

# A versatile surfactant for use in high electrolyte systems

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## Introduction

There is a growing demand for surfactants that are compatible with high electrolyte systems such as fertilizers for in-furrow applications, or multi-component tank mixes for spray applications. The combination of a pesticide and a starter fertilizer provides both protection and nutrition to young seedlings. The use of multi-component tank mixes allows for multiple modes of action, or multiple functions, to be applied in a single application.

## Phosphate esters

Phosphate esters are known to exhibit good stability in strong electrolytes when properly designed. The variety of raw materials available and methods of production provide ample scope for fine tuning of their structure and performance. Forms stable suspension concentrates that can be diluted in fertilizer.



### Design parameters

Alkyl chain length – shorter chains better wetting, longer chains better detergency  
 Degree of ethoxylation – improves tolerance to electrolytes  
 Process parameters – impacts monoester: diester ratio  
 Mono: Diester ratio – strongly influences surfactant application

## Phosphate ester properties

Property	Mono-ester	Di-ester
Hydrotropic	Excellent	Poor
Electrolyte tolerance	Excellent	Poor
Wetting	Good	Fair
Emulsification	Good	Good
Foaming	High	Lower
Dispersing	Poor	Excellent

In Agrilan® 1028 we have observed that its performance is strongly influenced by the structure of the hydrophobe and the degree of ethoxylation.

## Suspension concentrates

Imidacloprid SC		Bifenthrin SC	
Imidacloprid	21,4%	Bifenthrin (94.6%)	17,5%
Agrilan 1028	8 %	Agrilan 1028	8 %
Propylene Glycol	5%	Defoamer	0,3%
Kaolin Clay	5%	Xanthan gum	0,05%
Defoamer	0,3%	Water	up to 100%
Xanthan gum	0,2%		
Water	up to 100%		

These SCs are stable and can be diluted in fertilizers such as 10-34-0, ammonium thiosulfate, 30% AMS

## A suspension concentrate formulated in liquid fertilizer

A high concentration bifenthrin SC was formulated using 10-34-0 as the liquid medium. This SC can be readily diluted into a spray tank containing 10-34-0 fertilizer without compatibility issues. A 5% dilution of this SC in 10-34-0 showed no phase separation after 5 hours

	Wt%
Bifenthrin (94.6%)	33
Water	9.5
Agrilan 1028	2.5
10-34-0 Liq.	55

## Objective

To develop a surfactant that is:

- Tolerant to high electrolyte systems
- Forms stable suspension concentrates that can be diluted in fertilizers
- Improves compatibility in multi-active tank mixes
- Has regulatory approvals for use with crops

## Dilution of suspension concentrates in fertilizers

### SC Formulations

Active ingredient	17,5%
Agrilan 1028	8 %
Defoamer	0,3%
Water	up to 100%

- SCs are charged to dilution tubes at 2% w/w and inverted 15 times before evaluation
- Dispersion quality evaluated after 6h



Bifenthrin dispersions after 6h

Active	10-34-0	NH3-Thiosulphate 12-0-0	K-Thiosulfate 0-0-25	28% AMS
Bifenthrin	Homogenous dispersion	Homogenous dispersion	Homogenous dispersion	Phase separation
Trifloxystrobin	Homogenous dispersion	Homogenous dispersion	Homogenous dispersion	Phase separation
Atrazine	Phase separation	Homogenous dispersion	Phase separation	Homogenous dispersion

## 3-Component tank mixes

Three component tank mixes were prepared from four commercial potassium glyphosate formulations, a commercial atrazine WDG, and a trifluralin EC. A stable formulation could not be achieved without the addition of Agrilan® 1028 added at 0.5% w/w

	No additive	WG-A1 Trifluralin EC	
		0.15% Agrilan 1028	0.5% Agrilan 1028
Gly-K1	Heavy sedimentation	No sedimentation/ minimal flocculation	No sedimentation/ minimal flocculation
Gly-K2	Heavy sedimentation	Heavy sedimentation	No sedimentation/ minimal flocculation
Gly-K3	Heavy sedimentation	Heavy sedimentation	No sedimentation/ minimal flocculation
Gly-K4	Heavy sedimentation	No sedimentation/ minimal flocculation	No sedimentation/ minimal flocculation

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