



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OPP OFFICIAL RECORD  
HEALTH EFFECTS DIVISION  
SCIENTIFIC DATA REVIEWS  
EPA SERIES 381

OFFICE OF  
PREVENTION, PESTICIDES AND  
TOXIC SUBSTANCES

**MEMORANDUM**

Date: 12/July/00

**SUBJECT:** Monosodium Methanearsonate (MSMA) and Disodium Methanearsonate (DSMA) Reregistration. GLN#: 860.1500: Magnitude of the Residue in Citrus.

Reregistration Case No.: 2395.

PC Codes: 013803 and 013802.

DP Barcode Nos.: D214330 and D216740.

MRID Nos.: 43605901 and 43683101.

**FROM:** Sherrie L. Kinard, Chemist *Sherrie L. Kinard*  
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**THROUGH:** Alan Nielsen, Branch Senior Scientist *Alan Nielsen* 7/12/2000  
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**TO:** Tom Myer, Chemical Review Manager  
Accelerated Reregistration Branch  
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Attached is a review prepared by Dynamac Corporation of studies submitted for the magnitude of the residue of MSMA and DSMA in/on citrus commodities. This information has undergone secondary review in Reregistration Branch 2 and is consistent with Agency policies.

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## **EXECUTIVE SUMMARY**

### **1. 860.1500 - MSMA and DSMA Magnitude of the Residue in Citrus (MRID Nos.:43605901 and 43683101):**

The submitted residue data for MSMA and DSMA on citrus are adequate and support the established tolerance of 0.35 ppm (40 CFR § 180.289) provided the registrants amend all pertinent labels to specify a maximum single application rate of 4.9 lb ai/A.

#### ***Analytical Method:***

A GC/electron capture detection (GC/ECD) method was used to analyze MSMA, DSMA, and CA (cacodylic acid) in citrus from these studies. Recoveries of MSMA, DSMA and CA were adequate from fortified samples run concurrently with fruit from field trials. Separate method validation data were submitted for samples fortified with MSMA and CA, showing adequate recoveries at fortification levels of 0.05-0.2 ppm. This method is adequate for data collection.

#### ***Residue Data:***

At 27 sites, MSMA and DSMA were tested side-by-side on orange, grapefruit, lemon, and lime. Combined residues of MSMA and CA were < 0.10 - < 0.13 ppm in/on 27 citrus fruit samples from trees treated three times with the 6 lb/gal soluble concentrate/liquid (SC/L) formulation at 4 lb ai/A/application with a 0-day PHI. Combined residues of DSMA and CA were < 0.10 - < 0.16 ppm in/on 27 additional samples harvested on the day of the last of three applications of the 81% soluble concentrate/solid (SC/S) formulation of DSMA at 4.9 lb ai/A. Geographic representation was adequate. These data support the established tolerance of 0.35 ppm (40 CFR § 180.289); however, there is cause for concern since the third application was done on the day of harvest and does not provide adequate time for translocation of MSMA and DSMA to the citrus fruit.

#### ***Storage Stability:***

Fortified samples stored with the field samples and analyzed concurrently indicate that residues of MSMA are stable in/on citrus fruit in frozen storage for up to 15 months. These storage stability data are adequate to cover storage intervals up to 15 months. The stability data for MSMA residues are adequate and are representative of DSMA residues. Stability data for CA were cited from a citrus metabolism study (MRID 42391201).

## **DEFICIENCIES**

**Deficiencies in 860.1500 - MSMA and DSMA Magnitude of the Residue in Citrus (MRID No.:43605901 and 43683101):** There are no deficiencies that would seriously compromise the interpretation of these data; however, the registrants must amend all pertinent labels to specify a maximum single application rate of 4.9 lb ai/A for DSMA.

*Analytical Method:* There are no deficiencies that would seriously compromise the interpretation of these data. **This method is adequate for data collection.**

*Residue Data:* There are no deficiencies that would seriously compromise the interpretation of these data; however, the registrants must amend all pertinent labels to specify a maximum single application rate of 4.9 lb ai/A for DSMA [Drexel DSMA Slurry® (EPA Reg. No. 63239-14) and Ansar DSMA Liquid® (EPA Reg. No. 50534-42) list application rates of 7.2 lb ai/A/application]. There are some concerns that since the third application was done on the day of harvest, there was not adequate time for translocation of MSMA and DSMA to the citrus fruit; however, the US FDA Total Diet Study-Market Baskets 91-3 through 97-1 demonstrate that it is unlikely to find residues of arsenic in/on citrus fruit. Therefore, we can assume that the third application of MSMA/DSMA is unlikely to increase the residue levels over tolerance in citrus fruit.

*Storage Stability:* There are no deficiencies that would seriously compromise the interpretation of these data. **These storage stability data are adequate to cover storage intervals of samples for MSMA and are representative of DSMA residues.**

cc: Sherrie L. Kinard (RRB2), MSMA/DSMA List B File, MSMA/DSMA Subject File, RF, LAN. RDI:  
RRB2 Res. Chem. Team (3/28/00).

7509C: RRB2: S. Kinard: CM#2: Rm 722B: 703-305-0563: 7/12/00.

## MSMA/DSMA

PC Codes: 013803 and 013802; Case 2395

(DP Barcodes D214330 and D216740)

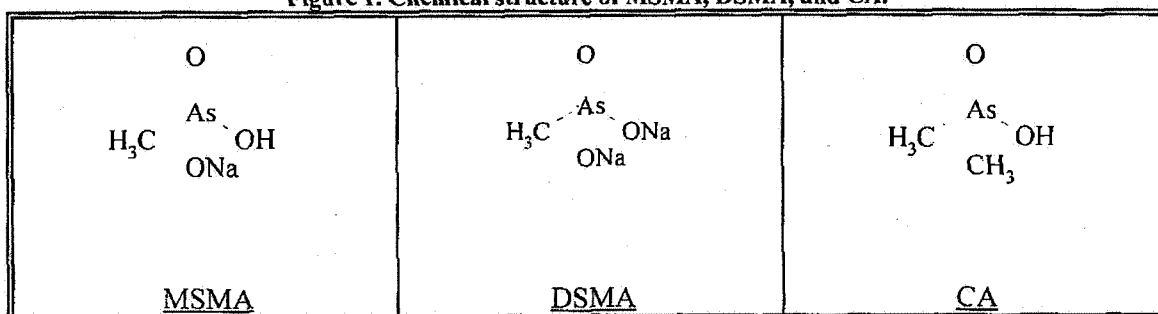
### REGISTRANT'S RESPONSE TO RESIDUE CHEMISTRY DATA REQUIREMENTS

#### BACKGROUND

The Methanearsonate Acid (MAA) Task Force Three (1995; MRIDs 43605901 and 43683101), consisting of APC Holding Company, GB Biosciences Corporation, and Luxembourg-Pamol, Inc., submitted data from field trials with MSMA or DSMA on citrus. The Phase 4 Reviews for MSMA and DSMA (8/31/90) required residue data on citrus. CBRs subsequently established that a total of 28 tests were required on orange, grapefruit, and lemon using one of the salts and that a limited number of side-by-side trials would be sufficient for the second salt, unless a significant difference in residue levels was observed for the two salts (M. Metzger, telecon of 3/8/93 with agent for MAA Task Force).

The nature of the residue in citrus (lemon) is adequately understood; the residues of concern in citrus associated with the use of MSMA and DSMA include MSMA and CA (HED Metabolism Committee, 1/26/95). The molecular structures of MSMA, DSMA, and CA are depicted below. Tolerances are currently established for the selective post-emergence herbicide methanearsonate acid (calculated as  $As_2O_3$ ) resulting from application of the disodium and monosodium salts of methanearsonate acid [40 CFR §180.289]. Currently, a colorimetric method is published in PAM, Vol. II as Method 1. Updated methodology for tolerance enforcement is currently under review.

Figure 1. Chemical structure of MSMA, DSMA, and CA.



## CONCLUSIONS

1. The submitted residue data for MSMA and DSMA on citrus are adequate, provided the registrants amend all end-use product labels to specify a maximum single application rate of 4.9 lb ai/A for DSMA [Drexel DSMA Slurry® (EPA Reg. No. 63239-14) and Ansar DSMA Liquid® (EPA Reg. No. 50534-42) list application rates of 7.2 lb ai/A/application].
2. At 27 sites, MSMA and DSMA were tested side-by-side on orange, grapefruit, lemon, and lime. Combined residues of MSMA and CA were  $< 0.10 - < 0.13$  ppm in/on 27 citrus fruit samples from trees treated three times with the 6 lb/gal SC/L formulation at 4 lb ai/A/application with a 0-day PHI. There is no established PHI for MSMA and DSMA. Combined residues of DSMA and CA were  $< 0.10 - < 0.16$  ppm in/on 27 additional samples harvested on the day of the last of three applications of the 81% SC/S formulation of DSMA at 4.9 lb ai/A. Geographic representation was adequate. These data support the established tolerance of 0.35 ppm (40 CFR § 180.289); however, there is cause for concern since the third application was done on the day of harvest, there was not adequate time for translocation of MSMA and DSMA to the citrus fruit.
3. A GC/ECD method was used to analyze MSMA, DSMA, and CA in citrus from these studies. Recoveries of MSMA (or DSMA) and CA were adequate from fortified samples run concurrently with fruit from field trials. Separate method validation data were submitted for samples fortified with MSMA and CA, showing adequate recoveries at fortification levels of 0.05-0.2 ppm. This method is adequate for data collection. The method is currently under review for enforcement.
4. Fortified samples stored with the field samples and analyzed concurrently indicate that residues of MSMA are stable in/on citrus fruit in frozen storage for up to 15 months. These storage stability data are adequate to cover storage intervals up to 15 months. The stability data for MSMA residues are representative of DSMA residues. Stability data for CA were cited from a citrus metabolism study.

## DETAILED CONSIDERATIONS

### Residue Analytical Methods

Residues of MSMA, DSMA, and CA in/on citrus fruit from the residue field trials (1995; MRIDs 43605901 and 43683101) were analyzed using a GC/ECD method titled "Analytical Method for Residues of Monosodium Methane Arsenate and Its Metabolite CA in Citrus." Using this method, MSMA (or DSMA) and CA in citrus fruit are extracted with water and made alkaline with the addition of NaOH. The residues are concentrated and acidified with HCl, then cleaned up on a C18 column. The extract is again made alkaline, concentrated, and acidified, and methylthioglycolate is added. The derivatized residues are partitioned into hexane and analyzed

by GC/ECD. The limit of quantitation for this study was 0.05 ppm. Validation data are presented in Table 1. Method recoveries obtained concurrently with residue samples are presented in Table 2. MSMA, DSMA, and CA were nondetectable (<0.05 ppm of each residue) in control samples of orange, grapefruit, lemon, and lime.

This method is adequate for collecting data on MSMA, DSMA, and CA residues in citrus fruit.

**Table 1. Recovery of MSMA and CA from fortified oranges.**

Fortification (ppm)	Recovery (%)	
	MSMA	CA
0.05	89.6-99.1 (3) <sup>a</sup>	92.6-111.2 (3)
0.10	70.7-109.4 (7)	79.1-113.0 (7)
0.20	103.5-116.4 (3)	86.7-90.7 (3)

<sup>a</sup> Numbers of samples given in parentheses

**Table 2. Concurrent Method recovery of MSMA or DSMA and CA from citrus fruit.**

Crop Fortification (ppm)		Concurrent Method Recovery			
		MSMA	CA	DSMA	CA
Orange	0.05	84.5	103.2	118.7	95.5
	0.10	105.5-120.8 (4)	93.6-117.4 (4)	98.1-118.8 (3)	88.6-108.5 (3)
Grapefruit	0.05	-- <sup>b</sup>	93.7	--	76.3
	0.10	76.1-119.2 (3)	83.3, 103.1	79.7-119.9 (3)	113.3, 125.9
Lemon <sup>c</sup>	0.10	116, 120	90.0, 94.7	73.2, 122.0	96.8, 107.7

<sup>a</sup> Numbers of samples given in parentheses; otherwise, each value represents one sample.

<sup>b</sup> -- = no data presented.

<sup>c</sup> Also includes one sample of lime.

### Storage Stability Data

Samples of orange, grapefruit, and lemon were fortified in the field and stored along with the treated samples. The fortified samples were analyzed 12-15 months later using the method described above; the results are presented in Table 3. The average overall recovery of MSMA from citrus fruit stored 14-15 months was 76.9%.

The registrants indicated that the frozen storage stability of CA for up to one year was demonstrated by data submitted with a citrus metabolism study (MRID 42391201). The registrants also asserted that the stability data for MSMA are also indicative of the storage stability of DSMA, as both dissociate to methane arsenate when dissolved in water.

**Table 3. Recovery of MSMA from field-fortified citrus fruit after frozen storage.**

Matrix	Storage interval (months)	Recovery (%)
Orange	14	63.8, 80.7, 68.0
	15	107.8, 86.3, 71.4
Grapefruit	14	70.4, 60.6, 73.8
Lemon	12	66.2, 84.8, 89.4

Adequate storage stability data are available to support the residue data from citrus field trials with MSMA, DSMA, and CA.

#### Magnitude of the Residue in Plants

Citrus Fruit: A tolerance of 0.35 ppm has been established for residues methanearsonate acid (calculated as  $As_2O_3$ ) in/on citrus fruit resulting from application of the disodium and monosodium salts of methanearsonate acid [40 CFR §180.289].

Active MSMA and DSMA end-use products are registered to MAA Task Force Three members. MSMA 4 and 6 lb/gal SC/L formulations and a 6 lb/gal EC (California only) are registered for application to citrus orchards, including orange, grapefruit, tangerine, lemon, and lime, at 2-4 lb ai/A/application in 50- 100 gal of water. A 81 % SC/S formulation of DSMA is registered for virtually identical use on citrus at 4.9 lb ai/A/application. These MSMA and DSMA application rates are equivalent in terms of total arsenic in water-soluble form at ~2 lb ai/A (expressed as elemental). A maximum of three applications per year are permitted. No PHI has been established.

Four representative DSMA labels registered to members of the MAA Task Force Three were examined for this review. The DSMA product used in the field trials, Ansar 8100 Herbicide® (EPA Reg. No. 50534-46), and the Luxembourg-Pamol DSMA 81P® (EPA Reg No. 42519-7), both 81 % SC/S formulations, specify a rate of 4.9 lb ai/A/application; however, the other two products, Drexel DSMA Slurry® (EPA Reg. No. 63239-14) and Ansar DSMA Liquid® (EPA Reg. No. 50534-42) list application rates of 7.2 lb ai/A/application. As the submitted DSMA field trials support a rate of 4.9 lb ai/A, the Task Force registrants must revise all end-use product DSMA labels to specify a maximum single application rate to citrus fruit of 4.9 lb ai/A. Alternatively, a full battery of residue trials will be required with DSMA on citrus at 7.2 lb ai/A/application.

The MAA Task Force Three (1995; MRIDs 43605901 and 43683101) submitted data from field trials on citrus treated side-by-side with MSMA or DSMA. MSMA (6 lb/gal SC/L) was applied three times at 4 lb ai/A/application (1x) and DSMA (81 % SC/S) was applied three times at 4.9 lb ai/A to oranges in 12 tests with each salt, grapefruits in eight tests, lemons in six tests, and limes in one test. The treatment was applied broadcast, topical to the ground under and around citrus trees during the growing season by CO<sub>2</sub> backpack sprayer. Twenty-

seven tests were conducted with each salt for a total of 54 tests. Eight fruits per tree were collected from four quadrants of each plot on the day of the last application. Samples were frozen in the field and shipped frozen to PTRL-East, Richmond, KY where samples were composited and analyses were conducted. Total frozen storage intervals were 61 days to approximately 1 year prior to analysis using the GC/ECD method described above. The results are summarized in Tables 4-6.

The submitted residue data for MSMA and DSMA on citrus are adequate, provided the registrants amend all end-use product labels to specify a maximum single application rate of 4.9 lb ai/A for DSMA.

**Table 4. Residues of MSMA or DSMA and CA in/on orange harvested on the day of the last of three applications of MSMA or DSMA, respectively, at 4 lb ai/A/application or 4.9 lb ai/A/application.**

Location	MSMA (12 lb total ai/A)		DSMA (14.7 lb total ai/A)	
	Residues (ppm)			
	MSMA	CA	DSMA	CA
Waddell, AZ	<0.05	<0.05	<0.05	<0.05
Yuma, AZ	<0.05	<0.05	<0.05	<0.05
Ivanho, CA	<0.05	<0.05	<0.05	<0.05
Sanger, CA	<0.05	<0.05	<0.05	0.11
McFarland, CA	<0.05	<0.05	<0.05	0.08
Piru, CA	<0.05	<0.05	<0.05	<0.05
LaBelle, FL	not reported	not reported	<0.05	<0.05
Ft. Pierce, FL	<0.05	<0.05	<0.05	0.08
Windermere, FL	<0.05	<0.05	<0.05	<0.05
Frostproof, FL	<0.05	<0.05	<0.05	<0.05
Harlingen, TX	<0.05	<0.05	<0.05	<0.05
Weslaco, TX	<0.05	<0.05	<0.05	<0.05
Edinburg, TX	<0.05	<0.05	<0.05	<0.05

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Table 5.

Residues of MSMA or DSMA and CA in/on grapefruit harvested on the day of the last of three applications of MSMA or DSMA at 4 lb ai/A/application and 4.9 lb ai/A/application, respectively.

Location	MSMA (12 lb total ai/A)		DSMA (14.7 lb total ai/A)	
	Residues (ppm)			
	MSMA	CA	DSMA	CA
Summerton, AZ	<0.05	<0.05	<0.05	<0.05
Mecca, CA	<0.05	<0.05	<0.05	<0.05
Calipatria, CA	<0.05	<0.05	<0.05	<0.05
LaBelle, FL	<0.05	<0.05	<0.05	<0.05
Ft. Pierce, FL	<0.05	<0.05	<0.05	<0.05
Frostproof, FL	<0.05	<0.05	<0.05	<0.05
Raymondville, FL	<0.05	<0.05	<0.05	<0.05
Weslaco, TX	0.07	<0.05	<0.05	<0.05

Table 6.

Residues of MSMA or DSMA and CA in/on lemon or lime harvested on the day of the last of three applications of MSMA or DSMA at 4 lb ai/A/application and 4.9 lb ai/A/application, respectively.

Location	MSMA (12 lb total ai/A)		DSMA (14.7 lb total ai/A)	
	Residues (ppm)			
	MSMA	CA	DSMA	CA
Yuma, AZ	<0.05	0.08	<0.05	<0.05
Yuma, AZ	<0.05	<0.05	<0.05	<0.05
Mecca, CA	<0.05	<0.05	<0.05	<0.05
Calipatria, CA	<0.05	<0.05	<0.05	<0.05
Delano, CA	<0.05	<0.05	<0.05	<0.05
Goleta, CA	<0.05	<0.05	<0.05	<0.05
Immokalee, FL <sup>a</sup>	<0.05	<0.05	<0.05	<0.05

<sup>a</sup> Limes were tested at this site instead of lemons.

### **MASTER RECORD IDENTIFICATION NUMBERS**

43605901 Johnson, T. (1995) Field Crop Residue Trials for MSMA on Citrus (Raw Agricultural Commodities: Lab Project Number: 769:1812. Unpublished study prepared by PTRL East, Inc. 537 p.

43683101 Johnson, T. (1995) Disodium Methanearsonate: Field Crop Residue Trials for DSMA on Citrus (Raw Agricultural Commodities: Lab Project Number: 769:1820:769-01. Unpublished study prepared by PTRL East, Inc. 549 p.

### **AGENCY MEMORANDA CITED IN THIS REVIEW**

CBRS No.: None  
DP Barcode: None  
Subject: Required Number of Field Trials for Citrus Crop Group Tolerance for MSMA and DSMA [Memorandum of Telecon]  
From: M. Metzger  
To: CB Files  
Date: 3/8/93  
MRIDs: None

CBRS No.: None  
DP Barcode: None  
Subject: Monosodium methanearsonate (MSMA); Disodium methanearsonate (DSMA); Cacodylic acid (CA). Outcome of the 12/19/94 meeting of the HED Metabolism Committee.

From: C. Swartz and B. Cropp-Kohlligian  
To: HED Metabolism Committee, HED  
Date: 1/26/95  
MRIDs: None