



# All-in-one Oil Dispersion solution for microbial formulations

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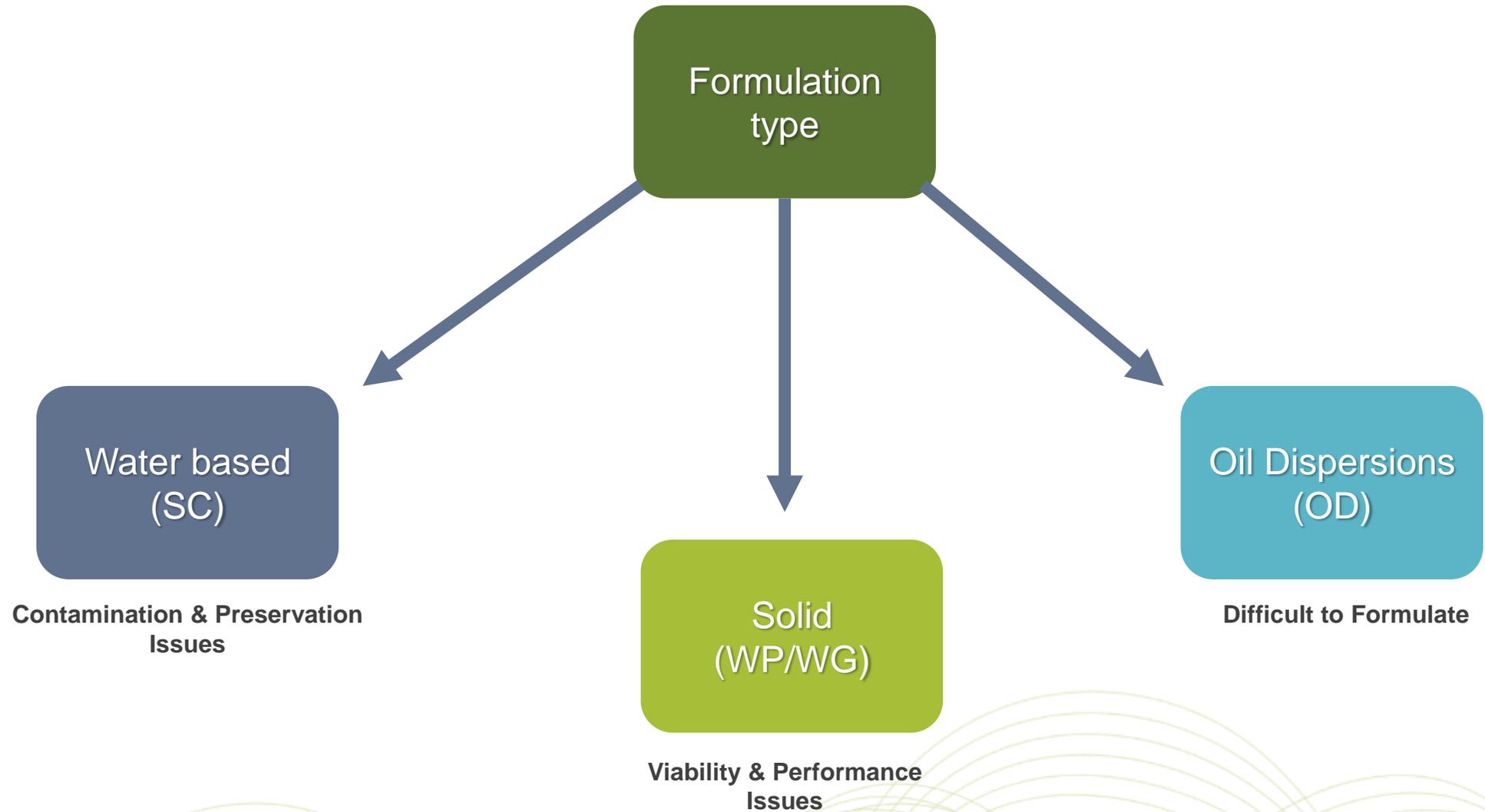
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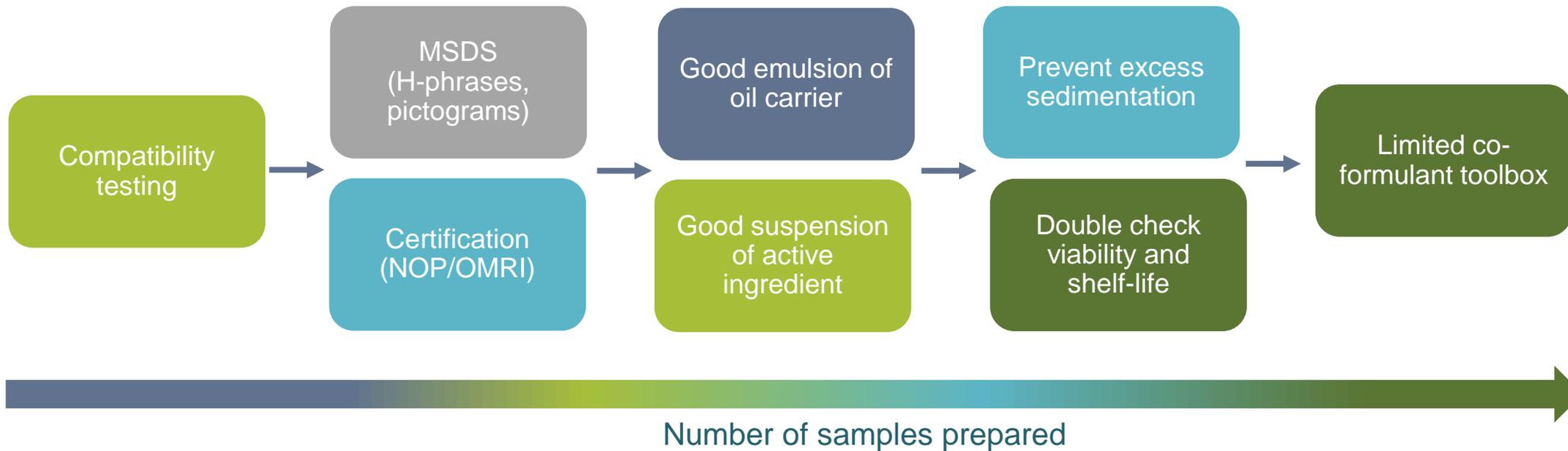
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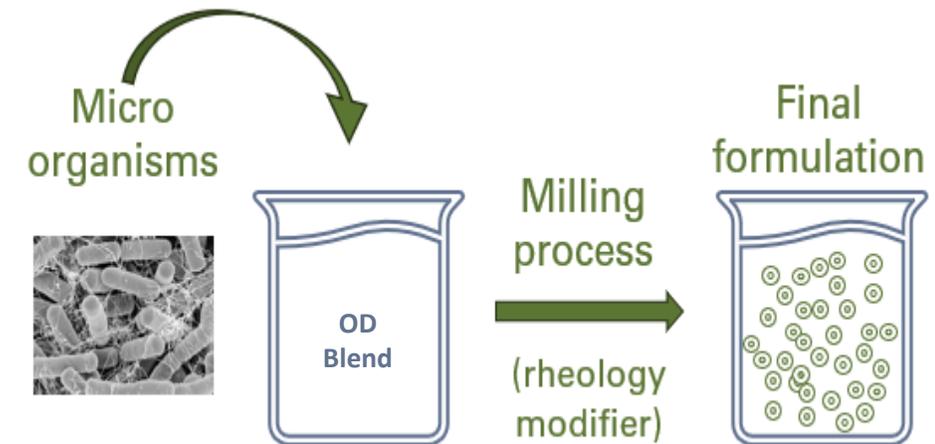
# Formulation Development with Microorganisms



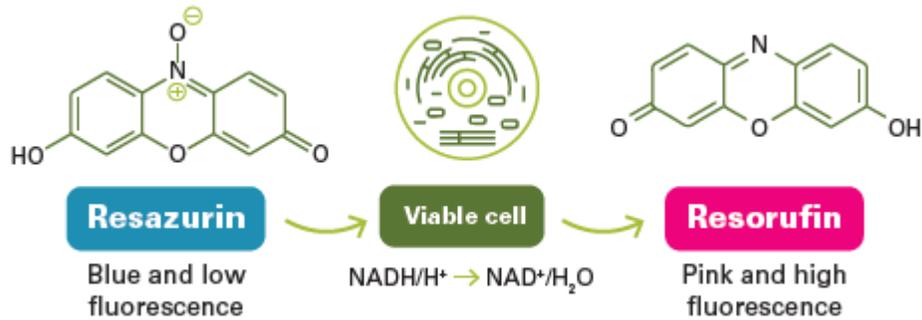
# Formulation development with Microorganisms



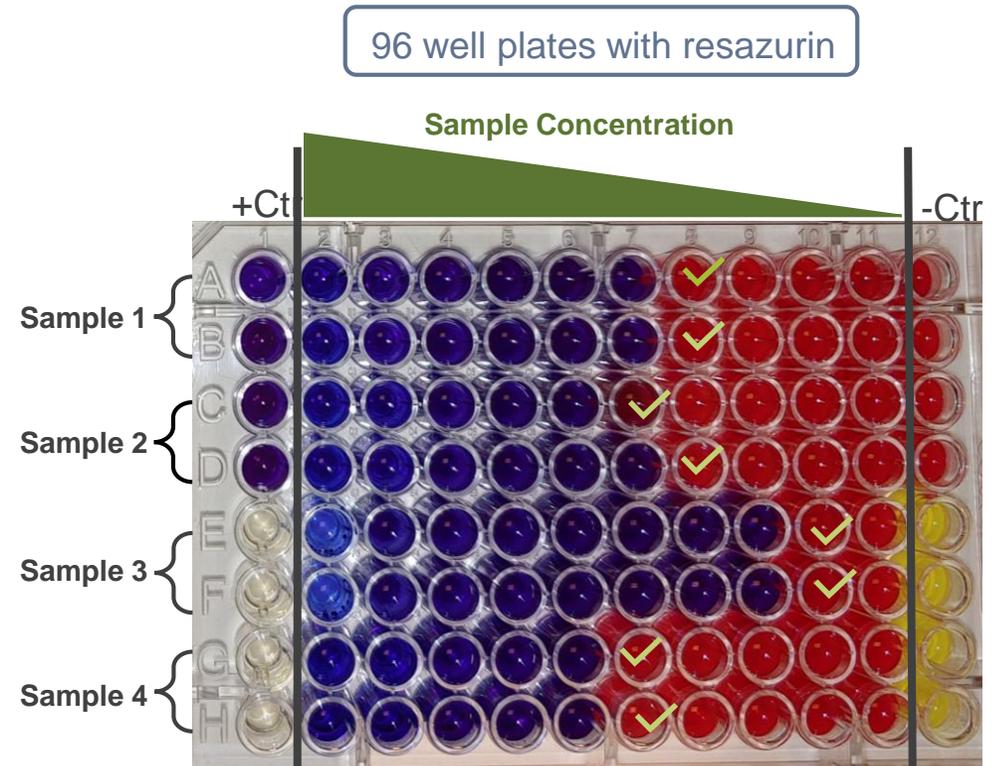
- Compatibility testing, coupled with Organic certifications/ low-hazard requirements drastically reduces choice of co-formulants!
- Making it even more challenging to optimize emulsion/suspension
- ✓ An all-in-one solution would simplify the process!



# Biological Compatibility Assay



Resazurin not reduced → Inactive cells  
 Resazurin reduced → Active cells



✓ Marks Compatible Concentrations

- Test 10 concentrations, in logarithmic scale
- Microbes and co-formulants mixed in solution, similar to real-life scenario
- 30x faster method than petri-dish assays
- Greatly reduced space use and waste

# Compatibility results : Resazurin assay

Product	Function	Max % tested	Gram+				Fungus		Gram-
			<i>Bacillus spp</i> vegetative	<i>Bacillus spp</i> spores	<i>Bacillus thuringiensis</i> vegetative	<i>Bacillus thuringiensis</i> spores	<i>Beauveria bassiana</i>	<i>Trichoderma harzanium</i>	<i>Pseudomonas fluorescens</i>
MAKON TD-50	Wetting agent	10	≥10 for all microbials						
ECOSTEP AE-13		5	≥5 for all microbials						
ECOSTEP BC-12	Emulsifier	10	≥10	5	≥10	≥10	2,5	2,5	≥5
ECOSTEP CE-13		20	≥20	≥20	≥20	≥20	≥20	10	10
ECOSTEP SE-11		20	≥20	≥20	≥20	≥20	≥20	10	10
STEP-FLOW 1500		20	≥20 for all microbials						
MAKON NF-180		20	≥20	≥20	≥20	10	5	10	10
TOXIMUL 8000		5	≥5 for all microbials						
TOXIMUL 8330		10	5 for all microbials						
ECOSTEP AES		5	0,005	0,039	0,039	0,010	≥5	0,16	
MAKON L64		10	2,5	5	5	5	≥10	≥10	≥10
NINEX MT-603		10	5	≥10	≥10	≥10	≥10	1,25	≥10
STEOL TSP 16N	Dispersant	2,5	≥2,5 for all microbials						0,16
STEPFAC TSP-PE-N		20	10 for all microbials						
STEPFAC 8181 PT3K		1,25	0,01	0,08	0,0098	≥1,25	≥1,25	0,6	2,5
STEPFAC TSP-PE-K		10	5	5	2,5	5	1,25	3,8	5
ECOSTEP PD-5		5	1,25	1,25	1,25	0,6	2,5	1,25	≥5

- ✓ Stepan has a comprehensive offering of co-formulants for biological applications
- ✓ Come to our booth for more information!

# All-in-one OD solution development

## Compatibility Data

- ZOI 370 samples, 10 strains
- BCA 130 samples, 4 strains

## Base Formulation

- >30 surfactants available
- One carrier oil

## Tests & Process

- Emulsions tests w/ CIPAC MT 36.3
- Laser granulometry later used to increase throughput
- Used Design of Experiment (DOE) approach and modelling to optimize emulsions

## Results

- >50+ combos of 3/4 surfactants tested at different ratios
- 500+ formulations prepared and tested

## Base Formulation

- Compatibility verified on 7 MO's
- Performance assessed on 5 MO's

**One final high performance formula !**

# STEPGROW® VIVO-101



Property	Result
Form at 25 °C	Liquid
Moisture content, %	< 1
pH at 5% in 1:1 IPA/H <sub>2</sub> O	6 - 7
Viscosity at 25°C, cPs	20
Pour point, °C	< -10

Regulatory and Manufacturing	
SDS classification	Non-hazardous
US EPA	40 CFR 180.920
NOP	Compliant
REACH	Compliant
Manufacturing Location	EU / Global

## Compatibility

Product	Max % tested	Gram+				Fungus		Gram-
		Bacillus spp vegetative	Bacillus spp spores	Bacillus thuringiensis vegetative	Bacillus Thuringiensis spores	Beauveria Bassiana	Trichoderma Harzanium	Pseudomonas fluorescens
<b>STEPGROW® VIVO-101</b>	<b>33</b>	<b>≥33 for all microbials</b>						

✓ No inhibition observed at any concentration

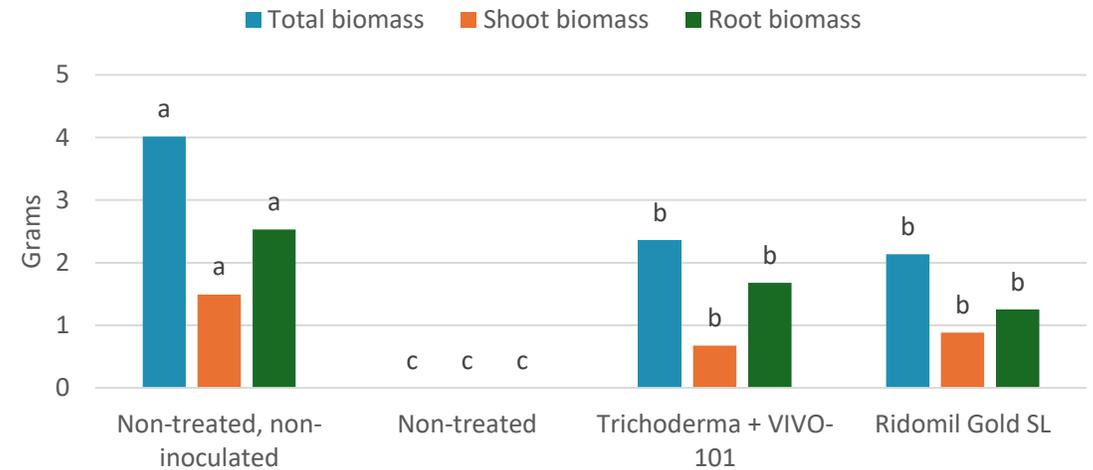
## Phytotoxicity

✓ No phytotox observed on Tomato, Cabbage, Soybean at 10x max use rate (10L/Ha)

## Water activity

✓ Low water activity ( $A_w \approx 0,4$ ) means no microbial growth, no need for preservatives

## Efficacy



✓ Biomass at 7 days of corn seedlings in soil inoculated with *Pythium ultimum*

✓ *Trichoderma harzianum* in STEPGROW® VIVO-101 as efficient as Ridomil® GOLD SL (Metalaxyl-M)

# Conclusion

**STEPGROW®VIVO-101 is a convenient All-In-One and solution to overcome all the challenges of a biological Oil Dispersion!**

- ✓ Excellent emulsion and suspension
- ✓ Excellent compatibility with wide range of microbials
- ✓ Hazard-free MSDS
- ✓ NOP compliant (180.920) / OMRI eligible
- ✓ Simplified development process
- ✓ A single product for all your OD needs!

**Meet us at booth 171 for more info!**



## Stepan – Staphyt Collaboration

- ✓ Comprehensive customer support at every step of the process
- ✓ Combining expertise of both groups : Stepan's formulation knowledge and Staphyt's regulatory and biological testing

**Staphyt**  
empower  
science together

**Stepan**   
Agricultural Solutions