

Impregnating agents and emulsions

Building protection with silicones

Kurt Obermeier GmbH

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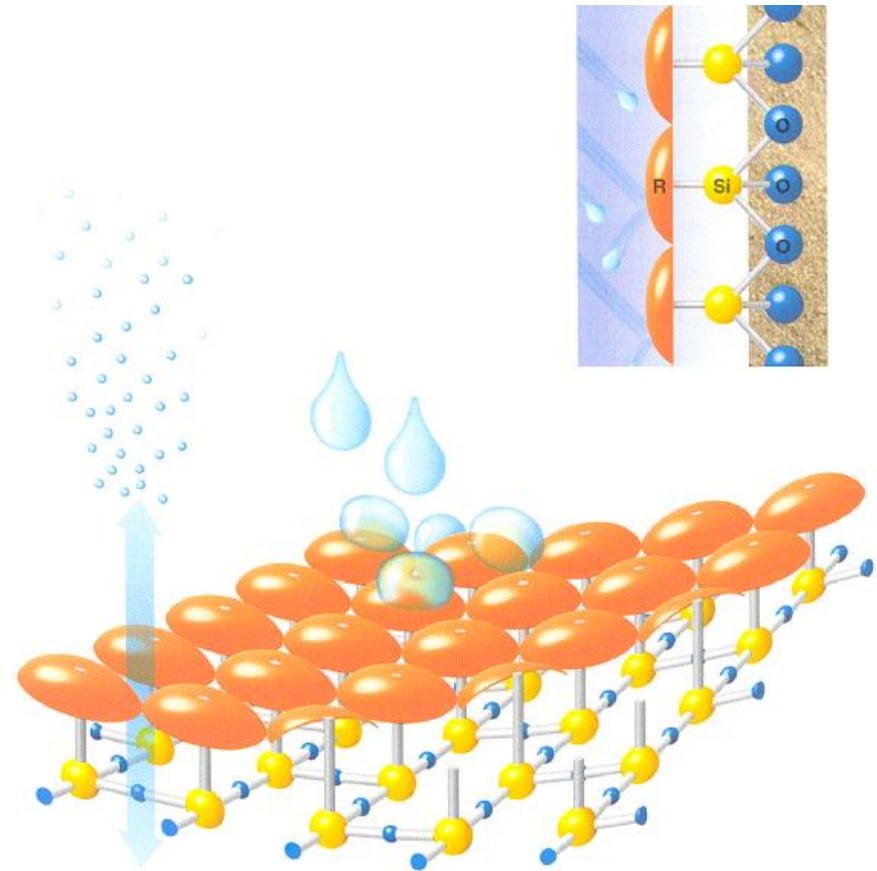
- Technical and chemical considerations
- Impregnating agents and emulsions
 - Basics
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 - Mass hydrophobization
 - Horizontal barriers
- Hydrophobization of facades and masonry
- Paints and plasters

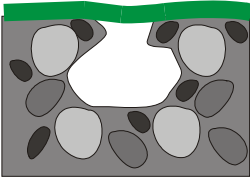
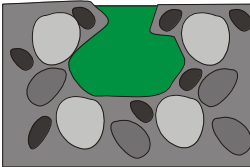
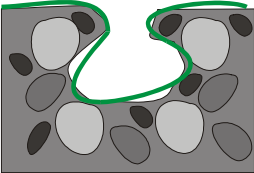


MODE OF ACTION

Alkyl groups (in the illustration marked in orange as methyl groups) protect the substrate due to their hydrophobic properties, comparable with umbrellas. Presented is the effect of the surface hydrophobization, e. g. by the use of silicone resin solutions.

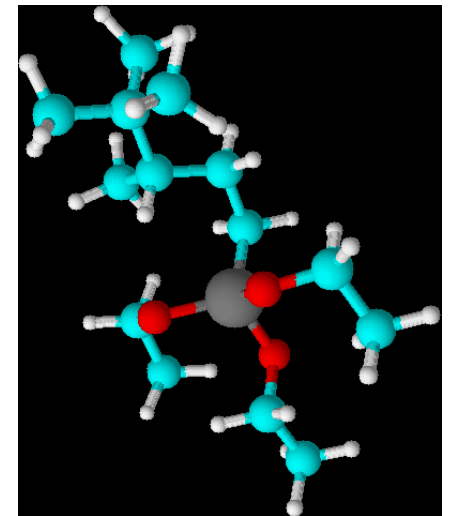
The penetrability for water vapour is practically not affected, thus the building material remains breathable.



Application	Properties
Coating 	<ul style="list-style-type: none"> • Surface treatment • Modification of surface appearance (use of pigments) • Capillary water absorption is not affected • Water vapor permeability is strongly dependent on formulation • Loss of protection if film is damaged
Pore filler Surface solidification 	<ul style="list-style-type: none"> • Treatment of surface pores • Minor change of appearance • Diminution of capillary water absorption • Diminution of efflorescences • Limited water vapor permeability • Substrate reinforcing effect • Negative impact on freeze/thaw performance
Impregnation 	<ul style="list-style-type: none"> • Treatment of building materials capillaries • Almost no impact on surface appearance • Significant reduction of capillary water absorption • Excellent water vapor permeability • Excellent freeze/thaw performance • Diminution/prevention of efflorescences

Mode of action of silanes in building protection

- As delivered, they do not exhibit any hydrophobic effect and are resistant to weathering
- Only after the elimination of the protective groups, a water repellent network is developed or the activated silanes react with corresponding groups of the building material
- In the area of impregnating agents, this reaction is triggered almost exclusively by the pH-value. Therefore, products based on silanes are mainly suited for alkaline or acid building materials



KORATECT SL-2, the silicone atom is indicated in grey

PRODUCT OVERVIEW

	Silanes	Siloxanes	Polysiloxanes
Molecular structure	monomer	oligomer	polymer
Penetration	Very high	High	Low
Application form (% active content)	20 to 100	1 to 10	3 to 8
efficiency	ca. 40 %	ca. 80 %	100 %
Beading effect (optical effect)	low	medium	pronounced
Surface modification	No	No / weak	Bathochromic shift "wet look"
Water vapor permeability	High	High	Medium
Solvent based products	KORATECT SL-2 KORATECT SL-4 KORATECT SL-12	KORATECT LO-N KORATECT MQ 1 KORATECT SL-1	
Water based products	KORATECT C1 KORATECT KMS-A KORATECT KMS-A2 KORATECT HZS KORATECT HSC KORATECT EA-7 KORATECT EA-3 KORATECT EA-6 KORATECT EA-8 KORATECT EA-18		KORATECT AMF 35 KORATECT EA-2 KORATECT EA-10 KORATECT EA-5 KORATECT EA-F

- Good water repellency
- Very good water vapour permeability
- Good resistance against alkaline pH-values and salts
- Good deep-penetration
- Excellent long-term resistance
- Improvement of freeze/thaw resistance
- no modification of the surface (brilliance, colour etc.)
- “Easy to clean” equipment for some fields of application
- “Corrosion protection” for ferro-concrete, especially for reconstructive application



Measurement of the water absorption

- A test specimen of the respecting material is treated with the impregnating agent to be analysed. After appropriate conditioning the sample is stored in contact with the relevant test-liquids.
- Typical test liquids are:
 - Water (tap water or demineralised water) => rain simulation
 - diluted alkalines => simulation of erosion from alkaline building materials
 - diluted acids => “acidic depositions”, erosions
- Test methods
 - Immersion storage
The test specimen is immersed completely into a defined volume of liquid.
 - Sponge storage
The test specimen is stored on an inert sponge soaked with the test liquid
- Evaluation
The water absorption is analysed by weighting of the samples prior and after contact with the test liquid and is typically indicated with reference to an untreated sample



Sample for immersion storage test carried out with different building material

Measurement of freeze/thaw performance according to DIN 51204

- A test specimen of the respective material is treated with an impregnating agent or emulsion and tested after a sufficient conditioning period. Test conditions:

- Air moist

The test specimen is stored under typical conditions (temperature, air humidity) for 24 h until equilibrium humidity is achieved.

- Saturation humidity

The test specimen is stored on a wire netting positioned maximum 1 cm above water level in a closed plastic container for approx. 24 h.

- Temperature profile

- Cool down from 20 °C to 0 °C within 6 h, exposure time 2 h
- Cool down from 0 °C to -17,5 °C, exposure time 4 h
- defrost to 20 °C
- Typically 28 cycles

- Evaluation is done by determination of mass loss in comparison to untreated specimens



Sample after freeze/thaw-exposure
Left with impregnation agent, right
without (after approx. 50 cycles)

Conductivity measurement

- Method according to ZTV-ING/ ZTV-SIB 90
 - The sponge electrode on the backside of the measuring device are soaked with an alkaline electrolyte and positioned on the sample surface
 - Penetration of the electrolyte into the building material leads to an increase of the conductivity
 - Good impregnation of the building material leads to a penetration of the electrolyte and to a lower increase of conductivity
- Advantages:
 - Nondestructive method
 - Allows on-site measurement
 - Documentation of results
- Limitations:
 - Interference of results by:
 - Surface roughness
 - Material humidity
 - Air humidity
 - Presently only measurements on level surfaces possible

CONCRETE PROTECTION

- Replacement of ZTV-ING by EN 1504-2
Change-over from „Ü-sign“ to CE-Label
- According EN 1504-2 certified products:
 - KORATECT C-1 / KORATECT SL-2 / KORATECT EA-7
 - This product reaches undiluted at a application rate of 400 g/m² top values (see below)
 - Reported is product classification together with the achieved test results stated in square brackets
 - Product registration only required for certain fields of application

	KORATECT C1
Penetration	> 10 mm [11 mm]
Freeze/Thaw	$\Delta c > 20$
Drying Class	Class I >30 % [33,2 %]
Water absorption	< 7,5 % [5,1 %]
Alkali resistance	< 10 % [5,3 %]



CE	
0921	
Kurt Obermeier GmbH & Co. KG Berghäuser Str. 70 57319 Bad Berleburg	
07	
0921 - CPR – 2020	
EN 1504 – 2:2004	
Oberflächenschutzprodukt – Hydrophobierende Imprägnierung KORATECT® C 1 EN 1504-2: ZA.1a	
Eindringtiefe*	Klasse II: ≥ 10 mm
Wasseraufnahme und Alkalibeständigkeit*	Absorptionskoeffizient < 7,5 % im Vergleich mit unbehandelter Probe < 10 % in Alkalilösung
Trocknungsgeschwindigkeit*	Klasse I: > 30 %
Masseverlust nach Frost-Tausalz-Wechselbeanspruchung*	Masseverlust min. 20 Zyklen später als bei nicht imprägnierter Probe
Gefährliche Stoffe	NPD

*Ergebnisse der Erstprüfung gem. DIN V 18026, Anhang B

CONCRETE PROTECTION

- The system KORATECT SL 2 is certified for application rates of 400 gr /m² in undiluted form
- System labeling is shown below

	KORATECT SL 2
Penetration	> 10 mm [12 mm]
Freeze/Thaw	$\Delta c > 20$ [> 20]
Drying class	Class I >30 %
Water absorption	< 7,5 % [3,8 %]
Alkali resistance	< 10 % [6,7 %]



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07	
Nr. 13035V1	
EN 1504 – 2:2004	
Oberflächenschutzprodukt, Hydrophobierende Imprägnierung EN 1504-2: ZA.1a	
Eindringtiefe*	Klasse II: ≥ 10 mm
Wasseraufnahme und Alkalibeständigkeit*	Absorptionskoeffizient < 7,5 % im Vergleich mit unbehandelter Probe < 10 % in Alkalilösung
Trocknungsgeschwindigkeit*	Klasse I: > 30 %
Masseverlust nach Frost-Tausalz-Wechselbeanspruchung*	Masseverlust min. 20 Zyklen später als bei nicht imprägnierter Probe
Gefährliche Stoffe	NPD

*Ergebnisse der Erstprüfung gem. DIN V 18026, Anhang B

CONCRETE PROTECTION

- The system KORATECT EA-7 is certified for application rates of 400 g/m² in undiluted form
- System labeling is shown below

	KORATECT® EA-7
Penetration	< 10 mm [7,4 mm]
Freeze/Thaw	$\Delta c > 20$ [32]
Drying Class	Class I >30 %
Water absorption	< 7,5 % [5,2 %]
Alkali resistance	< 10 % [9,1 %]



CE	
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13	
Nr. 13048V1	
EN 1504 – 2:2004	
Oberflächenschutzprodukt, Hydrophobierende Imprägnierung EN 1504-2: ZA.1a	
Eindringtiefe*	Klasse I: ≤ 10 mm
Wasseraufnahme und Alkalibeständigkeit*	Absorptionskoeffizient < 7,5 % im Vergleich mit unbehandelter Probe < 10 % in Alkalilösung
Trocknungsgeschwindigkeit*	Klasse I: > 30 %
Masseverlust nach Frost-Tausal-Wechselbeanspruchung*	Masseverlust min. 20 Zyklen später als bei nicht imprägnierter Probe
Gefährliche Stoffe	NPD

*Ergebnisse der Erstprüfung gem. DIN V 18026, Anhang B

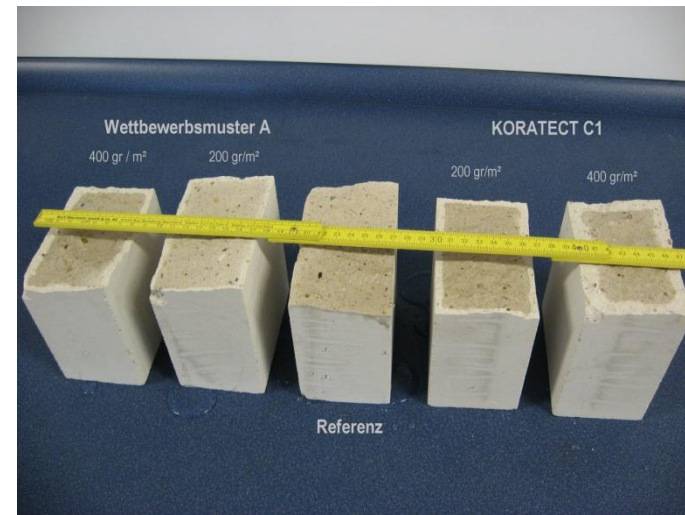
KORATECT C1

- Mainly for concrete and concrete products
- Easy to apply (brush, rollers , water brush, airless)
- Practically not-to-drip
Also for complex forms and for working overhead
- Highly concentrated, therefore
 - high penetration depth
 - Low changing of surface
- Leaves, after application, a whitish film on the surface, which vanishes after several hours



Penetration depth using Imprägniercreme KORATECT C1 for instance

- Test procedure
 - The exterior of the stones is impregnated with the stated amount of material. After drying the stone is broken and the surface of the break is moistened using desalted water.
 - Impregnated areas remain pale, not impregnated areas show a darkish colour
- Results
 - KORATECT C1 exhibits a very good penetration depth
 - Regarding applications not regulated within EN 1504-2 in most cases an application rate of approx 0,2 kg/m² of KORATECT C1 is sufficient

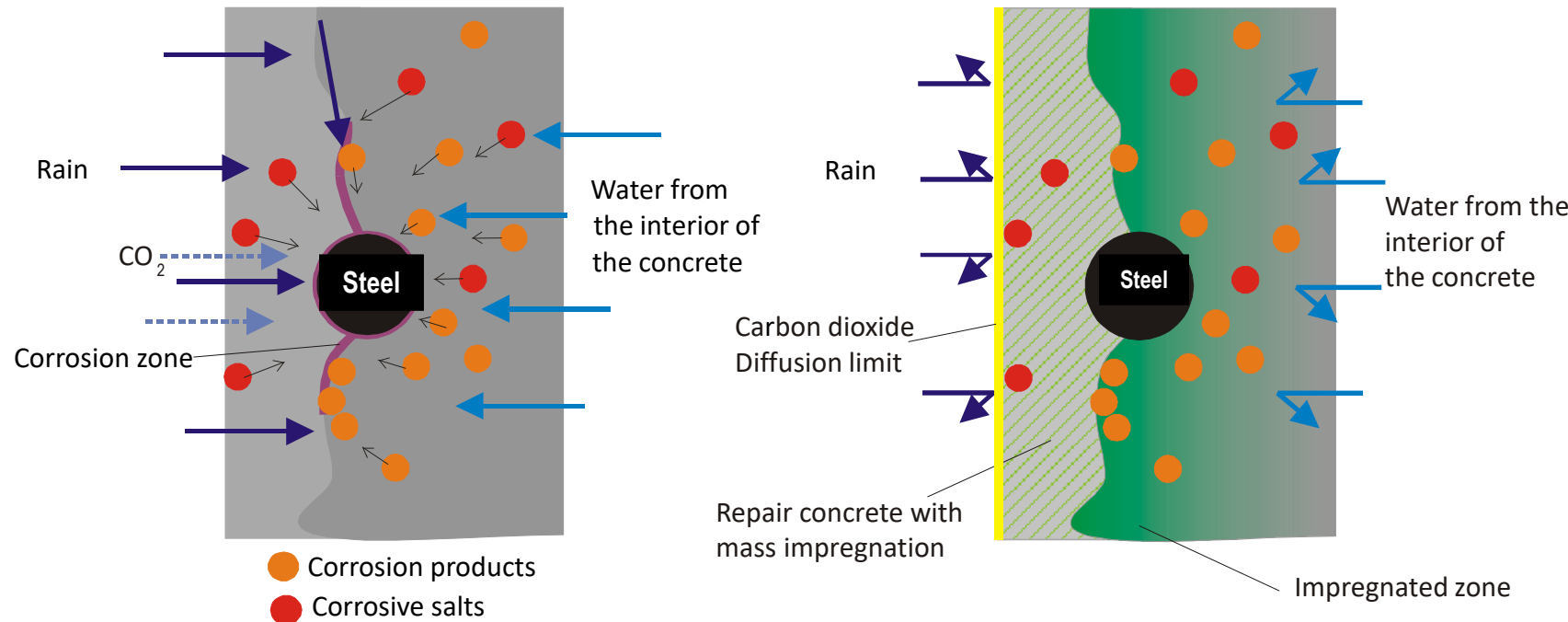


In first approximation there is a linear correlation between application rate and penetration depth

Considerations concerning corrosion

- Corrosion processes in steel reinforced concrete are caused by :
 - pH-shift from the alkaline to the neutral or acidic range
 - Absorption of salts such as de-icing salt
 - Combinations of concretes with different densities, e. g. original and repair concrete
 - Contact (direct and near) between different metals
- Corrosion damage
 - Development of iron oxide (=rust) leads to a significant increase of volume of the material and thus to flakings, especially if the size of the covering concrete is too thin.
 - The formation of rust may influence the bearing capacity of the material.
- Target substances
 - Water works as an electrolyte and thus an agent for the corrosion process.
 - In contact with humidity, carbon dioxide causes concrete neutralisation or acidity

=> Water and carbon dioxide have to be excluded to prevent further corrosion!

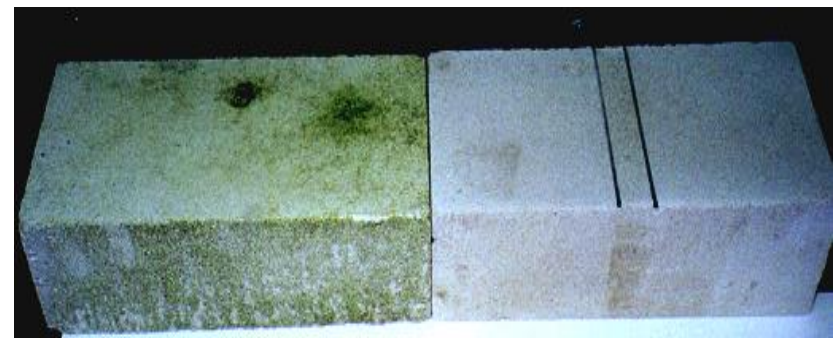
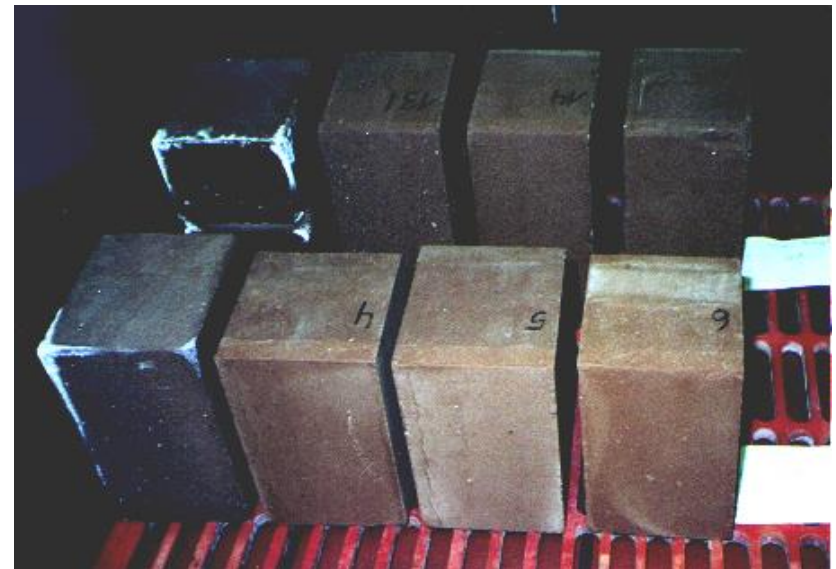


Proposal for proceeding

- Mechanical removal of loose adhesions, then first coating with KORATECT C1, KORATECT SL-2, KORATECT EA-7
- Replenishment of flakings with a concrete treated with additives (KORATECT SL-2)
- If necessary, application of a coating based on silicone acrylate to improve the protection of carbonatisation.

Utilising modern impregnating agents, like for example **KORATECT EA-6** the following effects can be achieved:

- Diminution or prevention of efflorescence
Upper picture: each brick on the left hand side without treatment for reference, all remaining bricks after treatment with impregnating agent
- Diminution of moss and algae growth
 - No biocidal effect, but pure physical effect, since on sufficient dry substrate no growth of moss or algae is observed.
 - Lower picture: Brick on the left without treatment, Brick on the right with impregnating agent, after outdoor weathering



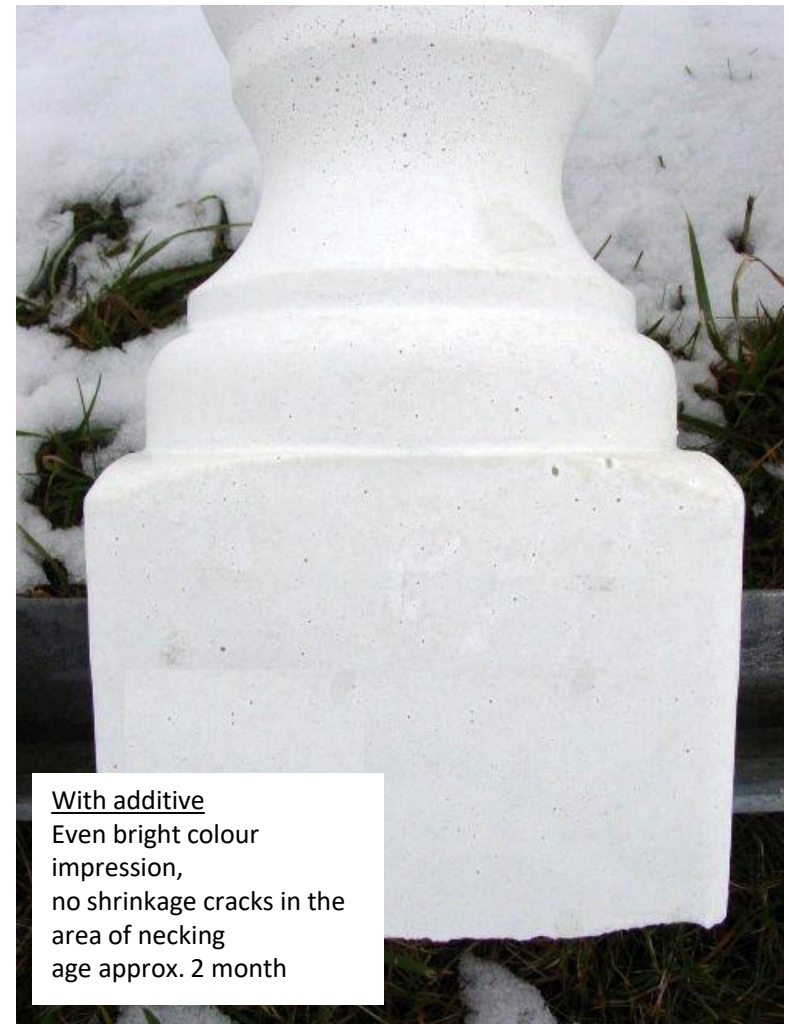
Special hydrophobizing agents for use as an additive to fresh concrete

- Addition to dry mixture -> KORATECT SL-12
- Addition via initially added water or directly into the liquid mixture -> KORATECT SL-12, KORATECT EA-18
- Advantages:
 - Diminution of the water absorption
 - Improvement of the freeze / thaw change resistance
 - Reduction of salt absorption, e. g. of de-icing salts
 - Diminution of the moss and algae growth
 - Diminution of the shrinkage crack formation
 - Prevention of efflorescences

Recommendation for
dosage in reference to
dry matter

Product name	Form	Active content	dosage
KORATECT EA-6	Liquid	60 %	0,17 % (w/w)
KORATECT EA-18	Liquid	50 %	0,50 % (w/w)
KORATECT SL-4	Liquid	100 %	0,10 % (w/w)
KORATECT SL-12	Liquid	100 %	0,10 % (w/w)

BULK IMPREGNATION



BULK IMPREGNATION



Without additive:
uneven, spotty colour
impression, shrinkage
cracks in the area of
necking significantly
worsened, pedestal
completely destroyed
Age approx. 12 month



With additive:
Uniform bright colour
impression, no
shrinkage cracks in the
area of necking, no
flaking observable
Age approx. 12 month

Diminution of efflorescence

After 2 days curing / then 4 weeks sprinkling



Blanc
Untreated



Reference
liquid



Reference
powder



KORATECT SL-4



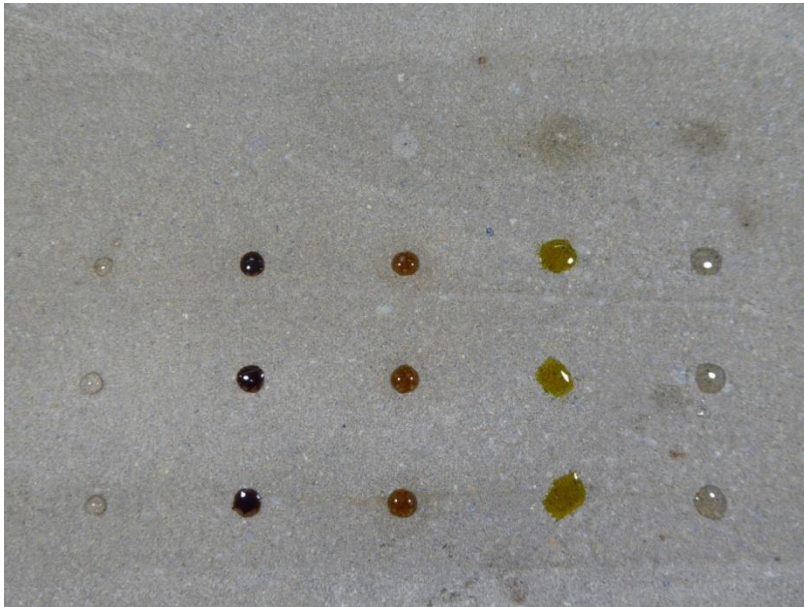
KORATECT SL-12



KORATECT EA-6

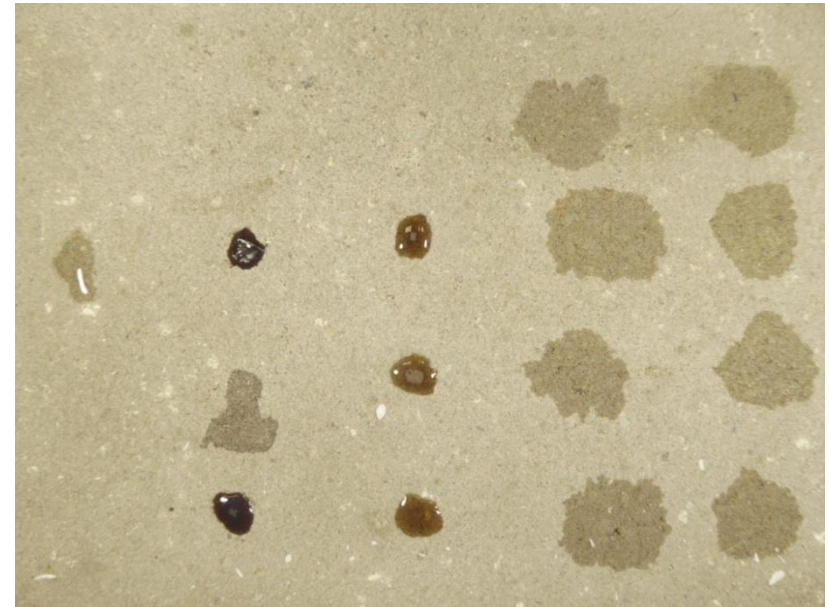
- Without affecting the surface / No film is formed
- 1st row shows the effect after 10 minutes

Water Red wine Vinegar 7% Hydraulic oil Edible oil



KORATECT SB1 A/ KORATECT SB1 B

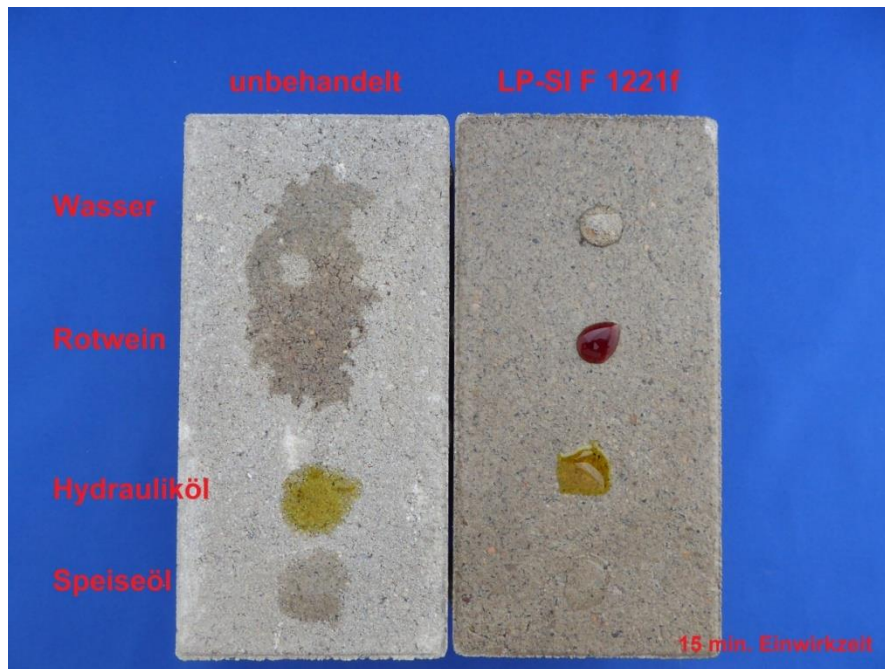
Water Red wine Vinegar 7% Hydraulic oil Edible oil



Reference (without any treatment)

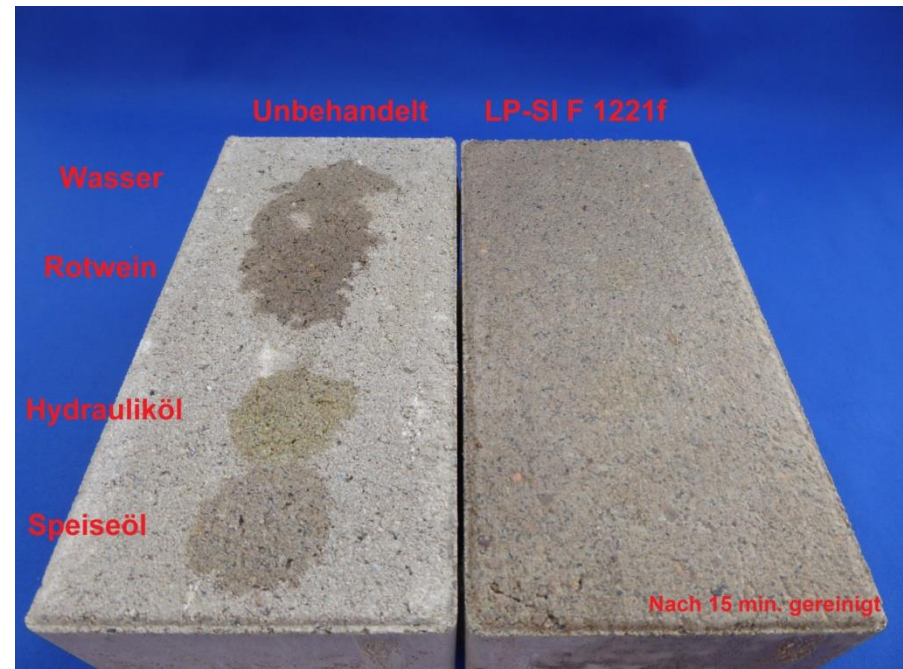
SURFACE PROTECTION

- Film forming formulation
- Cleaning after 15 min exposue



Left: no treatment

25 Right: treated with film forming formulation



Left: no treatment

Right: treated with film forming formulation

Products for the removal of rising damp

- Application by injecting into the bricking
 - Unpressurised with funnel
 - With positive displacement pump
 - **KORATECT HSC** with tubular-bag pistol
- After termination of the reaction, a hydrophobic barrier with capillar-breaking effect is formed in the masonry.
- Only limited effect against pressing water, not suitable for closing of cracks or gaps
- Suitable products are:
 - **KORATECT HZS**: Siliconate solution, causes pore sealing and hydrophobicity, also limitedly effective against slightly pressing water
 - **KORATECT HSC**, creamy silane preparation, especially simple in application also in cracky masonry, causes hydrophobicity, not for sealing cracks or gaps



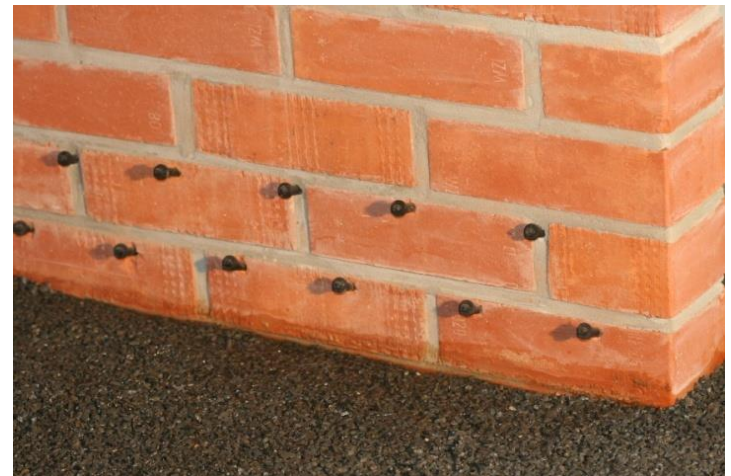
Examples of different packers and injection nozzles as well as different couplings for pressure pumps

- Reviewed by the MFPA Leipzig according to WTA-method 4-4-04.
- Accredited by WTA

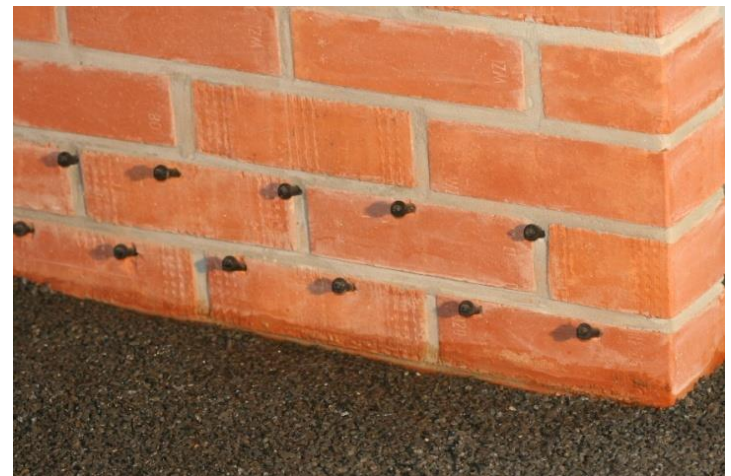


Application parameters:

- Up to 60 % moisture penetration: undiluted up to 1:4
- Up to 80 % moisture penetration: undiluted up to 1:3
- Up to 95 % moisture penetration: undiluted up to 1:2



Water-based impregnating cream for the use as horizontal barrier against ascending humidity in masonry in accordance to WTA technical bulletin 4-4-04 „Masonry injection against capillary humidity“



Hydrophobization of facades and masonry

- Besides the already mentioned products, the following water-based products are also suitable for this application area:
 - KORATECT EA-3
 - KORATECT EA-6
 - KORATECT EA-8
- The beading effect as well as the colour deepening properties of these products increase in the order KORATECT EA-3, KORATECT EA-6, KORATECT EA-8
- All before-mentioned products are principally suited for the use on well absorbent undergrounds



- For the use as base coat under paints and plasters are especially suited:
 - KORATECT SL-2
 - KORATECT C1
 - KORATECT EA-6
 - A more uniform impression of the plaster and a more homogeneous dry performance of the coating will be achieved by a pre-treatment with these products
 - The water vapour permeability of the wall is practically not affected
- For the use as an additive for facade paint in order to improve water vapour permeability and the weather resistance, KORATECT EA-1, KORATECT EA-F are especially recommended
KORATECT EA-2 and KORATECT EA-F show a significant beading effect
- KORATECT EA-5 is applied as an binding agent in silicone resin based plasters
By combination with KORATECT EA-2 or KORATECT EA-F, a remarkable beading effect is achieved



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