

Analytical method for flumiclorac pentyl ester and its acid, IMCA, in water

Reports: ECM: MRID 48904402. Green, CA. (2012) Flumiclorac Pentyl Ester: Determination of Flumiclorac Pentyl Ester and its Degradate, IMCA, in Water Laboratory Project ID: RM-29W-4. Unpublished study prepared by Valent Technical Center and submitted by Valent U.S.A, Corporation. 20 pp.

LV: MRID 48753704. Bondarenko S. (2012) Independent Laboratory Validation of Valent's Method RM-29W-4, Determination of Flumiclorac-pentyl Ester and Its Degradate IMCA, in Water. Project Number: 2012000022 38180. Unpublished study prepared by Valent Technical Center and submitted by Valent U.S.A, Corporation. 90 pp.

ILV: MRID 49175803. Bondarenko, S. (2013) Addendum: Independent Laboratory Validation of Valent's Method RM-29W-4, Determination of Flumiclorac-pentyl Ester and Its Degradate, IMCA, in Water. Project Number: 201300152, 38180. Unpublished study prepared by Valent Technical Center and submitted by Valent U.S.A., Corporation. 92 pp.

Document No.: MRIDs 48904402, 48753704, & 49175803

Guideline: 850.6100

Statements: All method validations were conducted in compliance with FIFRA GLP standards. Signed and dated Data Confidentiality, GLP Compliance, Quality Assurance, and Authenticity Certification (LVs only) statements were provided for the method, LV, and ILV reports.

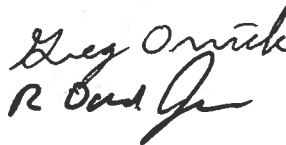
Classification: This analytical method is classified as **acceptable**.

PC Code: 128724

Reviewer: Gregory Orrick, Environmental Scientist

Peer reviewer: R. David Jones, Ph.D., Senior Agronomist

Date: January 30, 2014

**Executive Summary**

This analytical method, RM-29W-4, is designed for the quantitative determination of flumiclorac pentyl ester and its acid, IMCA, in water using LC/MS/MS (see Table 1). The method is quantitative for the analytes at the stated LOQ of 2.0 µg/L. The second laboratory validation (LV) was successful on the first attempt (MRID 48753704). However, the same Agilent 1200 HPLC was used for the initial and second validations, meaning that MRID 48753704 did not describe a fully independent validation. Therefore, a third laboratory validation (MRID 49175803) was conducted as the true ILV, using an Agilent 1260 Infinity HPLC (p. 14). The ILV was successful on the first full attempt.

Table 1. Analytical Method Summary

Analyte(s) by Pesticide	MRID		EPA Review	Matrix	Method Date	Registrant	Analysis	Limit of Quantitation (LOQ)
	Environmental Chemistry Method	Independent Laboratory Validation						
Flumiclorac-pentyl & Degradate IMCA	48904402	49175803		Water	8/1/12	Valent U.S.A. Corporation	LC/MS/MS	2.0 µg/L

I. Principle of the Method

Water samples are acidified with 1 N hydrochloric acid. Then, flumiclorac pentyl ester and IMCA residues are extracted twice with ethyl acetate. The ethyl acetate is removed using vacuum rotary evaporation. Then, the residues are re-dissolved first in methanol acidified with 0.05% formic acid (1:1, v:v), then with HPLC-grade water acidified with 0.05% formic acid (1:1, v:v). Extracts are adjusted to final volume and diluted in an autosampler vial for analysis with an HPLC with a triple quadrupole mass spectrometer (LC/MS/MS).

II. Recovery Findings

Mean recoveries and relative standard deviations (RSD) were within guideline requirements (mean 70-120%; RSD ≤20%), *i.e.*, the method is quantitative for each analyte, with an LOQ of 2.0 µg/L.

Table 2. Initial Validation Method Recoveries for Analytes in Water

Analyte	Fortification Level (µg/L)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Flumiclorac pentyl ester	2.00	5	100-108	105	3.0	2.8
	20.0	5	104-117	108	5.2	4.8
IMCA	2.00	5	100-112	107	5.0	4.7
	20.0	5	99-110	101	4.8	4.8

Table 3. Second Validation Method Recoveries for Analytes in Water

Analyte	Fortification Level (µg/L)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Flumiclorac pentyl ester	2.00	5	93-98	96	1.9	2.0
	20.0	5	96-97	96	0.8	0.8
IMCA	2.00	5	82-90	85	3.1	3.7
	20.0	5	93-96	94	1.2	1.3

Table 4. Independent Validation Method Recoveries for Analytes in Water

Analyte	Fortification Level (µg/L)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Flumiclorac pentyl ester	2.00	5	83-88	86	2.1	2.4
	20.0	5	91-95	92	1.5	1.6
IMCA	2.00	5	79-86	82	2.3	2.8
	20.0	5	89-92	90	1.7	1.8

III. Method Characteristics

The LOQ was defined as the lowest concentration tested at which acceptable recoveries were obtained with an RSD of $\leq 15\%$. The results for both flumiclorac pentyl ester and IMCA support the stated LOQ of 2.00 µg/L. The LOD of 1.00 µg/L is based on a 20-mL sample, a 10-mL final volume, a dilution factor of 4, and a 0.50 µg/L standard as the lowest concentration in the set of instrument calibration standards ($[0.50 \mu\text{g/L} \times 10 \text{ mL} \times 4] \div 20 \text{ mL} = 1.00 \mu\text{g/L}$).

Table 5. Method Characteristics

	Flumiclorac pentyl ester	IMCA
Limit of Quantitation (LOQ)	2.00 µg/L	2.00 µg/L
Limit of Detection (LOD)	1.00 µg/L	1.00 µg/L
Linearity (calibration curve r^2 and concentration range)	$r^2 > 0.99$ 0.50-50.0 µg/L	$r^2 > 0.99$ 0.50-50.0 µg/L
Repeatable	Yes	Yes
Reproducible	Yes	Yes
Specific	Yes	Yes

A second-order polynomial was used to fit the calibration curve. If the second-order term is significant, care should be taken with this approach to regularly re-fit the curve and to not use it to extrapolate beyond the concentration range. In this case, however, the second-order term was eight orders of magnitude less than the first-order term, indicating that the curve was linear. Therefore, in this case, use of a second-order polynomial to fit the calibration curve was not problematic.

IV. Method Deficiencies and Reviewer's Comments

There are no deficiencies with the analytical method, laboratory validations, or their documentation.

Sample analysis was performed at Valent Technical Center, a subsidiary of the registrant, Valent, U.S.A Corporation. OCSPP Guideline 850.6100 indicates that an independent laboratory can be privately or publicly owned or in the registrant's own organization. However, if the "laboratory is located in the registrant's organization, or is in anyway associated with the development of the original environmental chemistry method (ECM), the same people, equipment, instruments, and supplies should not be utilized to validate the ECM." The second laboratory validation (LV) was successful on the first attempt (MRID 48753704). However, the same Agilent 1200 HPLC was used for the initial and second validations, meaning that MRID 48753704 did not describe a fully

independent validation (the study director, staff, and other laboratory equipment were independent of those that conducted the initial validation).

Therefore, a third laboratory validation (MRID 49175803) was conducted as the true ILV, using an Agilent 1260 HPLC. The ILV was successful on the first full attempt.

Attachment 1: Chemical Names and Structures

Table 1. Flumiclorac-pentyl and Its Environmental Degradates

Code Name/ Synonym	Chemical Name	Chemical Structure
Flumiclorac-pentyl S-23031 V-23031	Pentyl 2-chloro-4-fluoro-5-(3,4,5,6-tetrahydrophthalimido)phenoxyacetate CAS No.: 87546-18-7 Formula: C ₂₁ H ₂₃ ClFNO ₅ MW: 423.87 g/mol SMILES: <chem>FC1=C(C=C(C(=C1)Cl)OCC(=O)OCCCC)N3C(=O)C2=C(CCC2)C3=O</chem>	
Flumiclorac acid IMCA	2-chloro-4-fluoro-5-(3,4,5,6-tetrahydrophthalimido)phenoxyacetic acid CAS No.: 87547-04-4 Formula: C ₁₆ H ₁₃ ClFNO ₅ MW: 353.74 g/mol SMILES: <chem>FC1=C(C=C(C(=C1)Cl)OCC(=O)O)N3C(=O)C2=C(CCCC2)C3=O</chem>	