

# AGROPAGES

2017 Formulation & Adjuvant Technology



125 ml  
± 5%

100

75

50

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# Evonik: New Multifunctional Additive for Sophisticated Formulations

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Formulations are key to agrochemical applications as they ensure the bioavailability of pesticide actives in a safe, economical, and effective way. Growers seek to improve the biological efficacy and increase crop quality and yield. Formulation experts and agronomists combine their knowledge of interfacial processes and application data, respectively, to develop multifunctional additives that optimize the performance of formulations.

Dispersing agents, as multifunctional additives, are required to prevent the settling and agglomeration of insoluble solid active ingredients within liquid carriers. During milling, wherein particles are ground to much smaller sizes for effective application, the overall surface area increases exponentially. Dispersing surfactants adsorb on to these particles as fresh surfaces are being created. These additives also stabilize particles in the final formulation either by electrostatic or steric repulsion as they contain functional groups with high affinity to particles that avoid

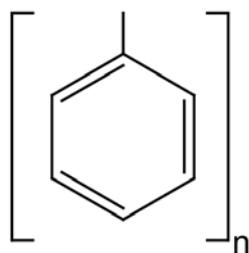


Figure 1: Innovative anchoring groups of BREAK-THRU® DA Dispersants

displacement by competing surfactants.

The typical functional groups responsible for anchoring to particle surfaces are carboxylates, phosphates, amines, and sulfonates. A new anchoring group with an outstanding physical adsorption on solids is found within the BREAK-THRU® DA dispersing agents from Evonik. The unique performance of these agents is based on delocalized  $\pi$ -electrons of styrene oxide containing dispersants.

BREAK-TRHU® DA products contain multiple occurrences of these anchoring groups which are particularly effective for adsorbing onto many organic pesticide particles. Due to their amphiphilic character, these dispersants decrease the surface tension of water and thereby provide wetting of solids into water. This enhances the milling efficiency and leads to smaller particle sizes which improves biological efficacy. In addition, overall formulation stability is increased with this type of dispersant after storage in extreme conditions (54 °C, -10 °C, etc.). Formulations with conventional dispersing agents often need additional co-wetting agents. Due to their performance, BREAK-THRU® DA products do not require additional products to effect this phenomenon.

BREAK-THRU® DA 647 is a multifunctional, non-ionic dispersant especially designed for SC and WDG formulation types. However, it also demonstrates



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emulsification properties for aromatic solvents and some oils used in EC formulations. Because of this unique attribute it is an excellent option for use in SE or FS (seed treatment) formulations. Regarding regulatory requirements, BREAK-THRU® DA 647 is exempt from a tolerance under 40 CFR 180.960 (FIFRA).

## Guideline formulations

### Suspension Concentrate (SC) Formulation

SC formulations are quite common and designed to deliver insoluble solid actives in an aqueous formulation. The challenge is in creating both a stable formulation and one which disperses readily into water for ease of application. Delivering solid

particles onto target surfaces at a constant rate is necessary to maintain proper efficacy. BREAK-THRU® DA 647 enables stable and highly effective formulations which have the potential to deliver optimal performance. Below is given one example using a common fungicide.

All ingredients except for the thickening gel were combined and poured into an appropriate vessel. Milling was performed using a Union Process® Attritor or DYNO®-MILL Research Lab. The viscosity values were measured with a Brookfield Dial Reading at 25 rpm (1/s) at 25 °C. Particle sizing data were obtained with a Beckmann Coulter Counter LS 13320. To evaluate storage stability, data were collected initially and after storage at elevated (54 °C, simulating two years storage) and environmental (RT) temperatures for two weeks. As seen in Figure 2 there was no appreciable change in particle size. Additionally, viscosity values were constant over time at 420 mPa\*s. BREAK-THRU® DA 647 enabled a homogenous and stable formulation which exhibited low foaming tendencies and good dispersion into water.

Pour-outs and visual assessments supported the stability data by having no significant separation (syneresis), agglomeration, sedimentation, or thickening. As shown in Figure 3 the SC formulation dispersed spontaneously upon dilution into water. In addition, the excellent biological efficacies in SC formulations with BREAK-THRU® have been confirmed through glasshouses and field trials. For more information, please refer to our In-Can brochure: <http://www.break-thru.com/product/break-thru/Documents/brochure-additives-for-pesticide-formulations.pdf>.

**Suspo-Emulsion (SE) Formulation:** SE formulations are relatively new among water-dispersible pesticides. The particular challenge faced is that they contain two water insoluble active ingredients dispersed in the aqueous phase: one solid and one liquid. Therefore it is possible to create a stable formulation of both types of active ingredients with different physical-chemical properties. SEs are essentially combinations of a suspension concentrate (SC) and emulsifiable concentrate (EC) or emulsion-in-water (EW). In order to generate this complex mixture two individual formulations are typically combined and optimized with additional additives. Conventional block copolymer, sulfonate, and carboxylate type dispersants are not sufficient alone for a SE formulation. The multifunctional performance of BREAK-THRU® DA 647 facilitates preparation of a stable suspo-emulsion without the need for additional surfactants. Below is provided an example using two common fungicides.

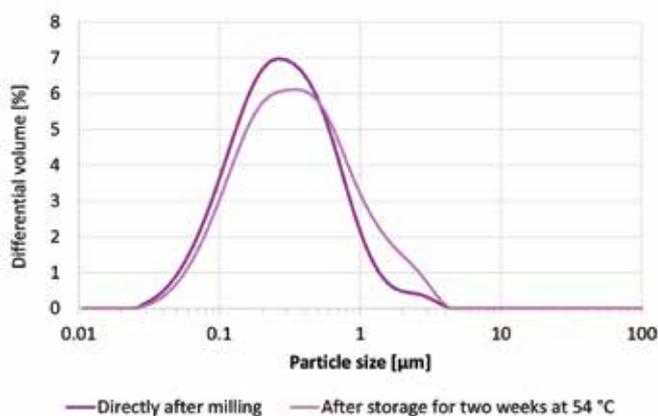
Equipment utilized for preparation and evaluations were the same as mentioned previously. The particle size data in this instance must be interpreted correctly. As shown in Figure 4

**Table 1: Azoxystrobin 250 SC**

g/L	Ingredient	Function
229.0	Azoxystrobin technical <sup>1)</sup>	Active Ingredient
22.9	BREAK-THRU® DA 647	Dispersing agent
2.7	BREAK-THRU® AF 9903	Antifoam
110.0	Thickening Gel <sup>2)</sup>	Thickener
q.s.	Water	Solvent

1) normalized for purity

2) made of 2 % Kelzan® with 2 % Proxel® GXL in 96 % water (w/w %)



**Figure 2: Particle size distribution of Azoxystrobin 250 SC formulation**



**Figure 3: Blooming effect of Azoxystrobin 250 SC upon dilution**

Table 2: Propiconazole / Azoxystrobin 195 SE Formulation

g/L	Ingredient	Function	Initial formulation
121.8	Propiconazole technical <sup>1)</sup>	Active Ingredient	EC
313.0	Aromatic 200 ND	Solvent	EC
60.9	Azoxystrobin technical <sup>1)</sup>	Active Ingredient	SC
59.4	BREAK-THRU® DA 647	Dispersing agent	SC
2.0	BREAK-THRU® AF 5503	Antifoam	SC
24.4	Thickening Gel <sup>2)</sup>	Thickener	SC
q.s	Water	Solvent	SC

1) normalized for purity

2) made of 2 % Kelzan® and 2 % Proxel® GXL in 96 % water (w/w %)

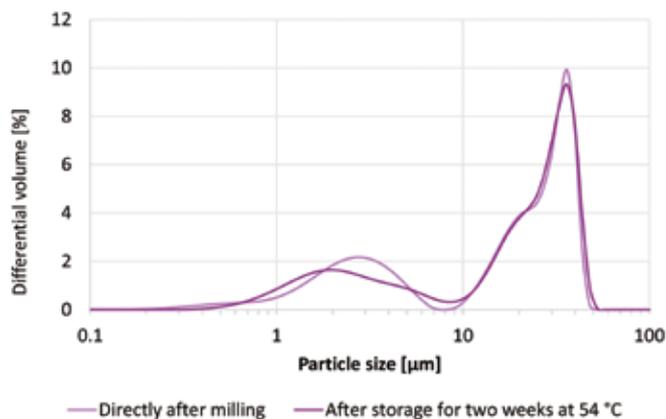


Figure 4: Particle size distribution of Propiconazole / Azoxystrobin 195 SE Formulation

there exist two distinct peaks: one for the milled particles and one for the emulsified oil droplets. Overall the formulation was stable and resulted in minor deviations between the particle size distribution of initial samples and those stored at elevated (54 °C) and environmental (RT) temperatures for two weeks. Pour-out and visual assessments supported the stability data by having no significant syneresis, agglomeration, sedimentation, or thickening. In addition the viscosity values were constant over time at 410 mPa\*s.

The improved stabilization, better biological efficacy, unique emulsifying properties, low foaming, benign toxicological profile, wetting ability, and the improvement of the milling efficiency makes BREAK-THRU® DA 647 a new multi-functional additive for innovative and effective pesticide formulations.

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## MAIN PRODUCTS:

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Diquat  
Fluroxypyr  
Haloxypop-R-Methyl  
Fluazifop  
Cyhalofop

**INSECTICIDE:**  
Chlorpyrifos  
Malathion  
Diflubenzuron  
Hexaflumuron

**PYRIDINE COMPOUND:**  
Pure Pyridine  
 $\alpha$ -Picoline  
 $\beta$ -Picoline  
3,5-Lutidine  
2,3-Lutidine

**CHLOROPYRIDINE:**  
2,3,5,6-Tetrachloropyridine  
2,3,4,5,6-Pentachloropyridine  
2-Chloro-5-Chloromethyl pyridine  
2-Chloro-5-Trichloromethyl pyridine  
2,3-Dichloro-5-Trichloromethyl pyridine

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