

# ADVANCING THE SCIENCE OF BIOFORMULATION



Expand your biological products portfolio while respecting your clients demands for quality, long shelf-life, easy handling and application and enhanced field action and persistence. Battelle combines decades of experience in agrichemical formulation with applied biologics expertise honed in the pharmaceutical and biodefense industries to find practical solutions to the unique challenges of agricultural bioformulation. Our integrated approach to research, development and regulatory compliance will help you move to market quickly while controlling costs and risks.

## BIOFORMULATION

Develop and lab-test new bioproducts to find answers to your bioformulation challenges. We work with all types of bio-based active ingredients (bacteria, fungi, viruses, proteins, metabolites) and apply innovative techniques to prepare stable, effective bioformulations.

- Feasibility studies
- Amendment selection and screening
- Formulation optimization
- Immobilization and encapsulation techniques
- On-seed testing
- Desiccation tolerance testing
- Storage stability testing
- New technologies development

## PRODUCTION AND PROCESSING

Move your biological product from the lab to the field with confidence. Our bioproduction experts can work with you from bench-scale testing to pilot production so you can move smoothly to commercial manufacturing.

- Batch preparation
- Scale-up and process transfer
- Production optimization
- Drying optimization
- Seed treatment

## REGULATORY SUPPORT

Get new formulations to market quickly and confidently with Battelle's regulatory compliance expertise. We can help you navigate regulatory requirements to gain access to new markets in the European Union, the United States and worldwide.

- Study design and support for global registration, including EU and EPA
- Gap analysis
- Dossier preparation and submission
- Expert advice for dossier defense
- A full range of GLP studies, including physiochemical, residue, plant and animal metabolism, environmental fate and more

## Capabilities

- Bioformulation
- Production and Processing
- Regulatory Support



At Battelle, we don't just apply cutting-edge biologics techniques—we invent them. We are leveraging decades of experience in agriculture, pharmaceuticals and biodefense to solve some of today's toughest bioproduct challenges, from extending shelf-life of biologics to developing liquid and dry formulations that are compatible with existing equipment.

**BIOLOGICS STABILIZER SCREENING PLATFORM**

Selection of stabilizing amendments for bioformulation has largely been done by trial and error in the industry. Battelle has developed a rationally designed approach that is fast, structured and adaptable to identify bioformulations that are best suited to stabilize your product. Our biologics stabilizer screening platform tests and compares the efficacy of hundreds of different amendment combinations all at once for faster and more consistent amendment testing and selection. This high-throughput testing method allows us to meet industry's need to move biologics products to market faster.

**PRODUCT ENCAPSULATION**

Encapsulation of biologics offers a number of benefits: protection from adverse environment, a substrate for adhesion and the opportunity to incorporate nutritional additives right where it's needed. Battelle is applying encapsulation techniques used in drug delivery and tissue engineering to the agricultural market. We encapsulated plant beneficial microbes in alginate beads to test the efficacy and stability of the encapsulation method. Results showed high microbial viability after encapsulation and superior stability at room temperature compared to unencapsulated microbes. More recently, a novel encapsulation technology to improve compatibility of microorganisms with chemical active ingredients is also being tested. Preliminary results show that this novel technology may be of interest for a variety of stabilized on-seed and on-shelf liquid applications with addition of chemical seed coating materials.

Finally, alternative technologies to alginate beads encapsulation are also under investigation as well as the use of biodegradable and environmentally friendly ingredients that can represent a novel solution to some of today's challenges in the agro-industry.

How We Can Help	
PROCESSES	RESULTS
<b>Bioformulation</b>	<ul style="list-style-type: none"> <li>• Our know-how and IP improve and significantly extend the shelf-life, field efficacy, and ease of application of a wide range of microbes for crop-based protectants or biostimulants.</li> <li>• Our experts in agrochemical formulation, advanced materials polymer chemistry and biology find solutions that solve problems for crop protection.</li> <li>• We provide microbial formulation development, production &amp; processing and regulatory support to enhance on-shelf and on-seed stability.</li> </ul>
<b>Encapsulation</b>	<ul style="list-style-type: none"> <li>• Our innovative microencapsulation technology can be adapted for a wide range of products</li> <li>• We have an IP portfolio and the expertise needed to provide solutions for formerly incompatible chemistries and ingredients to encapsulate a single shelf-stable product that can be designed and released as needed.</li> </ul>
<b>Synthetic Chemistry Formulation</b>	<ul style="list-style-type: none"> <li>• Our 40+ years of expertise formulating crop protection products is complemented with internal research and development and cross-disciplinary expertise.</li> <li>• We provide experience with all classes of chemistries, a full range of formulation types, seed coatings/dressings, and formulating microbial plant protection products.</li> </ul>
<b>Genomics, Proteomics, and Metabolomics</b>	<ul style="list-style-type: none"> <li>• Our technical subject matter experts fundamentally understand molecular, cellular and biological pathway organisms to support your product R&amp;D</li> <li>• Our breadth of services runs deep with decades of biological, bioscience and agrochemical formulation solutions that provide a full-service solution compared to competitor contract research organizations (CROs).</li> <li>• We provide unparalleled full service support with commercially focused endpoints in mind.</li> </ul>

Every day, the people of Battelle apply science and technology to solving what matters most. At major technology centers and national laboratories around the world, Battelle conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Headquartered in Columbus, Ohio since its founding in 1929, Battelle serves the national security, health and life sciences, and energy and environmental industries. For more information, visit [www.battelle.org](http://www.battelle.org).

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**It can be done**