



CLEANING & DISINFECTION - SHEET 1

Cleaning of concrete paths, floors and walls

Issue: Atmospheric pollution and green algal deposits can build up on concrete paths, concrete floors or glasshouse walls.

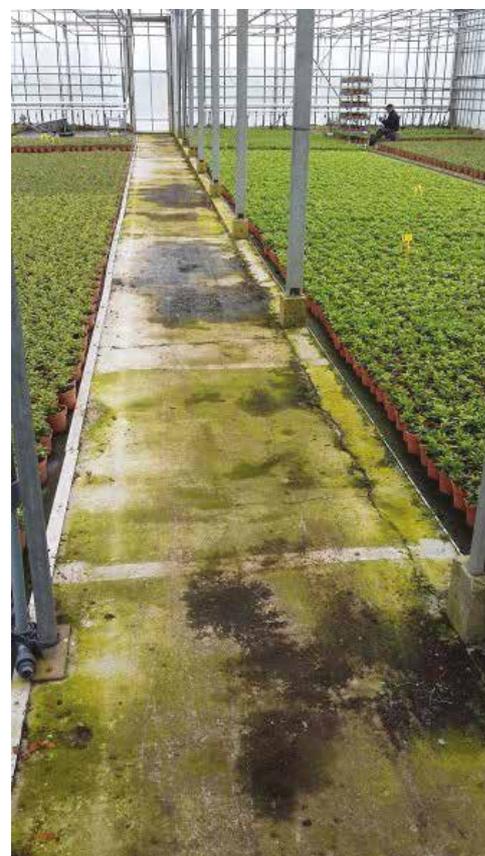
Best trial results: The table below shows the cleaning results of trial products at various rates (the best scoring products only). All applications were sprays on concrete paths or walls, without subsequent rinsing.

Product	Surface	Result per trial (each trial = different colour)				
		Inadequate	Moderately good	Pretty good	Good	Very good
Biomix ATM Plus	Dry path	100 ml		500 ml	250 ml 333 ml*	333 ml*
Greeneater			100 ml 50 ml	25 ml		100 ml*
Exp quat				25 ml		100 ml*
Quatam S472					40 ml	50 ml 80 ml*
EnzyMas					400 ml	
Biomix ATM Plus	Wet path			250 ml	333 ml	
Greeneater		50 ml	100 ml			
Exp quat					100 ml	
Quatam S472			80 ml		50 ml	
Biomix ATM Plus	Dry wall			250 ml		
Greeneater		100 ml				
Exp quat			100 ml			
Quatam S472			50 ml			
Biomix ATM Plus	Wet wall	250 ml				
Greeneater		100 ml				
Exp quat		100 ml				
Quatam S472		50 ml				

All rates in 1 litre, e.g. 250 ml = 250 ml product + 750 ml water

Trial (1) at PCS on dry concrete path, trial (2) and trial (3) at Meuninck Nursery on dry concrete path, or on a dry and a previously wetted concrete path, trial (4) at De Mol Nursery on a dry and a previously wetted concrete path and wall; all trials without replication, in trial (1), the concrete often became wet afterwards due to overhead irrigation, not in the other 3.

* Best trial result



These sheets are part of the Nursery Hygiene Project, with financial support from the East Flanders Province

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General advice for cleaning concrete surfaces

Best results are achieved by spraying with sufficient liquid on dry surfaces; on wet surfaces, the product is diluted or there is faster run-off; on dry surfaces, there is better absorption of products such as quaternary ammonium compounds; also, when treating vertical surfaces, be sure to apply to a dry surface and avoid rapid run-off using foaming equipment or addition of a adjuvant.

In order to have a sufficiently long effect, do not rinse, or avoid rain in the first 24 hours; if necessary, spray wash later if there is still dirt on the surface or if plants are to be placed on it (also do not stand plants down for several days' too).

Corrosion risk: Greeneater Conc. showed corrosion in a concrete trial (Javel products are also corrosive).

Crop risk: Do not spray on plants, and rinse any treated surfaces if plants are to be placed on them.

Product characteristics (Source: company technical/safety data sheets, PCS results and (1))

Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application, rate according to company and (1)	Environmental conditions required	Results when applied to concrete in PCS trials, and other information
Biomix ATM Plus = biocide 1615B Product Type 2 Bionova, 052/554393 €99.80/box 4 x 5 L, also drum 200 L or 1000 L	Green and black staining	Enzymatic compound, based on amines, reaction products of chloroacetic acid	Spray at 25 to 50% (25% = 1 L + 3 L water, 50% = 1 L + 1 L water) 1 L spray solution/10 m ² , no rinsing, no scrubbing	+10°C, no high temperatures No full sun No rain 24h after application	Max. effect after a few weeks. Corrosion of powder coated tubes possible. Store up to 3 years at <20°C. <u>PCS trials</u> : at least 25% concentration (also good on vertical wall if dry)
Exp quat	Cleaning moss on concrete paths, plastic walls, glasshouses (also bactericidal, fungicidal, yeast eradication)	Quaternary ammonium compound 100 g/L didecyldimethylammonium chloride	Spray at 5 to 10% (5% = 1/20, 10% = 1/10), home use 2.5%. Do not rinse, if necessary, rinse after 3 days if there is dirt residue (white discolouration) or if plants are placed on the treated surface, > 2 hours after rinsing	3 days 10°C, no night frost No full sun Dry surface No rain 24h after application	Effect on moss visible after 3 days, lichen after 8 weeks. In the case of treated stoneware pots, plants may go in after 24 hours. Quat. amm. ineffective on contact with soap. Test strips available for checking quat. amm. <u>PCS trials</u> : 1/10 concentration required (moderate on vertical wall)
Greeneater Concentrate = biocide 6506B Product Type 2 Ecostyle, 011/580582 €84 for 10 L	Cleans moss, algae deposits on stone, glass, etc.	Acid Act. sub = 20% pelargonic acid or nonanoic acid	Spray at 10% or 100 ml/L from a distance of 30 cm from the surface to be treated 1 L spray solution/10 m ² , do not rinse or scrub	+10°C = optimal operation On dry surface A few hours dryness after application is sufficient	Long after-effects. Do not discharge into the environment. <u>PCS trials</u> : 100 ml/L recommended, especially on dry surface (ineffective on vertical wall)
EnzyMas = cleaning agent Hortipro, 0031/341268639 Packaging: 1, 5, 10, 20 L €126 for 20 L	Cleaning black deposits, grease, atmospheric pollutants on concrete, glass and screens	Biological cleaner based on enzymes	Spray at 17 to 40% (17% = 1 L + 5 L water, 40% = 1 L + 1.5 L water), with large droplets (Teejet 8004 or 8005) 1 L spray solution/10 m ² , do not rinse	Enzymes most active from 13°C On dry or slightly damp, not too warm surface No rain 24h after application	Results visible after a few days to weeks. Long-acting. Avoid eye contact. <u>PCS trials</u> : 40% dosage recommended
Quatam S472 = cleaning agent Brenntag, 056/776944 Packaging: 1, 5, 25 L €9.75/L	Removes atmospheric pollutants on concrete, ground cover, container field areas, glasshouses	Quaternary ammonium compound Act. sub = 10-15% alkylbenzyl dimethylammonium chloride	Spray at 2.5 to 3% (25- 30 ml/L) with backpack sprayer, with sufficient liquid	On dry surface Keep dry for 2-3 hours after application	Results not immediately visible; on some materials only after several weeks. <u>PCS trials</u> : 40 ml/L required (moderate on vertical wall)

Cleaning moss deposits should be done with a recognised biocide such as Biomix ATM Plus and Greeneater Concentrate. Always check www.health.belgium.be/nl/lijst-van-toegelaten-biociden (1) for the current approvals.

This sheet contains general information. We recommend doing a small trial beforehand. PCS is not responsible for any damage resulting from this information.



CLEANING & DISINFECTION - SHEET 2

Cleaning of ground cover materials on container beds

Issue: Atmospheric pollutants or green algal deposits can build up on ground cover materials used for container beds.

Best trial results: The table below shows the cleaning results of the best scoring trial products at various rates. All applications were sprays without subsequent rinsing. These were done either outdoors or in glasshouses with overhead irrigation on various ground cover materials.



Product	Surface	Result per trial (each trial = different colour)				
		Inadequate	Moderately good	Pretty good	Good	Very good
Exp quat	(1) Black material container bed outside		50 ml	100 ml		
Greenpower SP				50 g		
Greenpower SG					30 g/m ² sprinkle	
Green kill ready to use				4%		
Exp quat	(2) Black material container bed inside	25 ml				
Greenpower SP			50 g			
Greeneater Concentrate				100 ml		
Biomix ATM Plus		100 ml		500 ml		
EnzyMas				400 ml		
Exp quat	(3) Black and white material container bed inside with capillary matting		25 ml			
Greenpower SP					50 g	
Greeneater Concentrate					100 ml	
Biomix ATM Plus				100 ml		500 ml
EnzyMas			400 ml			
Exp quat	(4) Wet black cloth material with capillary matting in seed tray	25 ml				
Greenpower SP					50 g	
Greeneater Concentrate				100 ml		
Biomix ATM Plus			100 ml		500 ml	
EnzyMas			400 ml			

Rate in 1 litre, e.g. 100 ml = 100 ml product + 900 ml water - all trials at PCS without subsequent rinsing

Trial (1) on black AW cover 137K 130 g/m² with black agricultural film underneath, which afterwards was exposed to rainfall, trial (2) on the same cover and film, which was exposed to overhead watering in the glasshouse, trial (3) black and white AW fabric with Aquafelt capillary matting underneath, and black agricultural film under that was exposed to overhead watering, trial (4) set-up with seeding trays in which black AW cover was placed on capillary matting; these were kept wet manually - in (1) and (2), the surface was drier; in (3) and (4) it was moister because of the underlying capillary matting

Unsatisfactory cleaning trial results: products based on sodium hypochlorite, hydrogen peroxides, etc.

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General advice when cleaning ground cover materials on container beds

Best results are obtained by spraying with sufficient liquid (or granular spread); material should be dry when using quaternary ammonium products (Exp quat), preferably wet with Greenpower and Biomix ATM Plus. In order to have a sufficiently long effect, do not rinse, or avoid rain in the first 24 hours; if necessary, rinse later if there is still dirt on the surface or if plants are to be placed on it (e.g. for Greeneater Concentrate, Biomix ATM Plus).

Crop risk: Do not spray on plants, and rinse any treated surfaces if plants are to be placed on them.

Product characteristics (Source: company technical/safety data sheets, PCS results and (1))

Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application, rate according to company and (1)	Environmental conditions required	Results when applied to ground cover material in PCS trials, and other information
Exp quat	Cleaning moss on concrete paths, plastic walls, glasshouses (also bactericidal, fungicidal, yeast eradication)	Quaternary ammonium compound 100 g/L didecyltrimethylammonium chloride	Spray at 5 to 10% (5% = 1/20, 10% = 1/10), home use 2.5% do not rinse afterwards, if necessary rinse after 3 days if there is dirt residue (white discolouration) or if plants are to be placed on the treated surface, placing plants > 2 hours after rinsing	3 days 10°C, no night frost, no full sun, dry surface 24hr, no rain after application	Effect on moss is visible after 3 days, lichen after 8 weeks. When treating stoneware pots, plants may be placed inside after 24 hours. Quat. amm. ineffective on contact with soap. Test strips available for checking quat. amm. <u>PCS trials</u> : 10% dose required
Greenpower SP and SG = cleaning agent from BSI, 056/772434 Packaging & price: SP: €35.10 for 4 kg SG: €64.75 for 15 kg	Powerful ecological cleaner for deposits and stains of organic nature (grease, soot, bird droppings, etc.) on paths, pavements, etc.	Inorganic peroxide, Na ₂ CO ₃ , etc.	SP: spray at 50 g/L GR: depending on the contamination, spread at 20-40 g/m ² - if surface is too dry, moisten very lightly after spreading - do not rinse/scrub	Apply to wet surface (must remain moist for 3 hours), therefore best in the morning or evening or after rain or irrigation	No problem for reservoir or pond water if granules enter drainage channels, granules gradually dissolve in moisture or in contact with the soil, takes effect within 3 days. <u>PCS trials</u> : 50 g/L (SP) best on wet material or 30 g/m ² (GR)
Greeneater Concentrate = biocide 6506B Product Type 2 from Ecostyle, 011/580582 €84 for 10 L	Cleans moss, algae deposits on stone, glass, etc.	Acid Act. sub = 20% pelargonic acid or nonanoic acid	Spray at 10% or 100 ml/L from a distance of 30 cm from the surface to be treated. 1 L spray solution/10 m ² , do not rinse or scrub	+10°C = optimal effect on dry surface Several hours of dryness after application is sufficient	Long after-effects do not discharge into the environment. <u>PCS trials</u> : 100 ml/L recommended
Biomix ATM Plus = biocide 1615B Product Type 2 from Bionova, 052/554393 €99.80 for a box of 4 x 5 L, also drums of 200 L or 1000 L	Green and black staining	Enzymatic compound, based on amines, reaction products of chloroacetic acid	Spray at 25 to 50% (25% = 1 L + 3 L water, 50% = 1 L + 1 L water), 1 L spray solution/10 m ² : no rinsing, no scrubbing	+10°C, no high temperatures, no full sun after application, 24h no rain	Max. effect after a few weeks corrosion of powder coated tubes possible, storage up to 3 years at <20°C. <u>PCS trials</u> : 10% dose effective on wet material, 50% dose needed on dry material
EnzyMas = cleaning agent from Hortipro, 0031/341268639 packaging: 1, 5, 10, 20 L €126 for 20 L	Cleaning black deposits, grease, atmospheric pollutants on concrete, glass and screens	Biological cleaner based on enzymes	Spray at 17 to 40% (17% = 1 L + 5 L water, 40% = 1 L + 1.5 L water), with large droplets, (Teejet 8004 or 8005) 1 L spray solution/10 m ² , do not rinse	Enzymes most active from 13°C on dry or slightly moist, not too warm, surface, no rain 24h after application	Results visible after a few days to weeks. Long-acting avoid eye contact. <u>PCS trials</u> : 40% concentration required, not good on wet material

Cleaning moss deposits should be done with a recognised biocide such as Biomix ATM Plus and Greeneater Concentrate. Always check www.health.belgium.be/nl/lijest-van-toegelaten-biociden (1) for the current approvals.

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CLEANING & DISINFECTION - SHEET 3

Cleaning of glasshouses (interior) and plastic walls

Issue: Atmospheric pollutants or green algal deposits can build up on glass and plastic structures, which can result in serious light reduction.

Trial results for glasshouses: The table below shows the cleaning results of trial products at various rates and application times on indoor glass. Clean A&M clearly scored the best if rinsed after 5 minutes. Quaternary ammonium compounds also had an effect, but a follow-up treatment with a soap that is then rinsed off seems appropriate. EnzyMas also showed effect (with and without rinsing).



Product	Rinse afterwards	Result per trial (each trial = different font colour/format)				
		No effect	Little effect	Moderately good	Good	Very good
Clean A&M	5 min			50 ml		100 ml 100 ml 200 ml
	1 hour				200 ml	
EnzyMas + adjuvant	None			500 ml		
	1 hour			500 ml		
Scalfoam plus	5 min	200 ml				
	1 hour		200 ml			
Biomix ATM Plus	None		100 ml			
Exp. quat > day 2 Menno Hortisept Clean Plus with foaming equipment	10 min on day 2 with MHC+				Exp. q. > 30 ml	
Menno Hortisept Clean Plus with foaming equipment	10 min	30 ml				
Exp. quat	None		25 ml			
EnzyMas	None			400 ml		
Biomix ATM Plus	None	100 ml	500 ml			
Greeneater Concentrate	None		100 ml			
Greenpower SP	None		50 g/L			
Peroxide + acetic acid	None		10 ml			
Sodium hypochlorite 13% (Javel)	None		100 ml			

Trial (1) (2) and (3) at the Aelterman Nursery on heavily soiled glasshouse glass panes (usually with subsequent rinsing, but no irrigation afterwards, because there was no irrigation in the section), trial (3) at PCS on slightly soiled glass panes (rinsing only with Menno Hortisept Clean, with subsequent overhead irrigation)

All rates in 1 litre, e.g. 200 ml = 200 ml product + 800 ml water

Inside glass panes: mainly products trialled without hydrofluoric acid (Flusol forte, Quickwit)

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Trial results on plastic structures: The table below shows the cleaning results of trial products at various rates and application times on indoor and outdoor plastic. Not all products were rinsed off with the aim of maximising the penetration time and because either rainfall or overhead irrigation was expected afterwards. Best applications without rinsing were the 'quats' and high rate Biomix ATM Plus. Clean A&M was best with rinsing; on plastic one hour contact worked better; EnzyMas also showed an effect. Plastic Film Cleaner was only moderate.

Product	Rinse afterwards	Glass or plastic inside or outside	Result per trial (each trial = different font colour/format)				
			No effect	Little effect	moderate effect	pretty good	Good
Exp. quat > day 2 Menno Hortisept Clean plus foam	None	Plastic inside					Exp. q. > 30 ml
Exp. quat	None	Plastic inside					25 ml 100 ml
Biomix ATM Plus	None	Plastic inside					500 ml
Greeneater Concentrate	None	Plastic inside			100 ml		
Greenpower SP	None	Plastic inside	50 g/L				
Sodium hypochlorite 2.5% (Javel)	None	Plastic inside	75 ml	150 ml			
Plastic Film Cleaner	None	Plastic inside		125 ml	500 ml		
Scalfoam plus	5 min	Plastic inside	50 ml				
Menno Hortisept Clean	5 min	Plastic inside	30 ml				
EnzyMas + adjuvant	None	Plastic inside		500 ml			
Quatam S472 + adjuvant	None	Plastic inside	160 ml				
Wipe&Clean + adjuvant	None	Plastic inside	100 ml				
Clean A&M	5 min	Plastic outside			200 ml	200 ml	
	1 hour	Plastic outside					200 ml
EnzyMas + adjuvant	None	Plastic outside			500 ml		
	1 hour	Plastic outside				500 ml	
Exp. quat + adjuvant	None	Plastic outside		100 ml			
Hortirein	15 min	Plastic outside	100 ml/L is currently being trialled (June 2017)				
Citric acid	15 min	Plastic outside	200 g/L is currently being trialled (June 2017)				
Plastic Film Cleaner	5 min	Plastic outside	100 ml		200 ml		
	1 hour	Plastic outside	100 ml				
Trial (1) at PCS on heavily soiled plastic (inside of glasshouse, without rinsing but afterwards exposed to daily overhead irrigation), trial (2) at Meuninck's Nursery on heavily soiled translucent very thin plastic (inside of glasshouse, some products with and some products without rinsing, but for the rest, no irrigation afterwards), trial 3, trial 4 and trial 5 at PCS on the outside of a heavily soiled plastic structure (largely with rinsing, and afterwards exposed to rainfall)							
All rates in 1 litre, e.g. 100 ml = 100 ml product + 900 ml water							



Foaming equipment for application of Menno Hortisept Clean plus and such

General advice for cleaning interior windows and plastic walls

When treating vertical surfaces, avoid rapid run-off by not spraying too much liquid, if necessary add an adjuvant or use foaming equipment (e.g. for quaternary ammonium compounds).

Rinsing: Depending on the product and the situation (indoor/outdoor, irrigation), it is advisable to rinse.

- In the case of cleaning products based on acids, etc., it is best to rinse off with a powerful jet soon after treatment in order to prevent the dirt from drying and sticking.
- Other products, such as quaternary ammonium compounds and enzymatic compounds, require a sufficient contact time to achieve maximum effect. The treated surfaces can then be rinsed of with a strong jet after a few days.

Corrosion risk: When using acids and fluorides, test the materials beforehand.

Crop risk: especially when using acids, do not splash on plants, do not spray on plants with the other products either.

Product characteristics (Source: company technical/safety data sheets, PCS results and (1))

Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application, rate according to company and (1)	Environmental conditions required	Results when applied to glass/plastic in PCS trials, and other information
Clean A&M = cleaning agent Vossen, 011/231600 €22.9/L when purchasing 12 bottles of 1 L	Cleaning of atmospheric and mineral pollutants / contaminations such as rust, iron phosphate, fertilisers, salts, etc. on glass, wall panels, etc.	Sulphuric acid 10-50% Phosphoric acid < 20% Ammonium hydrogen difluoride < 10%	Dilute product with lukewarm water and spray, allow contact for 2-5 minutes, and rinse thoroughly. Dirt on glass: 1/5 to 1/10 for etch removal, 1/10 to 1/100 for atmospheric pollutant cleaning. Dirt on porous floor: 1/5 to 1/10; solid floor: 1/10 to 1/20	In hot weather, rinse in good time (do not allow to dry) Do not apply to hot surfaces due to product vapourisation	Product with low pH. Effect visible immediately. <u>PCS trials:</u> 10% concentration good effect on dirty windows if rinsed after 5 minutes; 20% concentration quite good on dirty plastic (if rinsed)
Exp. quat	Cleaning moss on concrete paths, plastic walls, glasshouses (also bactericidal, fungicidal, yeast eradication)	Quaternary ammonium compound 100 g/L didecyl-dimethyl-ammonium chloride	Spray at 5 to 10% (5% = 1/20, 10% = 1/10), home use 2.5%. Do not rinse, if necessary, rinse after 3 days if there is dirt residue (white discolouration), or if plants are to be placed on the treated surface, > 2 hours after rinsing	3 days 10°C, no night frost No full sun Dry surface No rain 24h after application	Effect on moss visible after 3 days, lichen after 8 weeks. In the case of treated stoneware pots, plants may go in after 24 hours. Quat. amm. ineffective on contact with soap. Test strips available for checking quat. amm. <u>PCS trials:</u> 1/10 concentration good effect on dirty plastic
Biomix ATM Plus = biocide 1615B Product Type 2 Bionova, 052/554393 €99.80/box 4 x 5 L, also drum 200 L or 1000 L	Green and black staining	Enzymatic compound, based on amines, reaction products of chloroacetic acid	Spray at 25 to 50% (25% = 1 L + 3 L water, 50% = 1 L + 1 L water) 1 L spray solution/10 m ² , no rinsing, no scrubbing	+10°C, no high temperatures No full sun No rain 24h after application	Max. effect after a few weeks. Corrosion of powder coated tubes possible. Store up to 3 years at <20°C. <u>PCS trials:</u> 50% concentration moderate good effect on plastic contamination
EnzyMas = cleaning agent Hortipro, 0031/341268639 Packaging: 1, 5, 10, 20 L €126 for 20 L	Cleaning black deposits, grease, atmospheric pollutants on concrete, glass and screens	Biological cleaner based on enzymes	Spray at 17 to 40% (17% = 1 L + 5 L water, 40% = 1 L + 1.5 L water), with large droplets (Teejet 8004 or 8005), 1 L spray solution/10 m ² . do not rinse	Enzymes most active from 13°C On dry or slightly damp, not too warm surface No rain 24h after application	Results visible after a few days to weeks. Long-acting. Avoid eye contact. <u>PCS trials:</u> 50% concentration and adjuvant moderate to fairly good effect on plastic structure
Hortirein = cleaning agent Company CID lines, 057/217877 €75 for 23.6 L (= 26 kg)	Developed for the removal of all dirt in horticulture; possesses degreasing properties	5-15% glutamic acid, tetrasodium salt, di-acetic acid 1-5% NaOH Alcohol(C13)EO, D-glucopyranose, C8-10 glycosides	<u>On surfaces:</u> Spray at 2 to 10% concentration	No specific requirements	No corrosion. Very effective on paint, aluminium and glass. <u>PCS trials:</u> 10% concentration is currently being trialled (June 2017), results to be announced later
Menno Hortisept Clean and Menno Hortisept Clean plus = MHC+ = cleaning agent Royal Brinkman 0031/174 446100 MHC: €10.45/L MHC+: €10.82/L packages 10 L	Powerful cleaner suitable for crate and tray washers, etc., but also for roller tables, trolleys, facades and floors. Lifts plant juices and other organic impurities	MHC: 10 - 15% NaOH, 5 - <10% Sodium octyl sulphate, 1 - <5% Sodium p-cum-enesulphonate MHC+: idem + 1 - <5% Codime-thylamine oxide	Apply MHC 1% -3% (add while stirring) with warm water, contact time 1 to max. 5 minutes, avoid drying, then rinse the surface with warm water under high pressure. If foam is required, use MHC+ with Menno disinfection syringe or Skumix	Avoid drying out	Leaves no residue. MHC suitable for high pressure pump systems without foam generation. MHC+ plus suitable for foam application on dirty surfaces, carts, etc. If no previous experience, trial product compatibility with the material to be cleaned. <u>PCS trials:</u> 3% concentration after quat. good on plastic structure
Other products with moderate effect in PCS trials: Plastic Film Cleaner (alkaline cleaner from Sercodis, 056/400653), Scalfoam (fluorine-free cleaner from H&V chemicals, 02/2552080). Currently still in trial: citric acid (various companies).					

Cleaning moss deposits should be done with a recognised biocide such as Biomix ATM Plus. Always check www.health.belgium.be/nl/liijst-van-toegelaten-biociden (1) for the current approvals.



CLEANING & DISINFECTION - SHEET 4

Cleaning and corrosion risk of various materials

Issue: Atmospheric pollutants or green algal deposits and moss can appear on various glasshouse materials, such as the rubbers and metals around the glass panes and such, but also on all kinds of materials such as polystyrene insulation panels.

Trial results: The table below shows the cleaning results of trial products at various rates. All applications were applied as sprays without subsequent rinsing. These took place at various locations (PCS, 2 growers) in combination trials where other items (windows, concrete, materials) were also treated.



Product	Material	Result per trial (each trial = different colour)			
		Poor	Limited effect	Pretty good	Good
EnzyMas + adjuvant	Polystyrene panels				500 ml
Quatam S472 + adjuvant			160 ml		
EnzyMas			400 ml		
Biomix ATM Plus		500 ml			
Greeneater Concentrate			100 ml		
Exp. quat		25 ml			
Greenpower SP		50 g/L			
EnzyMas	Glasshouse rubber				400 ml
Biomix ATM Plus		100 ml		500 ml	
Greeneater Concentrate				100 ml	
Exp. quat		25 ml			
Greenpower SP		50 g/L			
EnzyMas	Glasshouse aluminium			400 ml	
Biomix ATM Plus				100 ml	
Greeneater Concentrate				100 ml	
Exp. quat				25 ml	
Greenpower SP				50 g/L	
Biomix ATM Plus					250 ml
Greeneater Concentrate			100 ml		
Exp. quat					100 ml
Quatam S472			50 ml		

All rates in 1 litre, e.g. 160 ml = 160 ml product + 840 ml water

Trial (1) at a grower only on polystyrene panels, trial (2) at PCS where various items were cleaned at the same time (glass panes with rubbers and aluminium, polystyrene panels, etc.; these were exposed to overhead irrigation afterwards, trial (3) at a grower on aluminium around a glass pane just above a concrete wall



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General advice for cleaning glasshouse materials

Spraying on with no rinsing to achieve maximum contact duration. However, if plants are to be introduced, rinse and allow to stand empty for a while when using Greener Concentrate, Biomix ATM Plus, etc.

For polystyrene panels, only EnzyMas (50% concentration) provided good results.

For glasshouse rubbers it was also EnzyMas (40% concentration), and applications of Greener Concentrate (10% concentration) and Biomix ATM Plus (50% concentration) were almost as good.

For aluminium pane surrounds, several products scored quite well, in particular the Biomix 25% concentration, and Exp. quat 10% concentration.

Product characteristics (source: company technical/safety data sheets, PCS results and (1))

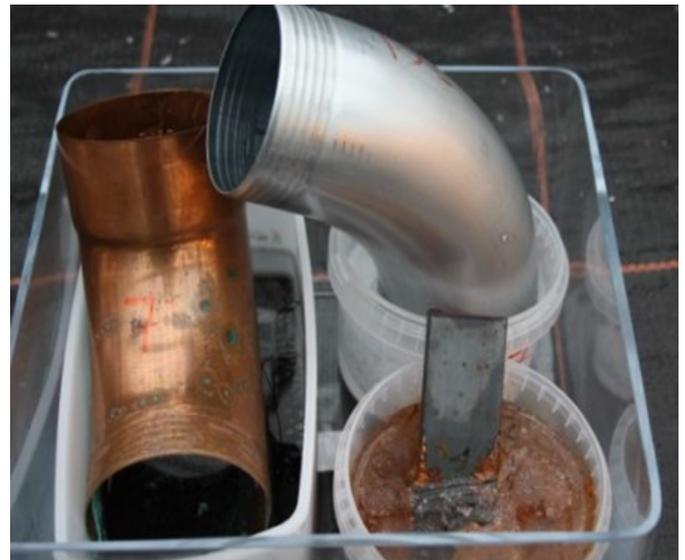
Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application, rates according to company and (1)	Environmental conditions required	Results when applied to materials in PCS trials, and other information
EnzyMas = cleaning agent Hortipro, 0031/341268639 Packaging: 1, 5, 10, 20 L €126 for 20 L	Cleaning black deposits, grease, atmospheric pollutants on concrete, glass and screens	Biological cleaner based on enzymes	Spray at 17 to 40% (17% = 1 L + 5 L water, 40% = 1 L + 1.5 L water), with large droplets (Teejet 8004 or 8005) 1 L spray solution/10 m ² , do not rinse	Enzymes most active from 13°C On dry or slightly damp, not too warm surface No rain 24h after application	Results visible after a few days to weeks. Long-acting. Avoid eye contact. PCS trials: 40% concentration a good cleaner of glasshouse rubber, 50% concentration on polystyrene
Biomix ATM Plus = biocide 1615B Product Type 2 Bionova, 052/554393 €99.80/box 4 x 5 L, also drum 200 L or 1000 L	Green and black staining	Enzymatic compound, based on amines, reaction products of chloroacetic acid	Spray at 25 to 50% (25% = 1 L + 3 L water, 50% = 1 L + 1 L water) 1 L spray solution/10 m ² , no rinsing, no scrubbing	+10°C, no high temperatures No full sun No rain 24h after application	Max. effect after a few weeks. Corrosion of powder coated tubes possible. Store up to 3 years at <20°C. PCS trials: from 10% concentration quite good cleaning on aluminium; 50% concentration on glasshouse rubber
Exp. quat	Cleaning moss on concrete paths, plastic walls, glasshouses (also bactericidal, fungicidal, yeast eradication)	Quaternary ammonium compound Act. sub: 100 g/L didecyldimethylammonium chloride	Spray at 5 to 10% (5% = 1/20, 10% = 1/10), home use 2.5%. Do not rinse, if necessary, rinse after 3 days if there is dirt residue (white discolouration) or if plants are to be placed on the treated surface, > 2 hours after rinsing.	3 days 10°C, no night frost No full sun Dry surface No rain 24h after application	Effect on moss visible after 3 days, lichen after 8 weeks. In the case of treated stoneware pots, plants may go in after 24 hours. Quat. amm. ineffective on contact with soap. Test strips available for checking quat. amm. PCS trials: 10% concentration required for cleaning of glasshouse aluminium
Greenpower SP = cleaning agent BSI, 056/772434 Packaging & price: €35.10 for 4 kg	Powerful ecological cleaner for deposits and stains of organic nature (grease, soot, bird droppings, etc.) on paths, pavements, etc.	Inorganic peroxide, Na ₂ CO ₃ , etc.	Spray at 50 g/L, no rinsing/scrubbing	Apply to wet surface (must remain moist for 3 hours), therefore best in the morning or evening or after rain or irrigation	PCS trials: 50 g/L gives fairly good cleaning of glasshouse aluminium
Greener Concentrate = biocide 6506B Product Type 2 Ecostyle, 011/580582 €84 for 10 L	Cleans moss, algae deposits on stone, glass, etc.	Acid Act. sub = 20% pelargonic acid or nonanoic acid	Spray at 10% or 100 ml/L from a distance of 30 cm from the surface to be treated. 1 L spray solution/10 m ² , do not rinse or scrub	+10°C = optimal operation On dry surface A few hours of dryness after application is sufficient	Long lasting effects. Do not discharge into the environment. PCS trials: 10% concentration cleaning on glasshouse rubber and aluminium

Cleaning moss deposits should be done with a recognised biocide such as Biomix ATM Plus and Greener Concentrate.
Always check www.health.belgium.be/nl/lijest-van-toegelaten-biociden (1) for the current approvals.

Corrosivity of cleaning products on metals

Trial results for PCS corrosion trial 1 on objects made of Cu (tube), Zn (tube) and Fe (slat): test materials were placed in a solution of the trial product for 2 months; the products were: rainwater, Biomix ATM Plus at 10 and 50% concentration, EnzyMas at 40% concentration, 50 g/L Greenpower SP, Greeneater Conc. at 10% concentration, Exp. quat at 2.5% concentration and another older quaternary ammonium compound, Menno Hortisept Clean (= alkaline soap) at 3% concentration, Sodium hypochlorite 13% (Javel) at 10% concentration, and a hydrogen peroxide with acetic acid product at 1% concentration. The results were as follows:

- In ordinary water: only interaction with iron > iron slat corroded, water therefore light orange in colour.
- Least corrosion with Greenpower and EnzyMas: liquids slightly blue with Cu tube; Biomix was also not too bad (only light blue to green discolouration of liquid with Cu, light green with Zn and Fe) and the same with Menno Hortisept Clean (only a heavy dark blue discolouration of liquid with Cu).
- Greeneater Concentrate (benzoic acid) solution was highly corrosive to copper pipes, and to a lesser extent to zinc pipes as well.
- The quats were highly corrosive to zinc pipes and iron slats.
- The peroxide with acetic acid product was very corrosive to copper pipes and iron slats.
- The Javel product was highly corrosive to all materials.



Corrosivity of cleaning products on rubber, metals and concrete

Trial results of PCS corrosion test on two glasshouse rubbers, galvanized iron, painted iron, aluminium profiles, concrete paving: test materials were placed in a solution of the trial product for 3 months; the products were: rainwater, Biomix ATM Plus at 50% concentration, a hydrogen peroxide with acetic acid product at 8 ml/L, an older quaternary ammonium compound, the disinfectants Menno Florades, Virocid and Exp. disinfectants at 40 ml/L, 5 ml/L and 10 g/L respectively, Greener Concentrate at 10% concentration and a related herbicide at 16% concentration, and a 13% sodium hypochlorite (Javel) at 10% concentration. The results were as follows:

- The pelargonic acid products, Greener and the herbicide proved to be very corrosive on all materials.
- Javel (and Biomix ATM Plus) were corrosive on iron.
- Peroxides and quaternary ammoniums gave rise to corrosion on concrete and iron.
- Menno Flor. and Exp. disinfection products were corrosive on concrete paving and aluminium profiles, and M.FI. also on rubber (and iron).
- Virocid proved to be the least corrosive: only interaction with painted iron.

	1. Water	2. Bio- mix	3. Peroxac. acid	4. Quat amm	5. Menno FI	6. Virocid	7. Exp.	8. Greentr	9. Herbi- cide	10. Javel
Glasshouse rubber					X			X	X	
Galvanized iron		X	X		(X)			X	X	X
Painted iron		X		X		X		X	X	X
Aluminium profile					X		X	X	(X)	
Concrete paving			X	X	X		X	X	X	

Green shading
= no corrosion
observed
(X) light corrosion,
X moderate
corrosion, **Red
shading and X** =
severe corrosion



This sheet contains general information. We recommend doing a small trial beforehand. PCS is not responsible for any damage resulting from this information.



CLEANING & DISINFECTION - SHEET 5

Cleaning of contaminants on plant leaves

Issue: Ornamental plants can become contaminated in various ways during production, leading to a direct reduction in commercial value of them.

Types of contamination on leaves:

- Fertiliser residues and chalky water deposits
- Residues of glass whitewashing accidentally deposited on plants
- Residues of plant protection products: visible or invisible spray residues
- In dark, humid periods of prolonged production: formation of algae on leaves
- After heavy infestation with aphids, mealy bugs or whiteflies: sticky honeydew, followed by black sooty mould and/or remnants of aphids (skin moults) or mealy bugs (white fluff), etc.
- Bird droppings if, for example, wagtails get into the glasshouse
- Yellow dust of pollen being dusted on the leaves as supplementary food for predatory mites



TABLE 1: Average result of cleaning of the various leaf contaminants with each cleaning product

(Green shading = good, yellow = fairly good, orange = moderate, red = poor)

SPRAYED CLEANING PRODUCT	Sooty mould	Algae on leaves	Chalk and fertiliser deposits	White-washing from glasshouse	Pollen	Bird droppings	Visible spray residue	Invisible spray residue
Water	Red	Red	Red	Red	Green	Yellow	Red	Red
Hortirein	20 ml/L – 1'	40 ml/L – 5'	20 ml/L – 5'	Red	20 ml/L – 1'	20 ml/L – 5'	20 ml/L – 5'	20 ml/L – 5'
Hachem	1.5 ml/L – 1'	Red	30 ml/L – 15'	30 ml/L – 1'	1.5 ml/L – 1'		1.5 ml/L – 5'	1.5 ml/L – 5'
Citric acid	25 g/L – 15'	Red	5 g/L – 5'	50 g/L – 60'!			5 g/L – 5'	5 g/L – 5'
Reduclean	10 ml/L – 15'	Red						
Prima Clean			1 g/L – 5'				1 g/L – 5'	1 g/L – 5'

Trial = rate - application time of best result
Red text = crop damage

These sheets are part of the Nursery Hygiene Project, with financial support from the East Flanders Province

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General advice for cleaning plants

Method:

- Prevention of contamination is obviously the best method (see p. 3 and 4), and the only method to avoid algae on the leaves or spots with glasshouse whitewash on plants.
- Cleaning with water: before using products, always try to get the plants clean with one or more generous irrigation sessions; for problems such as pollen on the leaves, this is sufficient.
- Product spraying and rinsing: for stubborn dirt, spray plants with soap or acid, but rinse well within 5 minutes (or sooner), so the dirt cannot dry again and the cleaning agent cannot scorch the leaves or flowers. Depending on the contaminant and plant type, trial which application gives the best and most crop-safe results.

Safety: wear protective clothing/glasses/eye protection for almost all products



Which product for which contaminant?

Pollen: rinse off with water

Sooty mould:

Spray with 20 ml/L Hortirein (or 1.5 ml/L Hachem) and rinse off after 1 minute

Chalk / fertiliser:

Spray with 5 g/L citric acid or 20 ml/L Hortirein and rinse off after 5 minutes

Bird droppings:

Spray with 20 ml/L Hortirein and rinse off after 5 minutes

Spray residues of plant protection products:

Spray with 20 ml/L Hortirein (or 1.5 ml/L Hachem) and rinse off after 5 minutes

For most visible residues, Hortirein is best, for some (e.g. cyprodinil = invisible) Hachem is better

Whitewash on leaves: citric acid best, but not crop-safe > only option = prevention!

Algae on leaves: Hortirein best, but only bleaching the colour, no removal > only option = prevention!

For more details, see the product characteristics table on p. 3



Please note: cleaning plants is a risky operation; when applying to plants, always do preliminary trials on your own plant species in your own growing system to determine the ideal application (product, rate, rinsing time).

General advice for prevention of leaf contamination

Prevention by type of pollution:

General: avoid applications of potential contaminants in the last weeks of production.

- Fertiliser residues and chalky water deposits > apply from below, rinse immediately, use proper water-soluble fertilisers.
- Residues of glasshouse whitewash: make sure all windows are closed when whitewashing.
- Plant protection product residues > towards the end of production, choose products that do not produce a visible residue or select products that break down quickly (see p. 4: code numbers for risk of visible spray residue on leaf, colour for estimation of residue persistence).
- Formation of algae on leaves: ensure good ventilation (sufficiently spaced crop, position and ventilation) in dark periods with high RH.
- Black sooty mould and/or remains of aphids (skin moults) or mealybugs (white fluff), etc.: ensure timely aphid, mealybug, soft scale, whitefly or echinothrips control.
- Bird droppings: make sure the glasshouse vents are closed just before sunset to keep wagtails and other birds out.
- Yellow dust from pollen from predatory mite feeding: do not dust powder too generously on the crop.

Product characteristics (Source: company technical/safety data sheets, PCS trials)

Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	Results when applied to plants in PCS trials, and general advice for glass or surfaces (company)	Environmental conditions required	Other comments
Hortirein = cleaning agent Company CID lines, 057/217877 €75 for 23.6 L (= 26 kg)	Developed for the removal of all dirt in horticulture; possesses degreasing properties	5-15% glutamic acid, tetrasodium salt, di-acetic acid 1-5% NaOH Alcohol(C13)EO, D-glucopyranose, C8-10 glycosides, etc.	<u>On plants</u> : spray at 20 ml/L > rinse off generously after 1 to 5 minutes depending on the contaminant to be cleaned (sooty mould, lime, spray residues, bird droppings, see table 1 on p.1). <u>on surfaces</u> : Spray 2 to 10% concentrations	No specific requirements, but when used on plants it is best not to do so in full sun!	Product may freeze without loss of cleaning capacity when used afterwards
Hachem = cleaning agent Royal Brinkman BV, 0031/174/446100 €7.29/L when purchasing 20 L	Originally a glass cleaning product that can also be used on plants to clean residues of impure water, pesticides or fertilisers that are present	50% Hachem (citric acid)	<u>On plants</u> : spray at 1.5 ml/L and rinse off after 1 to 5 min. depending on the contaminant to be cleaned (sooty mould or spray residue, see table 1 on p.1). <u>On glass</u> : spray at 1.5 ml/L > let it act on any residue present and then rinse for 3x3 minutes	Apply in overcast weather On plants, certainly not in full sun	Was also used in poinsettia production to clean the bracts
Citric acid mono gran = cleaning agent Royal Brinkman BV, 0031/174/446100 €3/kg when purchasing 25 kg	Normally used for removing the chalk (lime) or dirt residue from glass; this is often used at the end of the season, also used for cleaning residues on plants	≥ 99.8% citric acid monohydrate	<u>On plants</u> : against chalk / fertiliser residue: spray 5 g/L, rinse off after 5 min (see table 1 on p.1). <u>On glass</u> : spray at 25 kg /100 L, with 2500 L spray liquid/ha > after 48 hours wash off with plenty of water (do not allow it to dry)	On glass: apply in dry weather On plants, certainly not in full sun	
Other products: Prima clean (tank cleaner based on benzenesulphonic acid and sodium bicarbonate from Royal Brinkman, 0031/174/446100), Reduclean (glass cleaner based on NaOH from Mardenkro, www.mardenkro.com).					

Risk of crop residues from various insecticides and fungicides

Per product, 2 code numbers for the probability of VISIBLE residue = score from 0 to 3 = no, little, moderate and much residue, g = no data, oil = glossy residue (Source: 1st number = theoretical estimate based on formulation, 2nd number = residue observations in PCS trials).

Per product shade colour for estimation of PERSISTENCE = theoretical estimation of persistence from white to green, yellow, orange, red = none, short, moderately short, moderately long, long residue (Source: DT50 values of active substances at PPDB University Hertfordshire (+ extra information such as duration of safety periods from Phytoweb and duration of side effects from Koppert and Biobest websites)

E.g: Decis no visible residue (scores 0), but act. substance remains on the crop for a long time (red shading)

Insecticide / acaricide	Residue
VERTIMEC	0 - 0
KANEMITE	1 - 1
GAZELLE SG	2 - 0
NEEMAZAL-T/S	0 - oil
XENTARI WG	2 - 3
DIPEL DF	2 - 3
NATURALIS-L	0 - oil
BOTANIGARD 22 WP	2 - 2
FLORAMITE 240 SC	1 - 0
APOLLO	1 - 1
SCELTA	1 - 2
CYTOX	0 - 0
DECIS EC 2.5	0 - 0
DIMILIN SC-48	1 - 1
BORNEO	1 - 0
TEPPEKI	2 - 1
NISSORUN SC	1 - g
CONFIDOR 200 SL	0 - 0
STEWARD	2 - 2
RAPTOL	0 - oil
KARATE ZEON	0 - 1
ERADICOAT	0 - 0
MET 52 OD	0 - 1
MESUROL SC 500	1 - 1
MILBEKNOCK	0 - 0
PREFERAL WG	2 - 2
SUN SPRAY 7 E	0 - oil
BIO-PYRETREX	0 - oil
PIRIMOR	2 - 2
PLENUM	2 - 3
CAREX 100 SC	1 - ?
ADMIRAL	0 - 0
TRACER	1 - 0
ENVIDOR	1 - 1
MOVENTO 100 SC	1 - 0
MIMIC	1 - g
MASAI 20 WP	2 - 2
CALYPSO	1 - 1
ACTARA	2 - 1

Fungicide	Residue
AMISTAR	1 - 1
ORTIVA TOP	1 - 0
VALBON	2 - 3
SIGNUM	2 - 2
CAPTAN 80 WG	2 - 3
BRAVO	1 - 1
PANAX	1 - g
RANMAN TOP	1 - 0
TANOS	2 - 0
SWITCH	2 - 3
FRUGICO	1 - 1
GEYSER	0 - 0
PARAAT	2 - 0
ACROBAT EXTRA WG	2 - 3
FENOMENAL	2 - 2
TELDOR	2 - 1
SHIRLAN	1 - 0
LUNA PRIVILEGE	1 - 1
FUNGAFLOR	0 - 0
ROVRAL SC	1 - 3
CANDIT	2 - 1
DITHANE WG	2 - 3
UNIKAT PRO	2 - 2
REVUS	1 - 0
TRIMANGOL WG	2 - 3
FRUPICA	2 - 2
FUBOL GOLD	2 - 3
POLYRAM WG	2 - 3
SYSTHANE 20 EW	0 - 0
SPORGON	2 - 3
PROPLANT	0 - 0
PREVICUR ENERGY	0 - 0
BUMPER 25 EC	0 - 0
SCALA	1 - 2
TOPSIN M 500 SC	1 - 2
POMARSOL WG	2 - 2
RIZOLEX 500 SC	1 - 0
FLINT 50 WG	2 - 2
MICROSULFO	2 - 3

This sheet contains general information. We recommend doing a small trial beforehand. PCS is not responsible for any damage resulting from this information.



CLEANING & DISINFECTION - SHEET 6

Crop safety of cleaning products and disinfectants

Issue:

Cleaning products and disinfectants should not be sprayed on plants (except for cleaning of leaf contaminants). However, plants can come into contact with cleaning products and disinfectants in various ways:

- if plants are placed into containers (pots/packs/trays) that have been previously treated in which there is still product residue.
- by placing plants on capillary matting that have been previously treated.
- via the irrigation system, if product residues have ended up in the recirculation water.
- if plants are accidentally treated during spraying with cleaning products or disinfectants.

RESULTS OF VARIOUS TRIAL SIMULATIONS			
Treatment of:	10 g/L Exp. disinf.	40 ml/L Menno Florades	5 ml/L Virocid
a. Empty polystyrene trays - plants transplanted in after 3 days (Spray, fill up with seedling mix and after 3 days, sow tuberous begonia)	No damage, strong smell	No damage, slight smell	No damage, moderate smell
a. Empty polystyrene trays - plants transplanted in after 22 days (Same, but sowing after 22 days with tuberous begonia)	No damage, no smell	No damage, no smell	No damage, no smell
b. Capillary matting - plants placed on after 4 hours (Pour into black tray (6.4 L/m ²) > after 4 hours Spathiphyllum , Cordyline , Buxus with good rooting placed on it)	Damage Spathiphyllum	No damage	No damage
b. Capillary matting - plants placed on after 1 day (Pour on table (3.5 L/m ²) > after 1 day 40 pot and bedding plants placed on top (= various pot sizes, with or without rooting))	At 32.4% damage	At 29.3% damage	At 28.8% damage
b. Capillary matting - plants placed on after 8 days (Watered (1.75 L/m ²) > rinsed well next day > after 8 days just potted (P9) Begonia (tuberous, semperfl.) , Tagetes , Petunia placed on top) = without rooting	No damage	Slight damage to Tagetes	No damage
c. Plants stood in recirculation water with biocide residues (40-pot and bedding plant species placed in 1/5 concentration solution for 28h)	At 13.6% damage	At 27.3% damage	At 28.8% damage
d. Solution sprayed onto plants and rinsed off quickly (Spray 40 pot and bedding plants and rinse them directly)	At 28.6% damage	At 27.1% damage	At 22.9% damage
d. Solution sprayed onto plants (but not rinsed off) (Spraying 40 pot and bedding plant species)	At 73.0% damage	At 45.9% damage	At 47.3% damage

Green shading = safe, yellow shading = maybe slight damage, orange shading = damage, red shading = severe damage, no shading = untested

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RESULTS OF VARIOUS TRIAL SIMULATIONS	50% Biomix ATM	10% Greeneater Concentrate	100 ml/L Javel 13%
Treatment of:			
a. Empty polystyrene trays - plants transplanted in after 3 days (Spray, fill up with seedling mix and after 3 days, sow tuberous begonia)	Part failure, inhibition, no smell	No damage, strong smell	Germination, and then total cessation of growth, - moderate smell
a. Empty polystyrene trays - plants transplanted in after 22 days (Same, but sowing after 22 days with tuberous begonia)	Total loss, no smell	No damage, no smell	Not tested again
b. Capillary matting - plants placed on after 4 hours (Pour into black tray (6.4 L/m ²) > after 4 hours Spathiphyllum, Cordyline, Buxus with good rooting placed on it)	Severe damage Spathiphyllum, Cordyline	Probable damage Spathiphyllum	Severe damage Spathiphyllum, Buxus
b. Capillary matting - plants placed on after 8 days (Watered (1.75 L/m ²) > rinsed well next day > after 8 days just potted (P9) Begonia (tuberous, semperfl.), Tagetes, Petunia on top) = without rooting	No damage	No damage	Severe damage on all species
d. Solution sprayed onto plants (but not rinsed off) (Sprayed onto Azalea, Cyclamen plants)	Severe damage on Azalea, Cyclamen	Very severe damage on Azalea, Cyclamen	Severe damage on Azalea, Cyclamen

Summary of trial results on crop safety with disinfectants

Spraying ON the plants often led to crop damage with all disinfectants, even with rinsing!

Treatment of capillary matting mainly caused damage to plants with good rooting that were placed back on the matting too soon (e.g. after 1 day); after 8 days, only serious damage with Javel (presumably due to absorption of excess Cl).

Residual products that end up in the recirculation water can still cause serious damage, despite being diluted; only trialled here with 1/5 concentrations with Menno Florades and Viroid (damage in almost 30% plant species) and Exp. disinf. (damage in almost 15% plant species).

Treatment of polystyrene trays can have a long-lasting damaging effect if not rinsed out (e.g. when transplanted after 3 weeks); Javel and Biomix ATM especially caused damage in this study.

In general, Javel (sodium hypochlorite) proved to be the most dangerous substance for the plants.

Plants which in trials proved to be very susceptible to the absorption of biocides: young plants of the following species: *Begonia* varieties (especially *semperflorens*), *Pelargonium* varieties, *Primula*, *Dipladenia*, *Chrysanthemum*, *Azalea*.

Plants that tolerated absorption relatively well: succulents such as *Echeveria*, *Crassula arborescens*, *Sedum rosea*, *Sempervivum* and *Kalanchoë pumila*; pot plants such as *Peperomia*, *Vriesea*, *Cordyline 'Kiwi'*, *Dieffenbachia 'Camilla'*, *Spathiphyllum 'Alfa'* and the bedding plant *Petunia*.

A - Trials with tuberous *Begonia* seedlings in treated polystyrene trays (batches with differences in germination or growth)

B, D, E - Trials with 40 plant species, simulating various situations: spraying the plant with/without post-rinsing (B), the recirculation water (with product) being taken up (D), treated capillary matting on which plants are placed after 1 day (E)

C - after 8 days potted bedding plant on treated capillary matting



Crop safety of cleaning products



Cleaning contaminants on plant leaves:

Hortirein safest remedy. Recommend 20 ml/L and rinse off after 5 minutes.

Recommend Hachem: 1.5 ml/L and rinse off after 5 minutes

Recommend citric acid: 5 ml/L and rinse off after 5 minutes

See product information and trial results in information sheet 'Cleaning and Disinfection - Sheet 5'

Trialled in crop safety trial B:
Spraying 40 species with CLEANING PRODUCTS and rinsing off after 15 minutes (= part of the trial on photo B)

Product	Active substance	% of plant species damaged
20 ml/L Hortirein	1-5% NaOH, 1-5% glucopyranose	9.7%
15 ml/L Hachem	50% Hachem (citric acid, etc)	19.4
25 g/L citric acid	> 99.8% citric acid monohydrate	29.2
10 ml/L Reduclean	2% NaOH	15.3

NEVER SPRAY DIRECTLY ONTO PLANTS

> Trial for risk of crop damage conducted for 3 products: application of cleaning products at very high doses and various application times.

Damage	40 ml/L Hortirein				30 ml/L Hachem				50 g/L Citric acid						
	directly off	after 5 min	after 15 min	after 60 min	left on	directly off	after 5 min	after 15 min	after 60 min	left on	directly off	after 5 min	after 15 min	after 60 min	left on
<i>Plant species with direct damage</i>															
<i>Primula</i>					X					X	?	?	X	X	X
<i>Chrysanthemum</i>					R			?	?	X	?	X	X	X	X
<i>Tagetes</i>				X	X				X	X		X	X	X	X
<i>Pot Ro</i>					?										X
<i>Cordylone kiwi</i>															
<i>Azalea</i>					X					X					X

Rinsing within 15 minutes = safe

General advice on crop safety of cleaning products/disinfectants

If possible, spray/treat in an empty glasshouse or on surfaces/materials where there are no plants nearby; if splashes do get on the plants, rinse them off immediately.

Never place plants immediately into freshly treated pots or freshly treated polystyrene trays, but wait a sufficiently long time (several weeks, depending on the product); **rinse** treated materials before use, if necessary with disinfected water or tap water.

Never place plants onto treated capillary matting immediately, allow sufficient time before doing so (several days, depending on product and situation). Young plants in trays or plants which have rooted through the bottom of pots are the most susceptible; freshly potted plants are less sensitive, but when using products with a lot of damaging substances (such as Javel with chlorine) they can still be damaged by being taken up into the growing medium; this risk is less with overhead spraying.

Measure before the 'first irrigation after a disinfectant treatment' to see if there are still active components present in the recirculation water. There are measuring strips for Menno Florades (pH > 5, then safe), for Exp. disinfection and quaternary ammoniums (Virocid, Clean Special, etc.).

PROPERTIES OF GENERAL DISINFECTANTS				
Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application according to company and (1)	Experiences with crop safety in PCS trials and other information
Menno Florades = plant protection product 10212P/B Royal Brinkman 0031/174446100 €19.79/L Packaging 10 L	Approved in BE as plant protection product for disinfection of tools used in agriculture and horticulture (empty glasshouses, concrete floors, production benches, capillary matting, plant containers, cutting trays, trays, crates, knives, footwear, carts,...) to combat fungi, viruses, bacteria	90 g/L benzoic acid	Clean well beforehand. Can be sprayed using foaming equipment. Against bacteria, fungi and viruses: 0.2 L/m ² of a 1% solution for 16 hours or 2% solution for 4 hours. Against TMV virus 0.2 L/m ² of a 4% solution for 16 hours. On glasshouse standing areas and machines 0.6- 0.8 L/m ² . Empty glasshouse: 15- 20 L/ are. On benches without capillary matting, use 0.2 L/m ² , with matting 2 L/m ²	Check with pH strips whether the prepared solution is still active (pH 3-4.5 is good); a fresh solution is automatically in this pH range. Against <i>Alternaria</i> , <i>Botrytis</i> , <i>Cercospora</i> , <i>Chalara</i> , <i>Colletotrichum</i> , <i>Cylindrocladium</i> , <i>Erysiphe</i> , <i>Fusarium</i> , <i>Peronospora</i> , <i>Pythium</i> , <i>Phytophthora</i> , <i>Ramularia</i> , <i>Rhizoctonia</i> , <i>Thielaviopsis</i> , <i>Verticillium</i> , etc.. <u>PCS trials</u> : 40 ml/L hazardous directly on plants, as well as on treated capillary matting or via recirculation water, treated polystyrene trays do not cause any damage when used afterwards
Virocid = biocide 4605B Product Type 2, 3 Company CID-lines, 057/217877 €85.75 for 10 L, €162.85 for 20 L	Approved in BE for disinfection of tools in agriculture, horticulture and animal husbandry	170.6 g/L -alkyldimethylbenzylammoniumchloride 78 g/L didecyldimethylammonium chloride 107.25 g/L glutaraldehyde	Clean the surfaces well beforehand. Decontaminate by spraying at a concentration of 0.5% Virocid with a contact time of at least 15 minutes. Boots and wheels: 0.5%, renew the solution regularly	Application in empty glasshouses. <u>PCS trials</u> : 5 ml/L hazardous directly on plants, as well as on treated capillary matting or via recirculation water, treated polystyrene trays do not cause any damage when used afterwards
Exp. disinf.	Approved in BE for disinfection of agricultural buildings and equipment. Approved in NL for horticulture: disinfection against bacteria, yeasts and viruses in rooms or on materials, surfaces (wood, plastic, concrete) and footwear in glasshouses without crops	21.25% pentapotassium bis (peroxymonosulphate) bis (sulphate)	BE approved: clean and then spray at 0.5 to 1% for normal to total disinfection. Information technical data sheet: surfaces: after cleaning, spray with 10 g/L Exp. disinfectant, 10 minutes contact time. Disinfection of footwear or wheels with 10 g/L solution; replace after 4-5 days (or sooner, use measuring strips)	Also works at low temperatures. 1% solution kills bacteria with 5 minutes contact time. Check with Virkon test strips if the concentration in e.g. disinfection containers is still sufficient. <u>PCS trials</u> : 10 ml/L very hazardous directly on plants, as well as on treated capillary matting (even after 8 days), slight chance of damage via recirculation water, treated polystyrene trays do not cause any damage when used afterwards

PROPERTIES OF BIOCIDES AGAINST ALGAE					
Product, type of product, company, purchase price	Use in horticulture for	Chemical group, active substance	General advice on application, rate according to company and (1)	Environmental conditions required	Experiences with crop safety in PCS trials and other information
Biomix ATM Plus = biocide 1615B Product Type 2 Bionova, 052/554393 €99.80/box 4 x 5 L, also drum 200 L or 1000 L	Green and black staining	Enzymatic compound, based on amines, reaction products of chloroacetic acid	Spray at 25 to 50% (25% = 1 L + 3 L water, 50% = 1 L + 1 L water) 1 L spray solution/10 m ² , no rinsing, no scrubbing	+10°C, no high temperatures No full sun No rain 24h after application	Max. effect after a few weeks. Corrosion of powder coated tubes possible. Store up to 3 years at <20°C. <u>PCS trials</u> : 50% concentration was hazardous directly on plants, but there was a long after-effect also via treated materials such as capillary matting and polystyrene trays
Greeneater Concentrate = biocide 6506B Product Type 2 Ecostyle, 011/580582 €84 for 10 L	Cleans moss, algae deposits on stone, glass, etc.	Acid Act. sub = 20% pelargonic acid or nonanoic acid	Spray at 10% or 100 ml/L from a distance of 30 cm from the surface to be treated. 1 L spray solution/10 m ² , do not rinse or scrub	+10°C = optimal operation On dry surface A few hours of dryness after application is sufficient	Long after-effects. Do not discharge into the environment. <u>PCS trials</u> : 10% concentration was hazardous directly on plants, but no subsequent damage with treated capillary matting or polystyrene trays was observed

This sheet contains general information. We recommend doing a small trial beforehand. PCS is not responsible for any damage resulting from this information. www.health.belgium.be/nl/lijst-van-toegelaten-biociden (1)