



VISUALIZE YOUR FORMULATION PROCESS

With only ~0.2 hectares of arable land available per person and scarce water availability in many places around the world, the food production systems are on a growing risk. Crop protection chemicals help control the thousands of weed species, harmful insects and numerous plant diseases that afflict crops by increasing crop yields and decreasing costs of food. New and safer formulations are in high demand for applying safely and efficiently an Active Ingredient (AI). However, with over 75% of generic pesticides, formulation is also the desirable route for extension of Active Ingredients life cycles.

The basics and the challenges of AgroChem formulation development

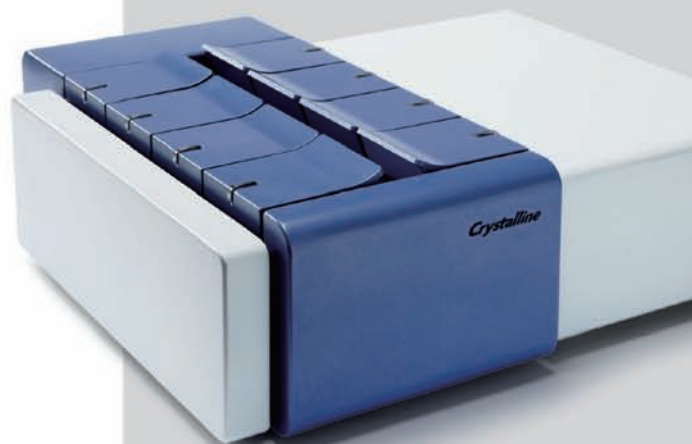
Formulation enables relatively small quantities of active ingredient to be applied safely and effectively over a relatively large area usually by combining the Active Ingredient (AI) with other components called formulators.

The factors a formulator should consider when choosing formulation type, developing and manufacturing agrochemical formulations are: physicochemical properties & impurity profile of Active Ingredient, stability requirements, cost and availability of formulators, suitability for packaging, ease of use, development timescales, product cost.

Nevertheless, the first factors which influence your choice while choosing the formulation are the physicochemical properties of Active Ingredient.

Physicochemical properties of AI	Choice of standard formulation*
AI soluble and stable in water	Soluble concentrate (SL) Water soluble granules (SG)
AI soluble and stable in non-polar solvents	Emulsifiable concentrate (EC) Emulsion (EW)
AI insoluble in water and solvents	Wettable powder (WP), Suspension concentrate (SC) Water dispersible granule (WG)

* Many other formulations are available for single AIs and combinations of AIs, or for special applications.



Formulations Old vs New

Formulation types are changing due to increased interest in reducing the dust exposure, optimizing efficacy, targeted delivery, operator safety, environmental safety, ease of use, dosing and application, safer solvents and formulators, product life extension and last but not least regulations. All these challenges need to be overcome by new formulations in timely and cost effective manner. The Crystalline will enable you to design formulated products to meet new technical challenges, ensure smooth scale-up, avoid wherever possible complex processes and unnecessary capital investments.

Optimize and control your formulation process

Optimize and control your formulation with the Crystalline, the ultimate tool for delivering your best formulation in a tight timescale, at lowest possible costs and with a low risk of failure on the field. Designed by experts in formulation development, the Crystalline provides real time answers to all your questions related to process/manufacturing aspects, physicochemical properties, impurity profiling, particle size distribution and stability.

Find out what and when is happening

Have you ever wondered what is happening during formulation development? How do you know if your sample is:

- foaming
- oiling out
- gelling/thickening,
- agglomerates
- precipitates/crystallizes

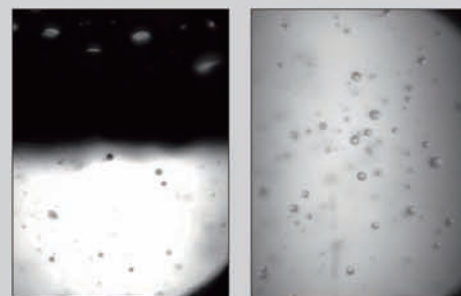
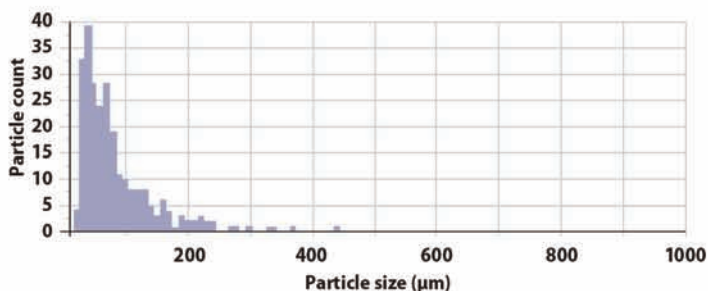


Stop guessing: now you can see what is happening. You can easily correlate turbidity signals with visual information – finally getting the complete picture of the formulation process.

Check the **stability** of your plant protection product by testing the effect of low and high temperatures on your formulation. With the 8 independently controlled reactors and integrated cameras, it is possible to study the effect of temperature and different formulators in a simple and easy fashion.

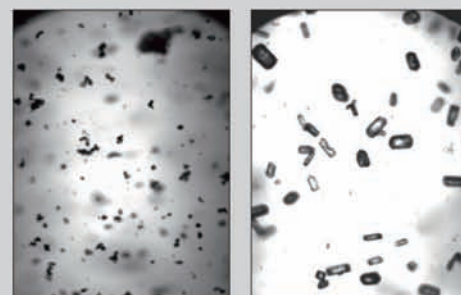
Crystalline enables you to efficiently determine **solubility** curves of your active ingredient and formulators. When appropriate, data related to relevant impurities can be also derived. The degree of dissolution and the dilution stability may be indirectly determined from the solubility curves. The real time turbidity measurements are carried out without any physical contact between sample and the probe – making this an extremely easy system to use. Just insert your sample into the reactor...

Check out the **particle size distribution** of your formulation product. For example, finer particles are less likely to settle, but have higher driving force for agglomeration. With four or eight high quality digital visualization probes, seeing what is happening in the vial and when has never been easier. The visualization probes are controlled separately from each other, and can be synchronized with turbidity measurements and temperature profile of each independent reactor.



Foaming

Oiling out



Agglomerates

Crystallization

Operating parameters

- 8 independently programmable temperature zones
- Temperature range: -25 to 150°C
- Heating/Cooling: individually programmable per reactor
- Temperature profile: non-linear profiles supported
- Temperature control accuracy: 0.1°C
- Stirring mechanism: overhead sample stirring or magnetic stirrer bars
- Stirrer speed: individually programmable from 0 – 1250 rpm
- Real time turbidity measurement: per individual reactor in transmission
- Working volume: (1 - 5 mL)
- Real time digital camera
- Particle size and shape information at the smallest scale