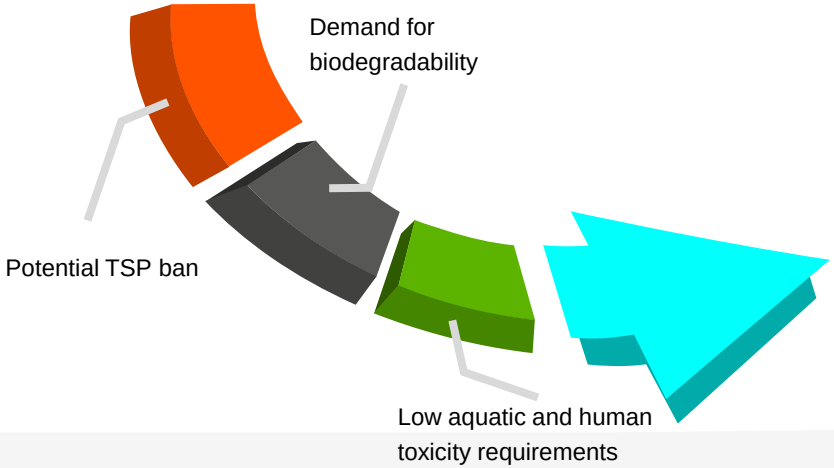
Agrilan® 1015

A biodegradable polymeric dispersant

Why another dispersant?

Currently, one of the workhouse of liquid dispersants based on Tristyrenated phenols (TSP) are under regulatory scrutiny due to environmental concerns and suspected to be endocrine disruptor by European Chemical Agency (ECHA); most likely outcome is to limit the use or total ban.

ECHA has also submitted a restriction proposal for microplastic particles that are intentionally added to mixtures used by consumers or professionals. Derogations are proposed for polymers that occur in nature, polymers that meet criteria for minimum (bio)degradability which makes (bio)degradability an important property in selecting formulation aids in crop protection formulations.



Agrilan® 1015

Procedure and methods

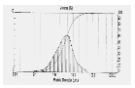
Recipe

Ingredient	g/L
Active	200-300
Morwet EFW	20
Agrilan 1015 or benchmark*	25
Ethylene Glycol	50
Defoamer	2
Xanthan Gum	1
Water	up to 1L

*TSP derivative

Premix
- Active ingredient(s)
- Dispersing and wetting agent
- Antifoam
- Water

Milling
- Adsorption
- Desired particle size



Final adjustment
- Adjuvants
- Antifreeze
- Stabilizers

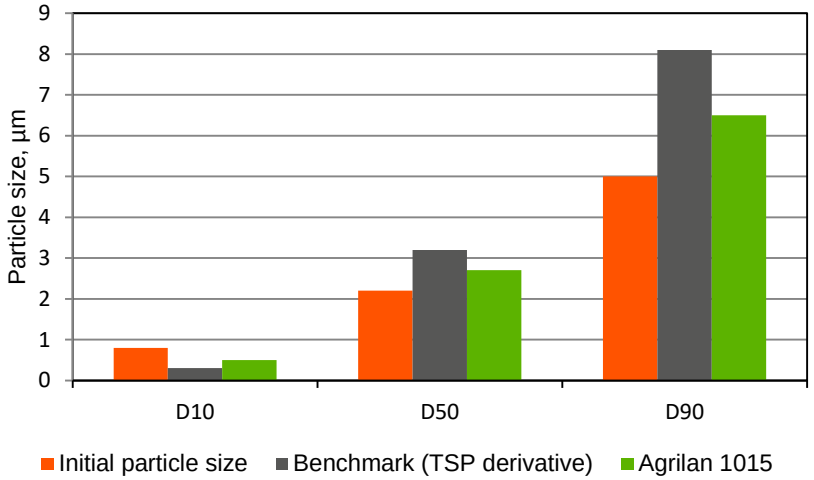
Adjust Viscosity
- Viscosity modifiers

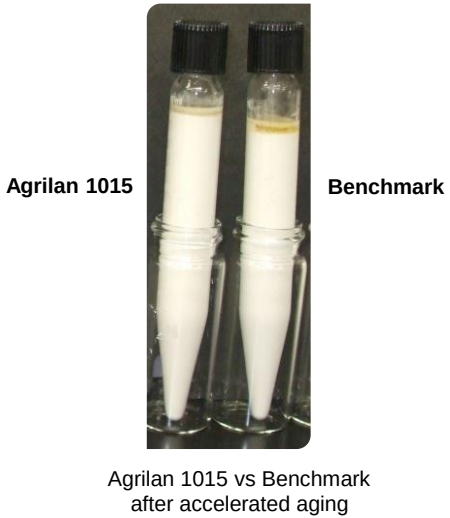
Mix until homogen
- Fine tuning

Properties evaluated

- Viscosity
- Particle size distribution
- Storage stability CIPAC 46.3 (2 weeks at 54°C)
- Suspensibility of diluted solution using modified CIPAC MT184 method in 1000ppm water

Diuron 300 g/L SC



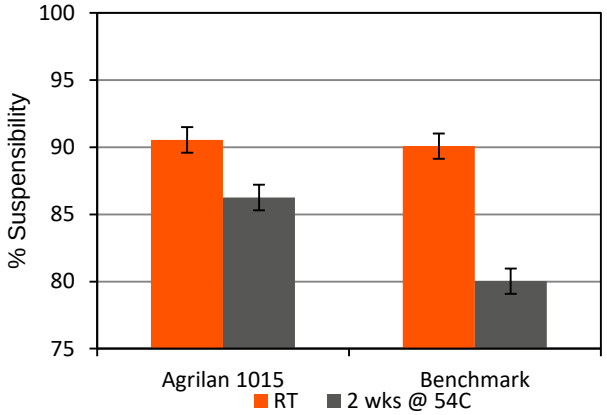


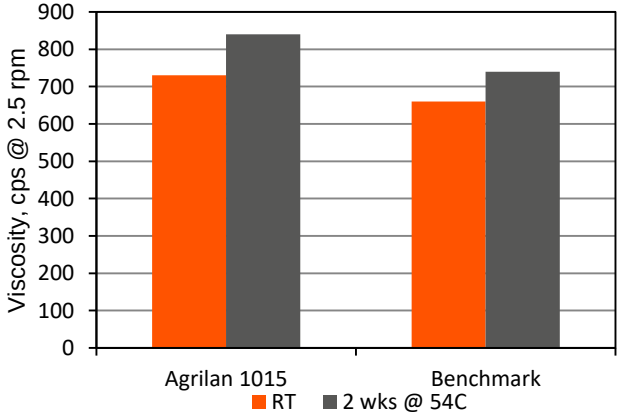
Agrilan 1015 vs Benchmark
after accelerated aging

Some particle size growth upon storage but under better control with Agrilan 1015

Diuron 300 g/L SC

- Overall viscosity* profile for both SC's are similar (low to moderate viscosity)
- Similar suspensibility (~90%) at RT but Agrilan 1015 is more favorable upon storage





*Small sample holder - Spindle: SC4-21/13R

Biodegradable liquid dispersant Agrilan 1015 works either as well or better than benchmark

Agrilan® 1015

as pigment dispersant in seed treatments/coatings

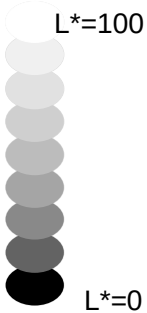
Dispersing pigments in seed coating

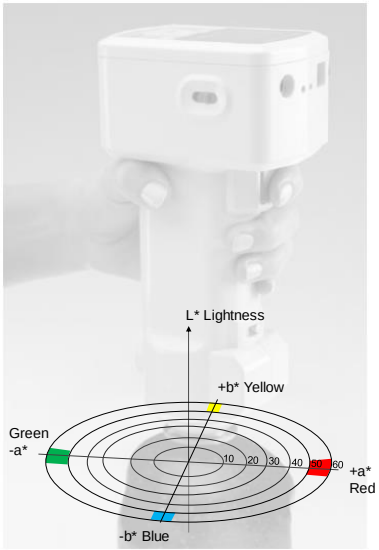
Dose effect to the Fipronil FS color

	Original (wt%)	+	++
Fipronil TC	19.3	18.8	18.3
Pigment*	1.3	1.2	1.2
D425	0.8	0.7	0.7
Agrilan 1015	0.8	4	7

*Agrocer™ Red 112

L*: 61.15 49.49 49.18





ΔL* difference in lightness/darkness values
Δa* difference on red/green axis
Δb* difference on yellow/blue axis
$\Delta E^* = (\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})^{1/2}$
ΔE∞ total acceptable color difference

Fipronil FS color strength shows that addition of Agrilan 1015 from 0.8 to 4.0% increases the color intensity by dispersing the pigment more efficiently. Further increase to 7% doesn't have any further effect.

Wetting, emulsification and surface tension

Wetting, emulsification and surface tension

Wetting Properties

- Wetting test was run using a modified version of ASTM D2281-68 (Draves Test)
- Test was run using 5 g Draves 40/2 cotton
- Time reported is an average of multiple runs
- Results indicate Agrilan 1015 has very good wetting properties compared to benchmark TSP derivative

Sample 1	Concentration	Time (sec)
Morwet EFW	0.13%	14
Agrilan 1015	0.13%	17
Benchmark	0.13%	310

Wetting, emulsification and surface tension

Emulsification properties

- Agrilan 1015 shows good emulsification properties in soy methyl ester (SME) and Aromatic 200 oil (A200) formulated with Ethylan NS-500 and Witconate P-1220
- Following mixtures were prepared and tested in both hard (1000ppm) and soft (34ppm) water at 5% dilution

Oil type / %	Agrilan 1015	% Ethylan NS-500LQ	% Witconate P-1220EH	1000ppm water	34ppm water
SME / 86%	9.3%	0.4%	4.3%	stable	stable
A200 / 86%	9.3%	0.4%	4.3%	stable	stable

Surface tension

- Lower equilibrium surface tension indicating better efficiency as surfactant

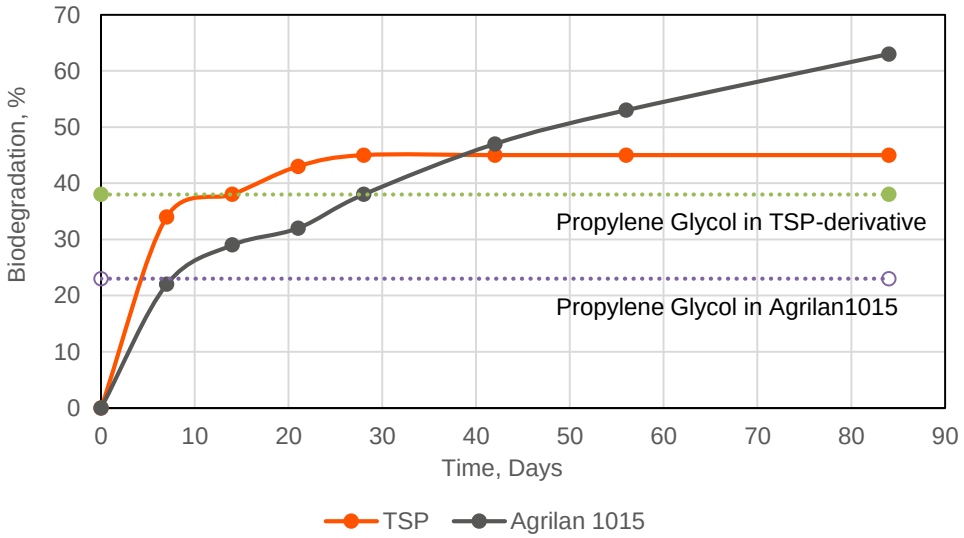
Conc, wt%	Surface tension, mN/m	
	Agrilan 1015	Benchmark
0.001	40.7	43
0.01	34.3	41.6
0.1	33.6	41.6

Toxicity profile

Biodegradability assessment

- Biodegradability of Agrilan 1015 as well as a competitor product based on TSP (Benchmark) were evaluated
- Agrilan 1015 continues to biodegrade even after 12 weeks, whereas for TSP derivative biodegradation levels out after three weeks
- Agrilan 1015 can be designated as inherently **biodegradable and not persistent**, whereas TSP derivative is non-biodegradable and persistent (conforms ECHA dossier)

Percentage of biodegradation of Agrilan 1015 and the Benchmark (TSP-derivative) by activated sludge. The horizontal line represents the percentage achieved upon complete degradation of propylene glycol.



Eye irritation

Bovine Cornea Opacity/Permeability test (BCOP) screening

- Eye irritation was screened using *InVitro* Bovine Corneal Opacity and Permeability test method (BCOP)
- Test was performed on product as is as well as at 10% dilution
- *InVitro* score of -0.1(product as is) and -0.3 (at 10% dilution) were obtained respectively
- A score of <3 can be categorized as **non-irritant**

Agrilan® 1015

Chemistry

Agrilan 1015 is a biodegradable dispersant for aqueous crop protection formulations. It offers unique technology with tapered linking between the hydrophobic and hydrophilic moiety

Regulatory Status

- TSCA and FIFRA listing is under consideration
- Meets REACH polymer exemption
- Listed in China and Japanese Chemical Inventory

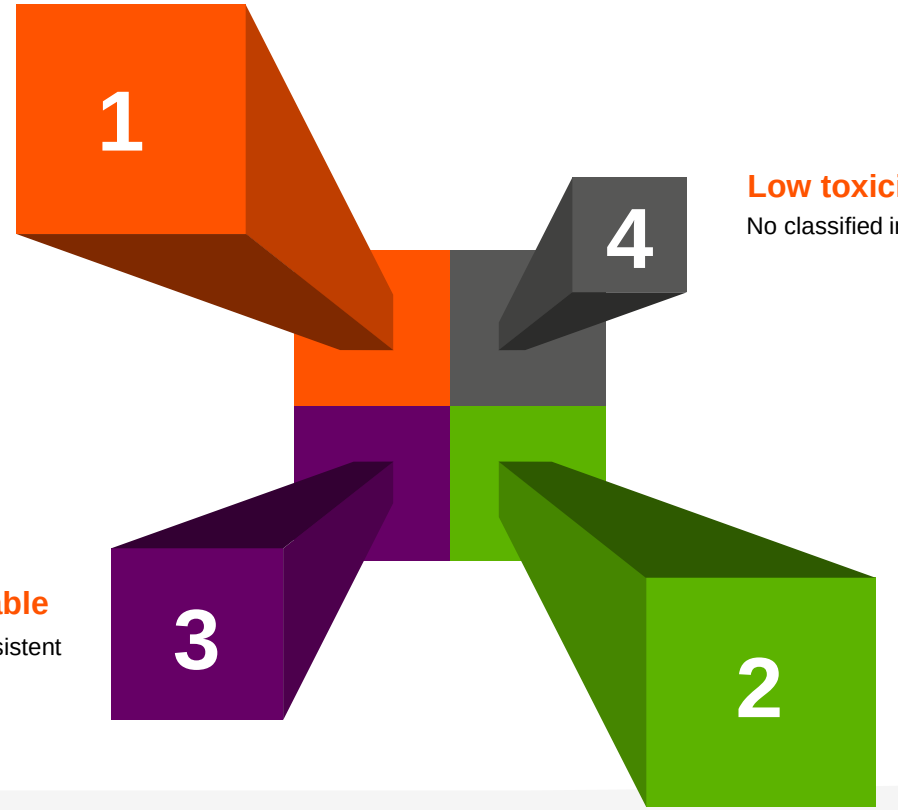
Property	Value
Appearance	clear liquid
Color	1 Gardner
Density at 20°C	1.06 g/ml
Surface tension at 0.1 w%	32 mN/m
pH 1% in water	6.0
Viscosity at 20°C (18 spindle @ 25 rpm)	700 cps
Solid content	50 %
CMC	68 mg/l

Picture of Agrilan 1015
'Clean' label
No hazardous substance or mixture

Agrilan® 1015

Liquid dispersant

For crop protection, including seed treatment formulations



Low toxicity

No classified ingredients

Biodegradable

And non-persistent

Emulsifier and wetting agent

For SEs and EWs, low foam

Back of the deck

Guideline recipes

Chlorantriniliprole 500 g/L SC

Ingredient	g/L
Chlorantriniliprole	500
Agrilan 1015	25
Adsee 900	10
Propylene glycol	40
Biocide	2
Defoamer	2
Xanthan Gum	1.4
Water	up to 1 L

Physical appearance	white liquid
pH (1% in water)	7.1
Density (25°C)	1.246
Particle size, d90, µm	4.2
Suspensibility	> 95%
Viscosity, 30 rpm, Spindle 3, 25°C	740
Stability, 54°C after 2 weeks	2% bleeding

Prochloraz 250 g/L EW

Ingredient	g/L
Prochloraz	250
Agrilan 1015	30
Berol 904	30
Solvesso 200	200
Defoamer	1
Mono ethylene glycol	50
Xanthan Gum	1.6
DI water	up to 1 L

Physical appearance	white liquid
pH (5% in water)	7.7
Density (25°C)	1.086
Emulsion stability (342 ppm)	stable (2 hrs)
Viscosity, 30 rpm, S62, 25°C	520
Stability, 0°C after 1 week	stable
Stability, 54°C after 2 weeks	trace

Nouryon