Biocides

For a sustainable future
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 dodecylidipropylene 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 7173-51-3)
- **TMAC** = Cocoalkyltrimethylammonium chloride (CAS number 61789-18-2)

Dodecylidipropylene 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 dodecylidipropylene triamine is Triameen Y12D.

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

Biocides regulations


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

<table>
<thead>
<tr>
<th>Main group I: Disinfectants and general biocidal products</th>
<th>Active substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Human hygiene disinfectant</td>
<td>BKC* DDAC TMAC Y12D**</td>
</tr>
<tr>
<td>2. Disinfectants and algicides not intended for direct application on humans (previously called: Private area and public health area disinfectants and other biocidal products)</td>
<td></td>
</tr>
<tr>
<td>3. Veterinary hygiene disinfectants</td>
<td></td>
</tr>
<tr>
<td>4. Food and feed area disinfectants</td>
<td></td>
</tr>
<tr>
<td>6. Preservatives for products during storage (previously called: In can preservatives)</td>
<td></td>
</tr>
<tr>
<td>8. Wood preservatives</td>
<td></td>
</tr>
<tr>
<td>10. Construction material preservatives (previously called: Masonry preservatives)</td>
<td></td>
</tr>
<tr>
<td>11. Preservatives for liquid-cooling and processing systems</td>
<td></td>
</tr>
<tr>
<td>12. Simicides</td>
<td></td>
</tr>
<tr>
<td>13. Working or cutting fluid preservatives (previously called: Metalworking fluid preservatives)</td>
<td></td>
</tr>
</tbody>
</table>

* 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 bacterial 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% Disolvin® GL-47-S + 82% water at 1.5% (= 450 ppm Triameen Y12D)

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

Triameen Y12D-30 at 0.2% (= 600 ppm Triameen Y12D)

Arquad MCB-50 at 0.4% (2000 ppm BKC)

EN 14348 (≥ 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% Disolvin® GL-47-S + 82% water at 1.5% (= 450 ppm Triameen Y12D)

Efficacy against mycobacteria (mycobactericidal, tuberculocidal) versus M. avium and M. terrae is passed for
- EN 14348 (≥ log 4 reduction, 60 minutes, clean effective.

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

In contrast to this Triameen Y12D is effective against all mycobacteria. Obligatory test strain to prove efficacy against M. avium. The test strain MVA (modified vaccinia virus Ankara) is the obligatory test organism to prove efficacy against M. avium.

EN 13697 (≥ log 4 reduction, 5 minutes, clean conditions) versus MVA 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% Disolvin® 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 BCoV (bovine coronavirus) is regarded as 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 fever)
- Filoviruses (e.g. Marburg virus, Ebola virus)
- 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)).

The test strain MVA (modified vaccinia virus Ankara) is the obligatory test organism to prove efficacy versus BCoV.

EN 14476 (≥ log 4 reduction, 5 minutes, clean conditions) versus MVA is passed for
- Triameen Y12D-30 at 0.2% (= 600 ppm Triameen Y12D)

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.

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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Active content %</th>
<th>RCI renewable carbon %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arquad 2.10-50</td>
<td>70</td>
<td>68</td>
</tr>
<tr>
<td>Arquad 2.10-80</td>
<td>97</td>
<td>77</td>
</tr>
<tr>
<td>Arquad MCB-50</td>
<td>50</td>
<td>59</td>
</tr>
<tr>
<td>Triameen Y12D</td>
<td>100</td>
<td>67</td>
</tr>
<tr>
<td>Triameen Y12D-30</td>
<td>30</td>
<td>67</td>
</tr>
</tbody>
</table>

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.
## Our products

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

### 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
Contact us directly for detailed product information and sample request at cleaning@nouryon.com

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.

For more information visit surfacechemistry.nouryon.com