of chitosan, especially on the basis of organic acids, leads to the fact that the chitosan "gels" in a water-soluble manner. Compared to encapsulation, it is a water-soluble complex that occurs in a single phase and is consequently available much faster than encapsulation technology. Furthermore, the film formation properties are more forced than reduced.

Synergy advantage of solvate complexes

In addition to the excellent film formation properties of the solvate complexes mentioned, synergy effects result from the complex partner, which are of particular interest for the following applications.

The LL complexes are of particular interest here: 2 water-insoluble complex partners that form to form a water-soluble complex.

- Hygiene applications
- Conservation applications
- Conditioner applications

Application examples

- Use of LL solvate complexes in disinfectants
- Use of LL solvate complexes in shampoo formulations as an organic conditioner (microplastic substituent), preservative and foam booster
- Use of LL-Solvate complexes in skin cream formulations as organic conditioners (microplastic substituents) and preservatives.

Use of LL solvate complexes in disinfectants

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Disinfectants with a significantly minimized risk of skin irritation:

While classic disinfectants based on ethanol, isopropanol or even quaternary represent a serious risk of skin irritation, the use of biopolymers (e.g. compared to glycerine) can significantly reduce the risk of irritation.

TEWL measurements for the detection of skin irritation risks of disinfectants

Courage Cologne

Moisture balance of skin
Affects significant to disinfection formulas...

Using a special Tewameter device, enables to measure the evaporation rate of water on skin. Information about the water content of the skin or the water loss against environmental influences are important information to evaluate formulas.

In general with this information a statement can be made about the condition of the skin moisture balance.

The induced value shows the evaporation rate in g / h / m * m.

TEWL measurements for the detection of skin irritation risks of disinfectants

WHO recipe

raw material	wt%
Ethanol	79,37 %
Hydrogenperoxide	0,15 %
Glycerin	2,26 %
denat. water	13,18 %

TEWL values (mean values - 35 subjects):

- Before disinfection: 10.1 g / h / m * m
- After disinfection: 32.4 g / h / m * m

Biopolymer formulation (BPC)

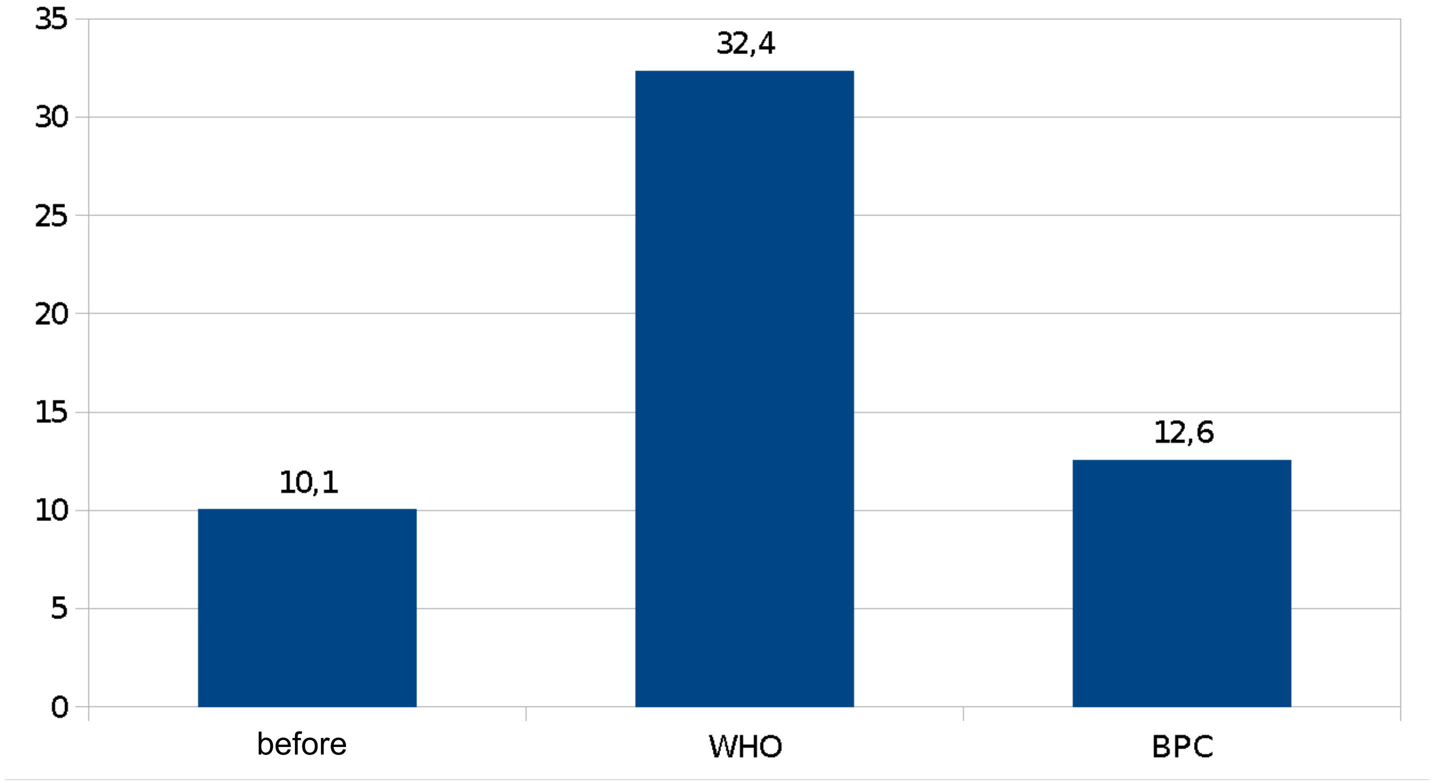
raw material	wt%
Ethanol	79,37 %
Hydrogenperoxide	0,15 %
Glycerin	2,26 %
LL-Solvate Complex	1,00 %
denat. Water	12,18 %

TEWL values (mean values - 35 subjects):

- Before disinfection: 10.1 g / h / m * m
- After disinfection: 12.6 g / h / m * m

TEWL measurements for the detection of skin irritation risks of disinfectants

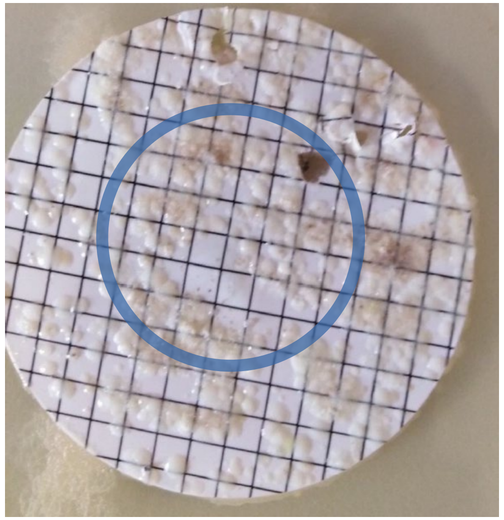
Values [g / h / m * m]



Microbiological analysis of disinfectants

Bioburden 48h after disinfection of a surface with constant contamination - **Limit value test**

WHO after 48h:



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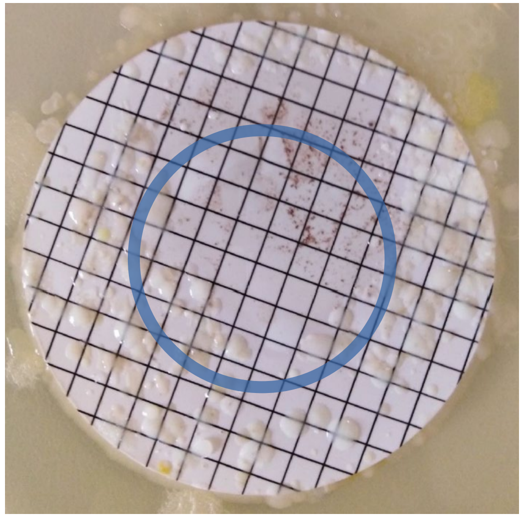
BPC after 48h:



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Microbiological analysis of disinfectants

Bioburden 48h after disinfection of a surface with constant contamination – **dipslide surface test**

WHO after 48h:

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t=48h

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CFU>30

BPC after 48h:

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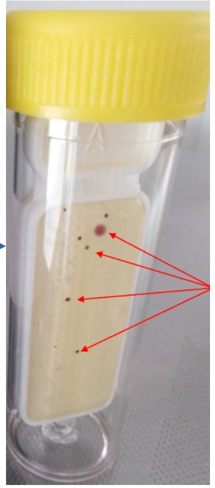
t=48h



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CFU=7

Use of LL-Solvate complexes in shampoo formulations

as organic conditioners (microplastic substituents), preservers and foam boosters

Hair conditioning through biopolymer complexes:

Substitution of microplastics by a biopolymer complex as a multiple active ingredient:

- Conditioner
- Conservator
- Foambooster

Use of 4% biopolymer complex

Ingredients:

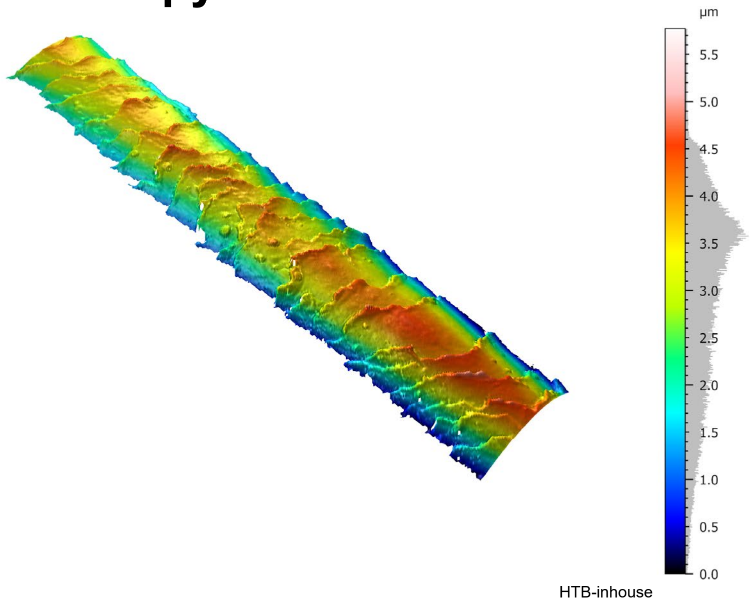
aqua, cocamidopopylbetaine, ethanol, chitosan salicylate, perfume

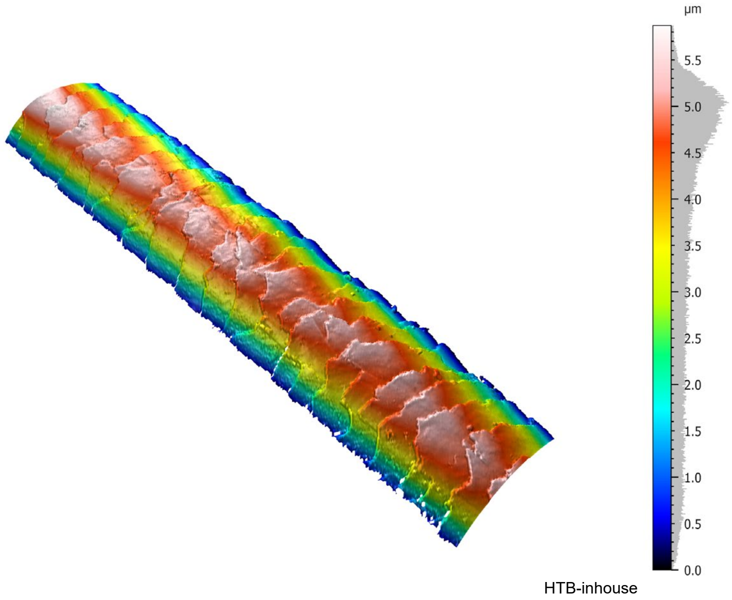
Use of LL-Solvate complexes in shampoo formulations

as organic conditioners (microplastic substituents), preservers and foam boosters

Hair conditioning through biopolymer complexes:
Substitution of microplastics by a biopolymer complex as a multiple active ingredient

Confocal microscopy

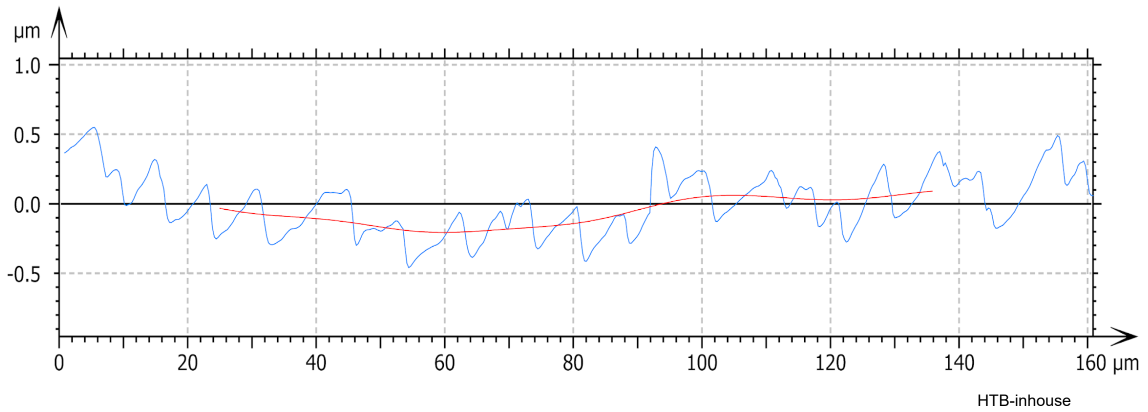


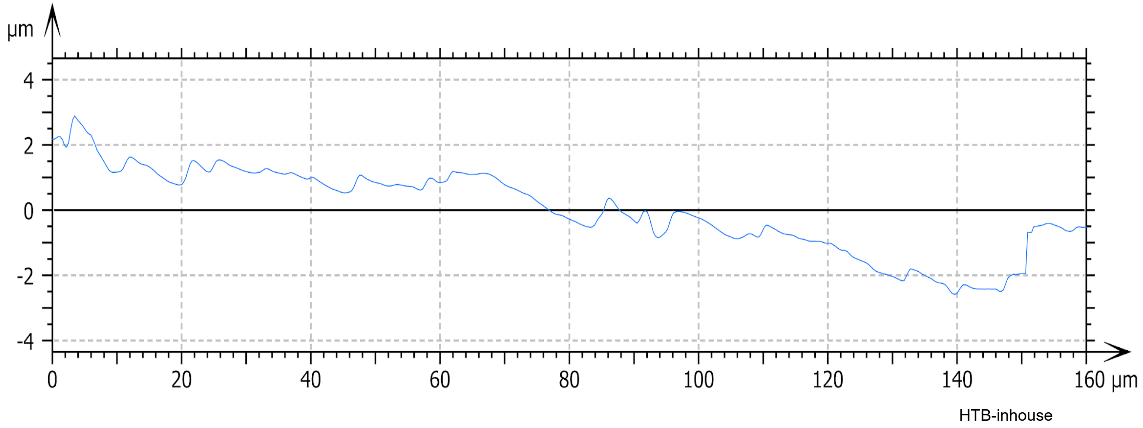


Use of LL-Solvate complexes in shampoo formulations

as organic conditioners (microplastic substituents), preservers and foam boosters

cuticular roughness





Profil: Ripple
Filter: Guassian filer, cut-off 50 µm
Scan: 160 µm

Use of LL-Solvate complexes in shampoo formulations

as organic conditioners (microplastic substituents), preservers and foam boosters

Hair conditioning through biopolymer complexes:
Substitution of microplastics by a biopolymer complex as a multiple active ingredient – **Conservator**:

CBU/g sample as a function of incubation period after contamination					
Incubation period	Staphylococcus aureus	Preudomonas aeruglinosa	Escherichia coli	Candida albicans	Aspergillus brasiliensis
Inoculum	$4{,}2*10^5$	$3{,}6*10^5$	$2{,}3*10^5$	$1{,}3*10^5$	$1{,}4*10^5$
Germ count after 7 days	<10	<10	<10	<10	<10
Germ count after 14 days	<10	<10	<10	<10	<10
Germ count after 28 days	<10	<10	<10	<10	<10

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You can also find out more about:

- Application of biopolymer complexes in the color fixation.
- Application of biopolymers in odor control as textile spraysor deodorants.
- Application of biopolymers in hair straightening.

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