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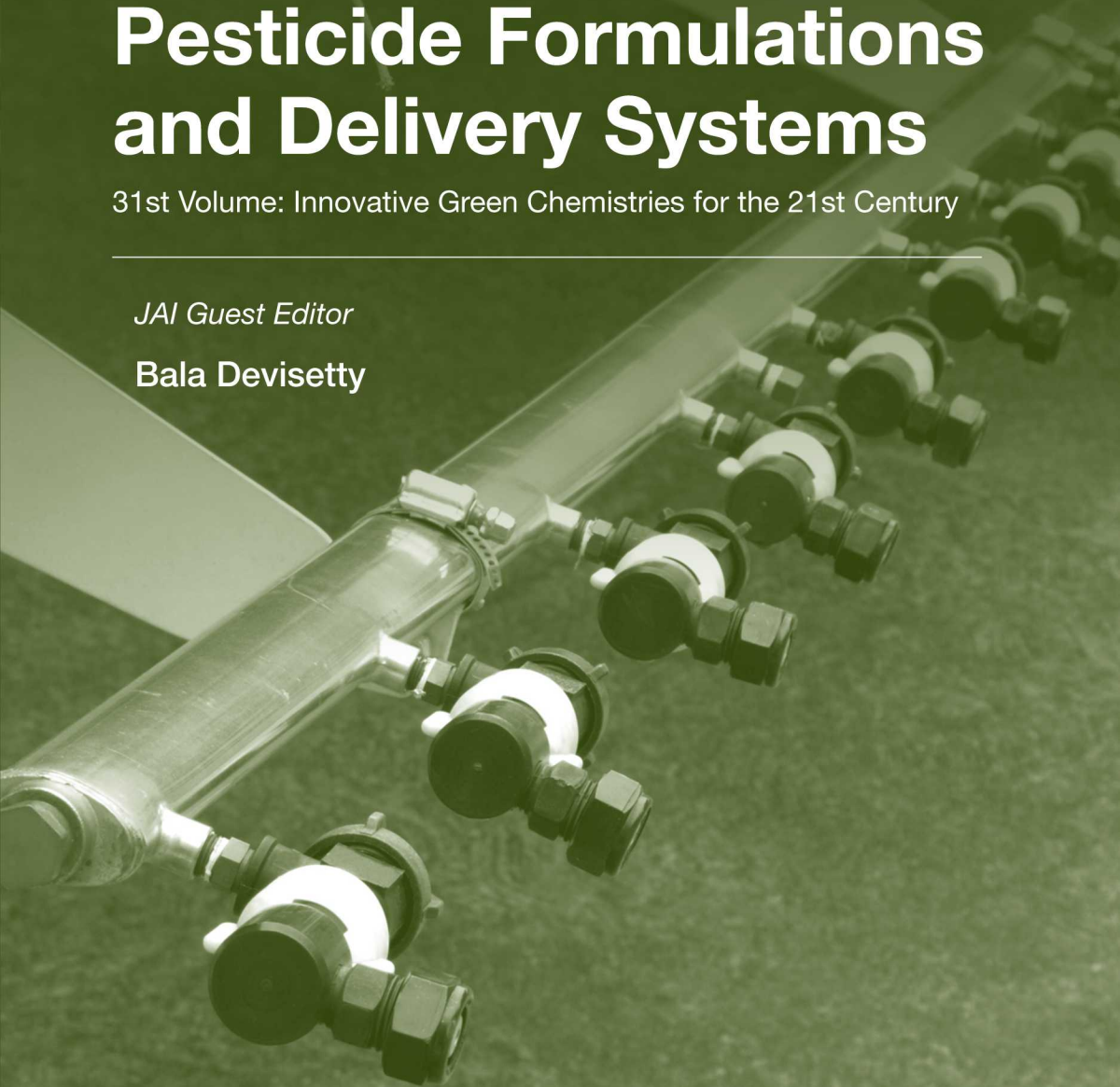
# **Pesticide Formulations and Delivery Systems**

31st Volume: Innovative Green Chemistries for the 21st Century

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*JAI Guest Editor*

**Bala Devisetty**



Journal of ASTM International  
Selected Technical Papers STP1537  
**Pesticide Formulations and Delivery  
Systems, 31<sup>st</sup> Volume: Innovative Green  
Chemistries for the 21<sup>st</sup> Century**

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## Foreword

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THIS COMPILATION OF THE *JOURNAL OF ASTM INTERNATIONAL* (JAI), STP1537, on *Pesticide Formulations and Delivery Systems, 31<sup>st</sup> Volume: Innovative Green Chemistries for the 21<sup>st</sup> Century* contains only the papers published in JAI that were presented at the 31<sup>st</sup> Symposium in San Antonio, TX on October 12-14, 2010 and sponsored by ASTM Committee E35 on Pesticides and Alternative Control Agents and Subcommittee E35.22 on Pesticide Formulations and Delivery Systems.

The JAI Guest Editor is Dr. Bala N. Devisetty, Research Fellow, Valent BioSciences Corporation, Long Grove, IL, USA.



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## Overview

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The ASTM Committee E-35 on Pesticides and Alternative Control Agents and its Subcommittee on Pesticide Formulations and Delivery Systems sponsored the 31<sup>st</sup> Symposium on “Pesticide Formulations and Delivery Systems: Innovative Green Chemistries for the 21<sup>st</sup> Century,” on October 12-14, 2010 in San Antonio, Texas.

There were a series of well-thought and informative presentations by key leaders in the field that touched upon critical aspects in pesticide formulations and delivery systems:

- **Kerry Leifer**, The Inerts Leader in the Environmental Protection Agency (EPA) Office of Pesticide Program’s Inert Ingredient Assessment Branch, delivered Keynote Address entitled “Inert Ingredient Regulation”. Leifer’s comprehensive presentation covered aspects such as Regulatory framework, registration of pesticide and inert ingredients, process for evaluation of inert ingredients, activities related to other ingredients, and the future of inert ingredient regulation. Inert ingredients are intentionally-added components in pesticide product formulations that do not act as an active ingredient against the targeted pest. Further, the inert ingredients are regulated under both the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) and the Federal Food Drug and Cosmetic Act (FFDCA). For pesticide products with food uses, all inert ingredients must also have appropriate tolerances or tolerance exemptions. Leifer stated that EPA published Advance Notice of Proposed Rulemaking (ANPRM) to seek comment on options for increasing public disclosure of all inert ingredients in pesticides. This ANPRM was designed to initiate the regulatory process by informing the public about the issues surrounding the potential rulemaking and to solicit input to help guide the Agency’s process to develop a proposal. Review of over 1000 comments received is ongoing.
- **Michael White**, The Director of Regulatory Affairs for the Chemical Producers and Distributors Association (CPDA), delivered a thoughtful address entitled “Pesticide Inert Ingredient Disclosure: An Industry Perspective.” White emphasized that the EPA decision to significantly increase the public availability of the identities of pesticide inert ingredients is premature. Due to the lack of consistent industry standards, this information should be withheld until the Agency has developed reliable supporting information for the products and their applications.
- **Gregory Lindner**, The Applications Manager for the Crop Care Business of Croda, Inc., discussed his perspectives and criteria for identi-



ifying green inert or similar ingredients. According to Lindner, important factors to consider include selecting a definition, deciding which ingredients to use, screening replacements for non-green or less green ingredients, and measuring product performance against the appropriate bench marks.

- **Ralf Hanel**, The Scientific Officer in the Federal Office of Consumer Protection and Food Safety, provided detailed procedures and policies on Collaborative International Pesticides Analytical Council's (CIPAC) cooperation with regulatory organizations to achieve globally accepted methods of analysis for pesticide products and other substances. These organizations include but are not limited to Association of Official Analytical Council (AOAC), ASTM, Food and Agriculture Organization (FAO) of the United Nations, World Health Organization (WHO), various international authority bodies, and industrial equivalents (e.g. CropLife International).
- **Warren Shafer**, The Vice President, Global R&D and Regulatory Affairs at Valent BioSciences Corporation, delivered a plenary lecture on "Biorational Pesticides in the 21<sup>st</sup> Century". Shafer stated that there is no uniform definition accepted on a global basis due to the numerous sub-categories and varying regulatory classifications. According to Shafer, biorational pesticides are active ingredients or formulations that are effective in controlling pests and are typically derived from biological or natural origins. They are characterized as providing added value to the end user and being highly targeted while having low impact on both the environment and non-target living organisms.

The presentations by the keynote speaker and other invited talks are not part of this ASTM Special Technical Publication (STP). However, I am grateful to these distinguished speakers for their substantial contributions to the Symposium.

Approximately 162 participated in the 31<sup>st</sup> Symposium representing the agriculture industry, universities, and related regulatory agencies. The 30 papers presented and 13 papers published in this STP reflect a diversity of professional and international affiliations. This research highlights the increasingly sophisticated Formulation Technologies and Application Systems and the need for common industry standards and advocacy.

The STP is organized into three main categories:

1. The First Section, "Advances in Green Formulation Technology" contains six papers covering approaches toward design of green matrices, (Nonylphenol Ethoxylates (NPE) replacement in solvent-based formulations, environmentally friendly solvents, botanical pesticides for

public health, organic herbicides, and use of polymeric surfactants in Wettable Granule (WG) and Wettable Powder (WP) formulations.

2. The Second Section, “Adjuvants and Test Methods” comprises four papers that cover novel surfactant derivatives for improving the infiltration of irrigation water into repellent soil, development and evaluation of an ASTM test method for adjuvants in spray drift reduction programs, a florescent tracer method for evaluating spray transport and fate, and a test method for evaluating water condition adjuvants.
3. The Third Section, “Drift Reduction (DR) – Formulation and Application Technologies” focuses on three papers covering formulation development and application technologies.

#### **Advances in Green Formulation Technology: Highlights**

- Kolazi provided examples of solvent pairs to formulate solvent-based formulations, stable micro-emulsion concentrates, aqueous suspension concentrates with polymer composites, and emulsifiable concentrates with derivatized vegetable oils that are self-emulsifying.
- Low showed an alternate but more simplified method in measuring emulsification performance in studies designed to replace or reformulate NPE-containing formulations.
- Murthy reviewed the development of an environment friendly polar solvent, Methyl 5-(dimethylamino) 2-methyl 5-oxopentanoate, for crop protection formulations.
- Paluch demonstrated the potential utility of select botanical terpenes/plant essential oils in public health programs but concluded that more research is needed in the development of effective delivery systems.
- Penner discussed methods of enhancing herbicidal activity of organic herbicide Caprylic acid with natural product emulsifiers.
- Hu showed that modified styrene acrylic polymeric surfactants are effective and efficient dispersants suitable for Wettable Granule (WG) and Wettable Powder (WP) formulations.

#### **Adjuvants and Test Methods: Highlights**

- Bially’s work demonstrated that esterified Alkyl Polyglucosides (APG) are effective at improving the infiltration of water through repellent soil profiles.
- Elsik proposed an ASTM test method for evaluating spray drift reduction adjuvants. This test method described the preparation, composition and test/application conditions for droplet size, spray pattern measurements and reduction of fines using known concentrations of oil and water soluble fluorescent tracer dyes into spray mixes.

- Fritz evaluated and described techniques that can directly measure the amount of active ingredient and/or spray mixture that deposits on sampling surfaces of interest.
- Zollinger proposed a test method for evaluating water conditioning agents toward CPDA certification. He further emphasized that water conditioning adjuvants should be evaluated at multiple locations to maintain high degree of precision.

#### **Drift Reduction - Formulation and Application Technologies: Highlights**

- Halecky developed oil dispersion of guar gum that not only achieved even dispersion of guar into the spray tank but also exhibited good physical stability.
- Hoffman studied the effects of air speed and liquid temperature on droplet size. By including a reference nozzle evaluated under the same conditions as the proposed Drift Reduction Technology (DRT), the percent reduction in driftable fines remained relatively constant across all conditions tested.
- Fritz evaluated the proposed US EPA DRT field testing protocols by conducting full-scale assessment for both aerial and ground spray application systems. While field testing protocols are more labor and resource intensive, they offer the benefit of a direct measure of downwind deposition from candidate systems. They also serve as a method for testing systems which do not readily fit either the low- or high-speed testing protocols.

I would like to acknowledge A. David Lindsay, Manager-Applied Research at Evonik Goldschmidt Corporation for serving as Co-Chair of this Symposium as well as for his steadfast guidance through out the year. Sincere thanks are also due to the ASTM E-35 Main Committee, ASTM E-35.22 Subcommittee, and ASTM administrative staff for all their guidance and support. Finally, I would like to sincerely acknowledge all the contributions by the presenters at the event, all those who prepared manuscripts for publication in STP 1537, and session moderators and manuscript peer-reviewers.

The STP provides significant scientific knowledge on the latest developments in green pesticide and adjuvant formulation/application technologies. These research and efforts will guide the ASTM Subcommittee E35.22 members in the development of consistent and rationale industry standards.

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