Biocides

For a sustainable future

Nouryon

Microbial control

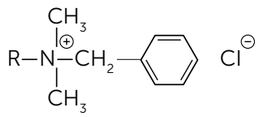
Microbes are ever present and may cause diseases or material deterioration. Control of harmful microorganisms is important in many application fields to ensure human and animal welfare and product integrity. The trend to more sustainable products/processes, like the use of natural based raw materials, the reduction of solvents, and the increased recycling of industrial water, enhances the risk of microbial deterioration. Hence biocides play an important role in safeguarding our current standard of living and realizing a more sustainable future.

We are one of the leading producers of biocides based on fatty amines and derivatives. A number of these active substances, especially quaternary ammonium compounds and dodecyldipropylene triamine, are widely used in formulations for control of bacteria, fungi, viruses and algae in disinfection or preservation applications.

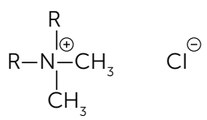
Quaternary ammonium compounds, commonly named Quats or QAC, have a permanent positive charge at the nitrogen atom and contain one or more alkyl chains. Our trade name for the QACs is Arquad.

There are 3 types of biocidal Quats:

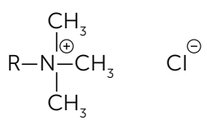
BKC = C12-16-alkyldimethylbenzylammonium chloride (CAS number 68424-85-1)



DDAC = didecyldimethylammonium chloride (CAS 7173-51-5)

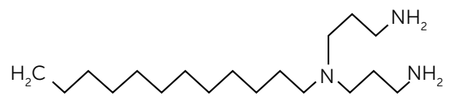


TMAC = Cocoalkyltrimethylammonium chloride (CAS number 61789-18-2)



Our active substances are:
- Highly effective biocides
- Free of halogens and aldehydes
- Free of sensitizers
- On the French Positive List
- Effective versus Coronavirus

Dodecyldipropylene triamine (CAS number 2372-82-9) does not have an ionic charge like the QACs. Depending on the pH value there can be a partial positive charge at the nitrogen atoms of the amine groups. Our trade name for the dodecyldipropylene triamine is Triameen Y12D.



Biocides regulations

In Europe the making available on the market and use of biocidal products is regulated by the European Biocidal Products Regulation (BPR, Regulation (EU) No 528/2012). It replaces the Biocidal Product Directive (BPD, Directive 98/8/EC).

The purpose of the BPR is to improve the free movement of biocidal products within the European Union while ensuring a high level of protection of both human and animal health and the environment.

It is very important for formulators of biocidal products in Europe to check if their suppliers are included in the Article 95 list for the product types of their interest. The list of approved suppliers of active substances is legally binding since 1st September 2015. Customers buying the actives from us can get on request a declaration of delivery (DoD) proving to the authorities that they are in compliance with Art. 95 of the BPR.

Product types supported according to European BPR

		Active substance			
	Product types	BKC*	DDAC	TMAC	Y12D**
Main group I: Disinfectants and general biocidal products	1. Human hygiene disinfectant	•	•		
	2. Disinfectants and algaecides not intended for direct application on humans (previously called: Private area and public health area disinfectants and other biocidal products)	•	•		•
	3. Veterinary hygiene disinfectants	•	•		•
	4. Food and feed area disinfectants	•	•		•
Main group II: Preservatives	6. Preservatives for products during storage (previously called: In can preservatives)				•
	8. Wood preservatives	•	•	•	
	10. Construction material preservative (previously called: Masonry preservatives)	•	•		
	11. Preservatives for liquid-cooling and processing systems	•	•		•
	12. Slimicides	•	•		•
	13. Working or cutting fluid preservatives (previously called: Metalworking fluid preservatives)				•

*BKC is in the review program of the BPR under the name ADBAC/BKC
**Triameen Y12D is in the review program of the BPR under the short name "Diamine"

Efficacy

All our products are highly efficacious against bacteria, fungi, algae and enveloped viruses including Coronavirus. Some examples for the antimicrobial efficacy according to European Norms (EN) are given below. More results are available on request..

Efficacy against bacteria: EN 13697 (non-porous surface test without mechanical action)

Obligatory test strains to prove bactericidal efficacy:
- Staphylococcus aureus (gram positive)
- Enterococcus hirae (gram positive)
- Escherichia coli (gram negative)
- Pseudomonas aeruginosa (gram negative)

EN 13697 (≥ log 4 reduction, 5 minutes, clean conditions) is passed for
- Arquad MCB-50 at 0.4% (2000 ppm BKC)
- Formulation based on 10% Triameen Y12D-30 + 8% Dissolvine® GL-47-S + 82% water at 1.5% (= 450 ppm Triameen Y12D)

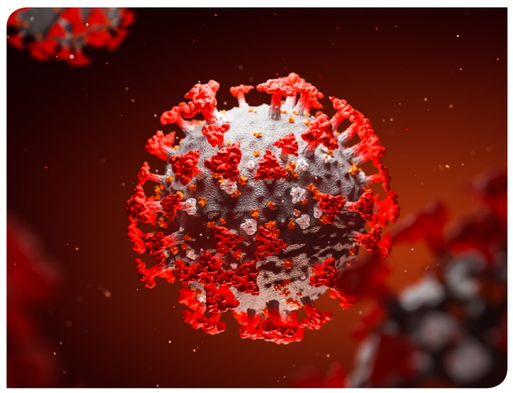
Efficacy against mycobacteria (mycobactericidal, tuberculocidal): EN 14348 (suspension test)

Mycobacteria have an extremely lipophilic cell wall which is impermeable to many biocides.

Obligatory test strain to prove efficacy against M. tuberculosis is M. terrae. Obligatory test strain to prove efficacy against all mycobacteria is M. avium.

Quats are known as being ineffective against mycobacteria. In contrast to this Triameen Y12D is effective.

EN 14348 (≥ log 4 reduction, 60 minutes, clean conditions) versus M. avium and M. terrae is passed for
- Triameen Y12D-30 at 0.2% (= 600 ppm Triameen Y12D)



Efficacy against yeasts: EN 13697 (non-porous surface test without mechanical action)

Yeasts belong to the group of fungal organisms. Obligatory test strain to prove yeasticidal efficacy is Candida albicans.

EN 13697 (≥ log 3 reduction, 5 minutes, clean conditions) is passed for
- Arquad MCB-50 at 0.4% (2000 ppm BKC)
- Formulation based on 10% Triameen Y12D-30 + 8% Dissolvine GL-47-S + 82% water at 1.5% (= 450 ppm Triameen Y12D)

Efficacy against Enveloped Viruses: EN 14476 (suspension test)

There are two main groups of viruses based on their structure: enveloped and non-enveloped viruses.

The test strain MVA (modified vaccinia virus Ankara) is the obligatory test organism to prove efficacy versus enveloped viruses like e.g.:
- Herpesviruses (e.g. Epstein-Barr virus, Herpes simplex)
- Poxviruses (e.g. smallpox, vaccinia virus)
- Hepadnaviruses (e.g. Hepatitis B virus)
- Asfarviridae (e.g. African Swine fewer)
- Flavivirus (e.g. Hepatitis C, Zika virus, dengue virus)
- Coronavirus (e.g. MERS-CoV, SARS-CoV-1, SARS-CoV-2)
- Hepatitis D virus
- Orthomyxovirus (e.g. Influenza virus A, B, C, D)
- Paramyxovirus (e.g. mumps virus, measles virus, rinderpest virus)
- Rhabdovirus (e.g. rabies virus)
- Rubella virus
- Filovirus (e.g. Ebola virus, Marburg virus)
- Retrovirus (e.g. Human Immunodeficiency Virus (HIV)).

EN 14476 (≥ log 4 reduction, 5 minutes, clean conditions) versus MVA is passed for
- Arquad 2.10-50 at 0.05% (= 250 ppm DDAC)
- Arquad MCB-50 at 0.2% (= 1000 ppm BKC)
- Formulation based on 10% Triameen Y12D-30 + 8% Dissolvine GL-47-S + 82% water at 2.5% (= 750 ppm Triameen Y12D)

The test strain BCoV (bovine coronavirus) is regarded as surrogate of members of coronaviridae family including MERS-CoV, SARS-CoV-1 and SARS-CoV-2.

EN 14476 (≥ log 4 reduction, 5 minutes, clean conditions) versus BCoV is passed for
- Arquad 2.10-50 at 0,05% (= 250 ppm DDAC)
- Arquad MCB-50 at 0,2% (= 1000 ppm BKC)
- Formulation based on 10% Triameen Y12D-30 + 8% Dissolvine GL-47-S + 82% water at 1.25% (= 375 ppm Triameen Y12D)

Sustainability

The alkyl chains as hydrophobic part of the quats and the Triameen Y12D are of vegetable origin (coconut- or palmkernel oil). Due to this they have high renewable carbon content.

Please find below for some of our products the calculated renewable carbon index.

Product name	Active content %[1]	RCI (% renewable carbon)[2]
Arquad 2.10-50	70	68
Arquad 2.10-80	97	77
Arquad MCB-50	50	59
Triameen Y12D	100	67
Triameen Y12D-30	30	67

1) Organic solvents are taken into consideration in the calculations
2) RCI% (renewable carbon index) looks at the total carbons in the raw material and counts what % of that carbon is of natural origin

The Roundtable on Sustainable Palm Oil (RSPO) is a global, multi-stakeholder initiative on sustainable palm oil, where we are a member. It is a raw material supply chain and audit system that allows end customers to certify their formulations as containing only palm oil derived ingredients from a sustainable source.

We currently offer RSPO-compliant versions of two of our products, certified according to the Mass Balance (MB) model:
- Arquad MCB-50 PO
- Triameen Y12D PO

Our products

Product	Description	Appearance 20°C	Active content %	Solvent	Colour Gardner	pH 10% in water	Flash point °C	Application	Disinfectants	Preservatives		Global avaliability	EMEA	Asia / Pacific	North America	South America
Arquad® 2.10-50	Didecyldimethyl ammonium chloride	Liquid	49-51	Water / 2-propanol	max 2	6-9	28 (d)		•	•			•	•		
Arquad® 2.10-70 HFP	Didecyldimethyl ammonium chloride	Liquid	69-71	Water / ethylene glycol	max 3	6-9	>100		•	•			•	•		
Arquad® 2.10-80	Didecyldimethyl ammonium chloride	Liquid	79-81	Water / 2-propanol	max 3	6-9 (a)	28 (d)		•	•			•	•		•
Arquad® C-35	Cocotrimethyl ammonium chloride	Liquid	33-37	Water	max 2	6-9	>100		•	•			•	•		
Arquad® MCB-50	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	49-52	Water	max 1	6-9	>100		•	•			•	•		•
Arquad® MCB-50 PO (c)	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	49-52	Water	max 1	6-9	>100		•	•			•			
Arquad® MCB-80	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	80-81	Water / ethylene glycol	max 4	6-9	>100		•	•			•	•		
Arquad® MCB-80 E	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	80-81	Water / ethanol	max 1	6-9	35 (d)		•	•						•
Arquad® MC 210	C12-C16 alkylbenzyl dimethyl ammonium chloride Didecyldimethyl ammonium chloride	Liquid	79-81	Water / diethylene glycol	max 1	6-9	>100		•	•						•
Triameen® Y12D	Dodecyl dipropylene triamine	Liquid	98-100	(b)	max 2	11.6	>100		•	•			•	•		•
Triameen® Y12D PO (c)	Dodecyl dipropylene triamine	Liquid	98-100	(b)	max 2	11.6	>100		•	•			•	•		
Triameen® Y12D-30	Dodecyl dipropylene triamine	Liquid	29-31	Water	max 1	11.5	>100		•	•			•	•		

Key

(a) 5% in 50/50 2-propanol/water
(b) Residual water max 1.5%
(c) Certified RSPO MB source
(d) Low flash point due to solvent system

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About Nouryon

We are a global specialty chemicals leader. Markets worldwide rely on our essential chemistry in the manufacture of everyday products such as paper, plastics, building materials, food, pharmaceuticals, and personal care items. Building on our nearly 400-year history, the dedication of our 10,000 employees, and our shared commitment to business growth, strong financial performance, safety, sustainability, and innovation, we have established a world-class business and built strong partnerships with our customers. We operate in over 80 countries around the world and our portfolio of industry-leading brands includes Eka, Dissolvine, Trigonox, and Berol.

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