

Liquid Suspensions

Agrochemical Formulation Guide for SC, SE and OD



Finding ways to enhance your crop protection formulations is what we do. Every day. AkzoNobel is a global company with a broad range of environmentally safe, biodegradable and cost effective solutions. This guide shows how AkzoNobel products can be used to explore the full potential of your liquid suspension.



Key products for successful Liquid Suspensions

Morwet D-400, Morwet D-425

Anionic naphthalene sulphonate condensate used as primary dispersant. Benchmark to achieve short milling time and low viscosity premix. Brings electrostatic stabilization and makes the formulation stable towards temperature changes.

Morwet EFW

An anionic blend for excellent wetting of most powders. The best choice for actives with crystallization problems.

Ethylan NS 500 LQ

Block copolymer that provides steric stabilisation. Combine with Morwet D-425 for best performance. A liquid polymer that is easy to handle.

Agrilan 755

High performance hydrophobically modified polyacrylate polymer when extra stabilization is needed. Adsorbs irreversibly to solid surfaces and oil droplets. Full potential is reached when combined with Morwet D-425. Soluble in both water and oil based systems. In addition, this polymer inhibits crystal growth.

Agrilan 700, Agrilan 789

White polyacrylate copolymers. Can be used as primary dispersants or in combination with Morwet D-400/D-425. Agrilan 789 is the premium product for high loadings or extreme water hardness conditions.

Suspension Concentrate (SC)

SC formulations are water based dispersions of fine particle active ingredients. The typical particle size is $<5 \mu\text{m}$. Due to their liquid nature SC formulations are easy and safe to handle.

Suspension Concentrates require efficient formulation additives to ensure long term stability. Due to their inherent stability issues their compositions are more complex compared to standard EC or WP formulations.

Preparation

1. Prepare a base mill by adding active ingredient, dispersing agent (Morwet D-425/Morwet D-400, Agrilan 789, Agrilan 700), wetter if necessary (Morwet EFW) and defoamer in water
2. Homogenize the premix with high shear mixer or homogenizer (Ultra Turrax) for few minutes.
3. Mill the slurry until desired particle size is achieved.
4. Formulate by adding stabilizer (Agrilan 755, Ethylan NS-500LQ) and mix properly with mill base.
5. Add other ingredients such as in-can adjuvant (Adsee AB600, Adsee 611, Adsee 900), anti-freeze (propylene glycol, 5-8%), thickener (xanthan gum 0,1-0,3%) and biocide as necessary.



Active Ingredients	Conc	Base mill - Step 1 (w/w)	Formulation - Step 2	Additional additives
Aclonifen	250 g/l	2.5% Morwet D-425	1.0% Ethylan NS-500LQ	3.0% MEG + 0.2% Biocide + 0.1% Defoamer + 0.2% Xanthan gum + water to 100%
Metobromuron	250 g/l			
Buprofezin	250 g/l	2.5% Morwet D-400		8.0% PG + 1% Biocide + 0.1% Defoamer + 0.25% Xanthan gum + water to 100%
Epoxiconazole	125 g/l	2.5% Morwet D-425	1.0% Ethylan NS-500LQ	0.15% Xanthan gum + 5.0% PG + 0.2% Antifoam + water to 100%
Ethofumesate	200 g/l	2.5% Morwet D-425	1.0% Ethylan NS-500LQ	0.15% Xanthan gum + 5.0% PG + 0.2% Antifoam + water to 100%
Phenmedipham	200 g/l			
Tebuconazole	430 g/l	2.5% Morwet D-425 1.0% Morwet EFW	0.5% Agrilan 755	0.15% Xanthan gum + 5.0% PG + 0.2% Antifoam + water to 100%

White formulations

Active Ingredients	Conc	Base mill - Step 1 (w/w)	Formulation - Step 2	Additive
Cyromazine	30% w/w	2.5% Agrilan 700	2.0% Agrilan 755	3.0% Glycerin + 0.15% Biocide + 0.1% Defoamer + 0.5% Bentonite + 0.15% Xanthan gum + water to 100%
Thiophanate-Methyl	6% w/w	2.0% Agrilan 789	1.0% Ethylan NS-500LQ	3.0% Glycerin + 1.0% Citric acid + 0.1% Biocide + 0.1% Defoamer + 1.0% Bentonite + 0.2% Xanthan gum + water to 100%
Azoxystrobin	3% w/w			
Metalaxyl	3% w/w			

Formulations containing Adjuvants

Active Ingredients	Conc	Base mill - Step 1 (w/w)	Formulation - Step 2	Additive
Bispyribac-Na	10% w/w	3.0% Agrilan 700	1.0% Agrilan 755 10.0% Adsee 611	5.0% PG + 0.1% Biocide + 0.1% Defoamer + 0.25% Xanthan gum + water to 100%
Chlorfenapyr	10% w/w	4.0% Agrilan 788	1.0% Adsee AB 615	3.0% Glycerin + 0.25% Biocide + 0.1% Defoamer + 1.5% Bentonite + 0.25% Xanthan gum + water to 100%
Fipronil	5% w/w	4.0% Agrilan 788	1.0% Adsee AB 615	3.0% Glycerin + 1.5% Magnesium aluminometasilicate + 0.2% Biocide + 0.1% Defoamer + 0.25% Xanthan gum + water to 100%
Indoxacarb	15% w/w	4.0% Agrilan 700	10.0% Adsee AB 615	3.0% Glycerin + 0.1% Biocide + 0.1% Defoamer + 0.5% Bentonite + 0.2% Xanthan gum + water to 100%

Suspo-Emulsion (SE)

SE formulations are water based dispersions of fine particles and oil droplets and can be used to combine water insoluble actives with oily/oil soluble actives as well as adjuvants. The development of suspo-emulsions needs careful consideration at the formulation stage as the dispersing and emulsifying agents can migrate between particles/oil droplets and create instability such as flocculation. SE offers the benefit of a broad spectrum of pest control due to mixed actives and in-can adjuvants.

Preparation

1. Prepare SC part: Make a premix slurry by adding active ingredient, dispersing agent (Morwet D-425) and defoamer in water. Homogenize and wet mill until particle size is below 5 µm (D50).
2. Prepare the oilphase by adding emulsifiers into the mineral oil.
3. Mix both part under high shear to form a suspo-emulsion. Add the EC under low shear to the SC. High shear mix to form a small droplet emulsion.

Active Ingredients	Conc	Dispersant	Emulsifier	Additive	Solvent
Iprodione	250 g/l	25 g/l Morwet D-425	25 g/l Witconate P-1460EH 25 g/l Berol 266 10 g/l Lankropol KPH70	0.2% Thickener, defoamer	200 g/l Mineral oil, Balance water

Oil Dispersion (OD)

An OD is a non-aqueous suspension concentrate. It can be used as replacement for EC, SC and WDG as it combines good biological efficacy with cost-effective and environmental friendly properties. A key benefit is that high amounts of adjuvants can be built into the formulation. OD formulation presents several challenges in production. To obtain a good and stable formulation over the time, optimal formulation additives are required in addition to optimum process.

Preparation

1. Make a base mill by adding the actives, the Emulsifier/Dispersant and the Bentone* to the solvent.
2. Mill the content until the desired particle size is achieved.
3. Add the stabilizer (Agrilan 755) and stir gently.

Active Ingredients	Conc	Solvent	Emulsifier / Dispersant	Stabilizer	Additive
Imidacloprid	20% w/w	Rape seed methyl ester, up to 100%	5.0% Witconate P-1460EH 5.0% Berol 266		2.0% Bentone SD-3
Pyridate	40% w/w	Rape seed methyl ester, up to 100%	2.0% Witconate P-1460EH 6.0% Berol 266		2.0% Bentone SD-3
Sulcotrione	22.5% w/w				
Terbutylazine	30% w/w	Coco methyl ester, up to 100%	10.0% Witconate P-1460EH 10.0% Berol 266		2.0-4.0% Bentone SD-3
Nicosulfuron	4% w/w	Soybean oil, up to 100%	5.0% Ethylan NS-500LQ 2.0% Ethomeen T/12 8.0% Berol 192	2.0% Agrilan 755	1.0-2.0% Bentone SD-1
Azoxystrobin	12% w/w	Soybean oil, up to 100%	5.0% Adsee 615 1.0% Ethomeen SV/12 0.5% Amadol 511	2.0% Agrilan 755	0.5-1.0% Bentone SD-3

* Bentone is a trademark of Elementis Specialties

Formulations in this guide complies with the following CIPAC methods;

- Appearance: (CIPAC MT 148,1)
- Stability (CIPAC MT 39.3, 46.3)
- Particle size (CIPAC MT 187)
- Suspensibility (CIPAC MT 160, 184)



Planet Possible: Our commitment to doing more with less

Our success as a company depends on sustainability. At AkzoNobel we have sharpened our focus on sustainability by reviewing our sustainability risks and opportunities against global trends and evaluating how they will impact our customers by 2020. We express the outcome as our Planet Possible approach to sustainability. It's our commitment to creating more value from fewer resources.



We know only too well that our future hinges on our ability to radically do more while using less.

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Employing our new strategy of radical efficiency, we work with customers and suppliers to open infinite possibilities to a finite world. Learn more at www.akzonobel.com/planetpossible

Number 1

was our position in the Materials industry group on the 2015 Dow Jones Sustainability Index.

At least 20%

is the share of revenue we aim to achieve by 2020 from products with a sustainability advantage for customers.

More than 25%

is the reduction we aim to achieve in our cradle-to-grave carbon foot print per ton of product by 2020.

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