

Analytical Method for Mesosulfuron-methyl in Surface Water

- Reports: ECM: Validation of the Enforcement Method EM F04/00-0
for Surface Water by LC-MS/MS
Mesosulfuron-methyl (AE F130060), Foramsulfuron (AE F130360)
- ILV: Independent Laboratory Validation of the Analytical Method for the
Residue Analysis of Mesosulfuron-methyl
(AE F130060), Foramsulfuron (AE F130360) in Surface Water
- Document No.: [MRIDs 46451701 & 46451702]
- Guideline: 850.6100 [U.S.], 8.2.2.3 [water];
- Statements: The study was conducted in compliance with the Principles of Good
Laboratory Practice (GLP) as revised in 1997 and set out in the OECD
document OECD-Doc. ENV/MC/CHEM(98)17, Paris 1998, with reference
to the laws and regulations embodying these Principles at the national level.
No claim of confidentiality is made for any information contained in this
study on the basis of its falling within the scope of FIFRA § 10(d)(I)(A), (B),
or (C).
- Classification: This analytical method is classified as **SUPPLEMENTAL** for monitoring
the parent sulfonyl urea mesosulfuron-methyl residues in surface water.
- Deficiencies: The ECM/ILV fails to report r^2 -values and the limit of
detection (LOD). This method cannot be used for detecting the residues for
the major degradates of concerns (>10%) of the above sulfonyl ureas.

PC Code: Mesosulfuron-methyl (122009)

1st Reviewer: He Zhong, Ph.D.  Signature:
Biologist, EPA Date: 6/27/2013

2nd Reviewer: Faruque Khan, Ph.D.  Signature:
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Executive Summary

This analytical method, MRIDs 46451701 & 46451702, is for the quantitative determination of
Mesosulfuron-methyl (AE F130060), Foramsulfuron (AE
F130360) in surface water using LC-MS/MS at the LOQ(s) of 0.005 µg/L (see Table 1). While

the ECM/ILV summarizes the results reported for each chemical (*i.e.*, mesosulfuron-methyl, foramsulfuron), this review only evaluates the validity of these methods to detect mesosulfuron-methyl residues in water. The LOQs are less than the lowest toxicological level of concern of mesosulfuron-methyl (0.19 µg/L, NOAEC for Duckweed) in surface water. The independent laboratory communicated with the sponsor (registrant) one time concerning the method recovery rates after a first attempt for LOQ and 10 fold LOQ. As a result from the discussion with the sponsor the pH value of the surface water must adjusted precisely to pH 3 - 4 by adding several droplets of acetic acid. The independent laboratory has two minor modification of the original analytical method: 1). Equivalent reagents were used. 2). Mesosulfuron-methyl is eluted with acetonitrile/water (6:4, v/v) into 10 ml graduated flask instead of 5 ml flask by the original method. No other major issues were identified by the independent laboratory.

Table 1. Analytical Method Summary

Analyte(s) by Pesticide	MRID		EPA Review	Matrix	Method Date (m/d/y)	Registrant	Analysis	Limit of Quantitation (LOQ)
	Environmental Chemistry Method	Independent Laboratory Validation						
Mesosulfuron-methyl	46451701	46451702		Water	1/2/2005	Bayer Crop Science	LC-MS/MS	0.005 µg/L

I. Principle of the Method

The surface water sample spiked with known amount of mesosulfuron-methyl can be filtered and is afterwards adjust to pH 3-4 with a few droplets of acetic acid. The sample is enriched on a RP C18-cartridge (conditioned with methanol and water). The sulfonyl urea is eluted with acetonitrile / water (6:4, v:v). The concentration of the sulfonyl urea in the final solution is determined by LC-MS/MS.

II. Recovery Findings

The mean recoveries and relative standard deviations (RSD) for ECM and ILV were generally within guideline requirements (mean 70-120%; RSD ≤20%), (Table 2 and 3).

Table 2. Initial Validation Method Recoveries for Mesosulfuron-methyl in Surface Water

Calibration with pure solvent standards

Analyte	Fortification Level (µg/L)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Mesosulfuron-methyl	0.005	5	110-117	113	3	2
	0.05	5	110-116	111	3	3

Matrix matched calibration

Analyte	Fortification Level ($\mu\text{g/L}$)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Mesosulfuron-methyl	0.005	5	106-111	109	2	2
	0.05	5	96-101	99	2	2

Table 3. Independent Validation Method Recoveries for Mesosulfuron-methyl in Surface Water Calibration with pure solvent standards

Analyte	Fortification Level ($\mu\text{g/L}$)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Mesosulfuron-methyl	0.005	5	105-111	107	3	9
	0.05	5	90-96	91	4	

Matrix matched calibration

Analyte	Fortification Level ($\mu\text{g/L}$)	Number of Tests	Recovery Range (%)	Mean Recovery (%)	Standard Deviation (%)	Relative Standard Deviation (%)
Mesosulfuron-methyl	0.005	5	86-93	89	3	7
	0.05	5	74-83	79	4	

III. Method Characteristics

The method characteristics are listed in Table 4.

Table 4. Method Characteristics

	Mesosulfuron-methyl
Limit of Quantitation (LOQ)	0.005 $\mu\text{g/L}$
Limit of Detection (LOD)	N/A
¹ Linearity (² calibration curve r^2 and concentration range)	$r^2 = 0.999$ 5 – 200 $\mu\text{g/L}$
Repeatable	Yes
Reproducible	Yes
Specific	Yes

¹calibration curve is based on quadratic regression ($y=a+bx+cx^2$)

²The reported r^2 is calculated based on r-value from ILV method. ECM method fails to report r-value or r^2 -value

Linearity is not established in the calibration. Calibration functions were calculated and plotted by quadratic regression ($y=a+bx+cx^2$) using external standards (matrix matched standards as well as standards in pure solvent). The correlation coefficient of the calibration curves was above 0.998 reported in ILV. Evaluation of the final extracts was performed against the non-linear regression curve. The **limit of quantification** (LOQ) is 0.005 $\mu\text{g/L}$. The method in general satisfies the **repeatability** criteria with mean recoveries are in the range of 70-120% and RSDs are $\leq 20\%$. **Reproducibility** is satisfactory with the independent validation confirmed the LOQ(s) established by the initial validation. **However, the limit of detection (LOD) is not reported.** This method using LCMS/MS demonstrated excellent **specificity** by selecting the following daughter and parent ions (Table 5).

Table 5. Method Specificity—LC-MS/MS Parent and Daughter ions

Analyte	Parent ion	Daughter ion
Mesosulfuron-methyl	453.27	182.17

IV. Method Deficiencies and Reviewer's Comments

- 1). The ECM only provided limit of quantification (LOQ), **but failed to specify the limit of detection (LOD)**. Even though the “apparent residues” were provided in Annex V, it did not follow the proper procedure of analyzing the lowest detectable residues for the LOD.
- 2). EFED can accept a non-linear calibration curve ($y = a + bx + cx^2$) used for three tested compounds over the tested range of 0.1 to 4 ng/ml. However, the **r-values or r²-values were not reported in ECM** even though the calibration graph appears to be a good fit. The satisfactory r-values were provided in ILV that are used by EFED to calculate the r²-value. The registrant needs to demonstrate r²-value is > 0.995 in original ECM.
- 4). Both ECM and ILV failed to explain what type of the “pure solvent” used for the calibration.
- 5). Surface water parameters were not tested via GLP method in ECM. The ECM did not specify how matrix matched standards were prepared. A clarification is needed on how to prepare the calibration standards (e.g. using pure solvent standards and matrix matched standards).
- 6). No degradates were reported in the ECM and ILV. The ECM/ILV should include the major degradates (>10%) for the sulfonyl ureas.
- 7) The statement “equivalent reagents were used” included in the ILV report needs to be explained.

V. References

- Wrede, A. 2002. Validation of the Enforcement Method EM F04/00-0 for Surface Water by LC-MS/MS Mesosulfuron-methyl (AE F130060), Foramsulfuron (AE F130360). MRID 46451701
- Reichert, N. and Klimmek, S. Independent Laboratory Validation of the Analytical Method for the Residue Analysis of Mesosulfuron-methyl (AE F130060), Foramsulfuron (AE F130360) in Surface Water. MRID 46451702