BIOPESTICIDES REGISTRATION ACTION DOCUMENT

Tagetes Oil
PC Code : 176602

U.S. Environmental Protection Agency
Office of Pesticide Programs
Biopesticides and Pollution Prevention Division

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BIOPESTICIDES REGISTRATION ACTION DOCUMENT (BRAD) TEAM

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I. EXECUTIVE SUMMARY:

Tagetes oil is a new biochemical pesticide active ingredient intended for use as an insecticide/acaricide for the control of mites, whiteflies, aphids, thrips, mealybugs, scales, and pyslla on a variety of food crops. The active ingredient is extracted from the flowering herb, *Tagetes minuta* (Muster John Henry or Mexican Marigold). The major constituents of the identified components of tagetes oil are terpenes, which are found in a variety of essential oils. Tagetes oil, as *Tagetes patula L.*, *T. erecta L.*, or *T. minuta L*. (*T. glandulifera* Schrank), is approved by the U.S. Food and Drug Administration (FDA) for use in food as a natural flavoring substance and natural adjuvant (in the oil form only) under 21 CFR 172.510. Tagetes oil is also used in some cosmetics including shampoos, soaps and lotions (EWG, 2010).

The Biopesticides and Pollution Prevention Division (BPPD) determined that the data/information submitted for product chemistry and Tier I acute toxicity for tagetes oil satisfy the current guideline requirements. Acceptable scientific rationales were submitted for the subchronic [90-day oral (OCSPP 870.3100) and 90-day inhalation (OCSPP 870.3465)], developmental (OCSPP 870.3700), and mutagenicity data requirements [in vitro mammalian cell assay (OCSPP 870.5300 and 5375)] in lieu of data. BPPD determined that the rationales submitted were acceptable based on tagetes oil's toxicological and exposure profiles. Significant exposure to humans is not anticipated for tagetes oil based on low application rates, appropriate Personal Protective Equipment (PPE) requirements on the product label, and rapid degradation in the environment. BPPD granted a waiver from conducting a 90-day dermal study (OCSPP 870.3250) based on the rapid volatilization of the active ingredient and because prolonged dermal exposure is not expected (the product is not purposely applied to the skin and handlers/applicators are required to wear appropriate PPE). BPPD received data for the mutagencity data requirement [Ames test (OCSPP 870.5100)], which indicated that tagetes oil was not mutagenic with or without metabolic activation. Although the data requirements were satisfied for the new active ingredient, tagetes oil, BPPD notes that should future intended end-use product (EP) applications result in different anticipated exposures to humans, these data requirements may need to be readdressed.

For nontarget organisms and environmental fate data requirements (OCSPP 850.1010 to 850.4450), the applicant either submitted acceptable data/information for the EPs or the data were waived because the guideline study was not applicable. BPPD granted a request to bridge the data from the EPs to the active ingredient, tagetes oil, because the applicant indicated that the active ingredients in the EPs act synergistically; thus, the combination of these chemicals is more potent as an insecticide than each active ingredient alone. Therefore, the toxicological profile of the EPs is more relevant to the risk assessment than the toxicological profile of tagetes oil alone. Based on the nontarget organism data from the EPs, which indicated that the EPs were practically nontoxic, and the screening level risk assessment, the Agency determined that registered use of tagetes oil in the EPs should not result in adverse effects to birds, fish, aquatic invertebrates, plants, or nontarget insects.

Based on the acute toxicity data for tagetes oil, the active ingredient is toxicity category III. EPA has not identified any toxic endpoints for nontarget mammals, birds, plants, aquatic, or soil organisms. EPA has no concerns for any nontarget organisms exposed to tagetes oil when used

in accordance with approved label directions. Given that tagetes oil has very low toxicity and presents little, if any, risk to nontarget organisms, EPA has concluded that it is in the best interests of the public to issue the registration for the EPs, Bug Oil Food Use (EPA File Symbol No. 85937-E) and Bug Oil Ornamental (EPA File Symbol No. 85937-R), which contain this new active ingredient, tagetes oil.

BPPD has reviewed the data/information in support of the requirements for granting registration under Section 3(c)(5) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It has been determined that the data/information submitted adequately satisfy current guideline requirements (please refer to 40 CFR Subpart U § 158.2000).

On October 1, 2009, EPA announced a new policy to provide a more meaningful opportunity for the public to participate on major registration decisions before they occur. According to this policy, EPA provides a public comment period prior to making a registration decision for the following types of applications: new active ingredients, first food use, first outdoor use, first residential use; and any registration decisions for which the Agency believes there may be substantial public interest.

Consistent with the policy of making registration actions more transparent, tagetes oil was subject to a 30 day comment period as a "new active ingredient". The notice for this comment period included the draft Biopesticides Registration Action Document (BRAD) and draft product labels for the EPs, Bug Oil Food Use and Bug Oil Food Ornamental, which contain this new active ingredient, tagetes oil. The docket identification (ID) number is EPA-HQ-OPP-2009-0822. The Agency did not receive any comments on the registration of tagetes oil. Therefore, the Agency is issuing the registration for this active ingredient. The Agency believes that based on the risk assessment and information submitted in support of the registration of the EPs containing tagetes oil, it is in the best interests of the public to issue the registration for Bug Oil Food Use and Bug Oil Food Ornamental. The basis for this decision can be found in the risk assessment for tagetes oil, which is characterized in this BRAD.

II. ACTIVE INGREDIENT OVERVIEW

Common Name: Tagetes Oil

Chemical Names: N/A

Trade & Other Names: Marigold Oil

CAS Registry Number: 8016-84-0

OPP Chemical Code: 176602

Type of Pesticide: Biochemical Pesticide (Insecticide/Acaricide)

III. REGULATORY BACKGROUND

On September 18, 2009, EPA received an application filed by Exponent, 1150 Connecticut Avenue, NW, Suite 1100, Washington, DC 20036, on behalf of Plant Impact plc, 12 South Preston Office Village, Cuerden Way, Bamber Bridge, Preston, PR5 6BL, United Kingdom, to register the products, Bug Oil Food Use (EPA File Symbol No. 85937-E) and Bug Oil Ornamental (EPA File Symbol No. 85937-R) containing the new biochemical active ingredient, tagetes oil, and the currently registered active ingredients, canola oil, thyme oil, and wintergreen oil. A notice of receipt (NOR) of this application, allowing for a 30-day comment period, was published in the Federal Register on December 16, 2009 (74 FR 66639). No comments were received following this publication.

A. Classification

On July 6, 2006, the biochemical classification committee determined that tagetes oil is marigold oil, which was previously classified as a biochemical in 1997 due to its nontoxic mode of action, natural occurrence in the environment, and history of exposure to humans and the environment demonstrating minimal toxicity. Tagetes oil is derived from Tagetes spp. (marigolds), specifically, African marigold (*Tagetes erecta*) and Aztec marigold (*Tagetes minuta*). The mode of action is repellency by tagetes oil alone and suffocation by tagetes oil in conjunction with the other actives in the proposed EPs, canola oil, thyme oil, and wintergreen oil.

B. Food Clearances/Tolerances

The applicant filed a petition (PP 9F7619) proposing to establish an exemption from the requirement of a tolerance for residues of tagetes oil in or on all food commodities. A notice of filing (NOF), allowing for a 30-day comment period, was published in the Federal Register on December 16, 2009 (74 FR 66644). No comments were received following this publication. The Agency determined during the review of the petition that the active ingredient, tagetes oil, is an edible oil and is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 180.950(c). Therefore, the petition (PP 9F7619) filed by the applicant is no longer

applicable, nor needed, for this new active ingredient, tagetes oil, and has been withdrawn by the Agency.

IV. RISK ASSESSMENT

A. Active Ingredient Characterization

Tagetes Oil is a new biochemical pesticide active ingredient intended for use as an insecticide/acaricide for the control of mites, whiteflies, aphids, thrips, mealybugs, scales, and pyslla on a variety of food crops. The active ingredient is extracted from the flowering herb, *Tagetes minuta* (Muster John Henry or Mexican Marigold). There are many species within the *Tagetes* genus. The herb is non-native to the United States, but is found in California, Hawaii, and in most of the states on the east coast (USDA Plants Database, 2010). It has a widespread geographic distribution, but is prevalent in subtropical and tropical climates. The major constituents of the identified components of tagetes oil are terpenes, which are found in a variety of essential oils.

Tagetes oil, as *Tagetes patula L.*, *T. erecta L.*, or *T. minuta L.* (*T. glandulifera* Schrank) is approved by the U.S. Food and Drug Administration (FDA) for use in food as a natural flavoring substance and natural adjuvant (in the oil form only) under 21 CFR 172.510. Reported uses of tagetes oil as a food additive are in alcoholic beverages, nonalcoholic beverages, baked goods, chewing gum, condiments (e.g., relishes), frozen dairy, gelatins (e.g., puddings), hard candy, and soft candy (Burdock, 2005). Tagetes oil is also used in some cosmetics including shampoos, soaps and lotions (EWG, 2010).

Descriptions of the product formulation and production process, formation of impurities, and physical and chemical characteristics were examined by BPPD and found to be acceptable in meeting current guideline standards.

All product chemistry data requirements for registration of tagetes oil have been **satisfied.**

For more information regarding product chemistry data requirements, refer to Tables 1 and 2 in Appendix A.

B. Human Health Assessment

1. Toxicology

For acute toxicity data requirements, toxicity categories are assigned based on the hazard(s) identified from studies and/or information on file with the Agency. The active ingredient is classified into Toxicity Category I, II, III or IV where Toxicity Category I indicates the highest toxicity and Toxicity Category IV indicates the lowest toxicity.

Adequate mammalian toxicology data/information is available to support registration of tagetes oil. All toxicology data requirements for tagetes oil have been **satisfied.**

a. Acute Toxicity

Acute toxicity testing is required to 1) determine systemic toxicity from acute exposure via the dermal, inhalation and oral routes, 2) determine irritant effects from exposure to the eyes, and 3) determine the potential for skin sensitization (allergic contact dermatitis).

Tier I acute toxicity studies submitted and reviewed showed that tagetes oil is a toxicity category III (slightly toxic) compound via acute dermal route of exposure, based on testing at a limit dose of 2000 mg a.i./kg in rats, and is moderately irritating to the skin based on the results of a primary dermal irritation study in rabbits. Tagetes oil falls in Toxicity Category IV (not toxic) for acute oral toxicity, acute inhalation toxicity, and primary eye irritation. Tagetes oil is minimally irritating in the eye and is not a dermal sensitizer.

For more information regarding acute toxicity data requirements, refer to Table 3 in Appendix A.

b. Subchronic Toxicity

Subchronic data are required to determine a no-observed-effect-level (NOEL) and any toxic effects associated with repeated or continuous exposure to a test substance for a period of ninety days.

Rationale was submitted for the subchronic [90-day oral (OCSPP 870.3100) and 90-day inhalation (OCSPP 870.3465)] in lieu of data. BPPD determined that the rationale submitted was acceptable based on the EPs toxicological and exposure profile, summarized below.

i. Tagetes oil is an edible oil and is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 180.950(c).
ii. Tagetes oil is an edible oil and is already consumed in the human diet as it is used as a food additive and FDA has approved the use of the oil (in oil form only) with no limitations as a food additive under 21 CFR 172.510.
iii. Significant exposure to humans is not anticipated based on low application rates and rapid degradation in the environment.
iv. Significant repeat exposure of tagetes oil to humans as a gas, vapor, or aerosol is not anticipated based on the use pattern.

A waiver requested for the subchronic [90-day dermal (OCSPP 870.3250)] was granted by BPPD, based on the EPs toxicological and exposure profile, summarized below.

i. Prolonged dermal exposure is not expected because the product is not purposely applied to the skin and handlers/applicators are required to wear appropriate PPE.
ii. Tagetes oil is expected to volatilize rapidly after application.

For more information regarding the subchronic data requirements, refer to Table 3 in Appendix A.

c. Developmental Toxicity and Mutagenicity

A rationale for lack of toxicity was submitted for the developmental toxicity data requirement (OCSPP 870.3700) in lieu of data. BPPD determined that the rationale submitted was acceptable based on the EPs toxicological and exposure profile, summarized below.

i. Tagetes oil is an edible oil and is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 180.950(c).
ii. Tagetes oil is an edible oil and is already consumed in the human diet as it is used as a food additive and FDA has approved the use of the oil (in oil form only) with no limitations as a food additive under 21 CFR 172.510.
iii. Significant exposure to female humans is not anticipated based on low application rates, appropriate PPE requirements on the label, and rapid degradation in the environment.

The tier I mutagenicity study [Ames test (OCSPP 870.5100)] submitted and reviewed showed that tagetes oil concentrations of up to 5,000 ug/plate were not mutagenic with or without metabolic activation. Rationale was submitted for the Tier I mutagenicity data requirement [in vitro mammalian cell assay (OCSPP 870.5300 and 5375)] in lieu of data. BPPD determined that the rationale submitted was acceptable based on the EPs toxicological and exposure profile, summarized below.

i. Tagetes oil is an edible oil and is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 180.950(c).
ii. Tagetes oil is an edible oil and is already consumed in the human diet as it is used as a food additive and FDA has approved the use of the oil (in oil form only) with no limitations as a food additive under 21 CFR 172.510.
iii. Significant exposure to humans is not anticipated based on low application rates, appropriate PPE requirements on the label, and rapid degradation in the environment.

For more information regarding developmental and mutagenicity data requirements, refer to Table 3 in Appendix A.

d. Tier II/Tier III

The data requirements were not required due to the nature of the active ingredient and its intended uses in potential new EP products (insecticides and acaricides).

e. Effects on the Endocrine System

As required under FFDCA section 408(p), EPA has developed the Endocrine Disruptor Screening Program (EDSP) to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a “naturally occurring estrogen, or other such endocrine effects as the Administrator may designate.” The EDSP employs a two-tiered approach to making the statutorily required

determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and nine inert ingredients. This list of chemicals was selected based on the potential for human exposure through pathways such as food and water, residential activity, and certain post-application agricultural scenarios. This list should not be construed as a list of known or likely endocrine disruptors.

Tagetes oil is not among the group of 58 pesticide active ingredients on the initial list to be screened under the EDSP. Under FFDCA section 408(p) the Agency must screen all pesticide chemicals. Accordingly, EPA anticipates issuing future EDSP test orders/data call-ins for all pesticide active ingredients.

For further information on the status of the EDSP, the policies and procedures, the list of 67 chemicals, the test guidelines and the Tier 1 screening battery, please visit our website: http://www.epa.gov/endo/.

2. Dose Response Assessment

Because no toxicological endpoints were identified for this active ingredient, a dose response assessment was not required.

3. Drinking Water Exposure and Risk Characterization

No significant exposure via drinking water is expected when tagetes oil is used according to the product label directions. The active ingredient biodegrades rapidly in the environment (59% volatilization in 48 hours), is applied at low application rates and is not directly applied to water; therefore, residues of tagetes oil are unlikely to accumulate in drinking water. In the unlikely event that exposure via drinking water does occur, the health risk would be expected to be minimal based on the low acute oral toxicity of tagetes oil and the fact that tagetes oil is an edible oil and is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 180.950(c).

4. Occupational, Residential, School and Day Care Exposure and Risk Characterization

a. Occupational Exposure and Risk Characterization

An occupational exposure assessment was not conducted for tagetes oil, and is not required. Appropriate PPE requirements on the label will mitigate any potential exposure to applicators and/or handlers. Additionally, no relevant toxicological endpoints have been identified. Based on

the data and information available to the Agency, anticipated exposure is not likely to result in unreasonable risk to humans.

b. Residential, School and Day Care Exposure and Risk Characterization

Exposure to tagetes oil will be minimal in residential, school, and day care areas, as the product containing this active ingredient is intended for use on horticultural and agricultural crops.

5. Aggregate Exposure from Multiple Routes Including Dermal, Oral, and Inhalation

There is reasonable certainty that no harm to the U.S. population will result from aggregate exposure to tagetes oil. This includes all exposures for which there is reliable information. The Agency arrived at this conclusion based on the lack of toxicity of this active ingredient and the already widespread exposure without any reported adverse effects on human health. The risks from aggregate exposure via oral, dermal and inhalation exposure are a compilation of three low-risk exposure scenarios and are negligible.

6. Cumulative Effects

Pursuant to FFDCA section 408(b)(2)(D)(v), EPA has considered available information concerning the cumulative effects of tagetes oil residues and other substances that have a common mechanism of toxicity. No toxicological endpoints have been established for exposure to tagetes oil; therefore, cumulative effects with other substances that share a common mechanism of toxicity are not expected.

7. Risk Characterization

The Agency considered human exposure to tagetes oil in light of the relevant safety factors in FQPA and FIFRA. A determination has been made that no unreasonable adverse effects to the U.S. population in general, and to infants and children in particular, will result from the use of tagetes oil when label instructions are followed.

C. ENVIRONMENTAL ASSESSMENT

1. Ecological Hazards

Adequate nontarget toxicology data/information is available to support registration of tagetes oil with the submission of nontarget toxicology data on the EPs. All nontarget toxicology data requirements for tagetes oil have been **satisfied.**

The EPs are practically nontoxic to birds, fish and aquatic invertebrates and is not phytotoxic. The EPs are practically nontoxic via exposure through contact to nontarget insects.

For more information regarding nontarget organism toxicity data requirements, refer to Table 4 in Appendix A.

2. Environmental Fate and Ground Water Data

Environmental fate and groundwater data are not required at this time because the results of the nontarget organism toxicity assessment (Tier I data requirements) did not trigger these Tier II data requirements.

3. Ecological Exposure and Risk Characterization

Toxicity studies have not been submitted for tagetes oil. A lack of toxicity rationale and data on the proposed EPs have been submitted to fulfill these data requirements. According to the applicant, the active ingredients act synergistically; thus, the combination of these chemicals is more potent as an insecticide than each ingredient alone. Therefore, the toxicological profile of the EPs are germane to the risk assessment rather than the toxicological profile of tagetes oil alone. For registration of the proposed EPs, the Agency has bridged the nontarget organism toxicology data from the EPs to the active ingredient, tagetes oil. The product is a contact insecticide that operates through a physical mode of action. The product is practically nontoxic to birds, fish and aquatic invertebrates and is not phytotoxic; toxic endpoints have not been identified for these species. The product is practically nontoxic via exposure through contact to nontarget insects. Based on the data submitted, the Agency has indicated in its review that the product may be moderately toxic via oral exposure to nontarget insects; however, no mortality was observed at the highest dose tested in the study. Additionally, significant oral exposure is not anticipated as the product is a contact insecticide and is expected to degrade rapidly in the environment. Toxic endpoints have not been identified for nontarget insects via the oral or contact route of exposure. The results of the submitted studies and screening-level risk assessment indicate that use of the product according to label instructions should not result in adverse effects to birds, fish, aquatic invertebrates, plants or nontarget insects.

4. Endangered Species Assessment

The Agency has not conducted a risk assessment that supports a complete endangered species determination. The ecological risk assessment planned during registration review will allow the Agency to determine whether tagetes oil's use has "no effect" or "may effect" federally listed threatened or endangered species (listed species) or their designated critical habitats. When an assessment concludes that a pesticide's use "may affect" a listed species or its designated critical habitat, the Agency will consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Services (the Services) as appropriate.

D. EFFICACY DATA

Product performance data must be developed for all pesticides to ensure that pesticide products will perform as intended and that unnecessary pesticide exposure to the environment will not occur as a result of the use of ineffective products. The Agency reserves the right to require on a case-by- case basis, submission of efficacy data for any pesticide product registered or proposed for registration that are intended to be used to control a pest of significance public health importance and a public health pest as defined in FIFRA section 28(d) and section 2(nn). For further guidance on product performance requirement, refer to Pesticide Registration Notice (PR)

Notices 96-7, 2002-1 and Explanation of Statutory Framework for Risk-Benefit Balancing for Public Health Pesticides (http://www.epa.gov/PR_Notices/pr1996-7.pdf) (http://www.ea.gov/PR_Notices/pr2002-1.pdf) and (http://www.epa.gov/pesticides/health/risk-benefit.htm).

The EPs submitted with this new active ingredient did not list pests of significance public health importance or a public health pest as defined in FIFRA section 28(d) and section 2(nn). Therefore, product performance (efficacy) was not evaluated.

V. Risk Management Decision

A. Determination of Eligibility for Registration

Section 3(c)(5) of FIFRA provides for the registration of a new active ingredient if it is determined that: (A) its composition warrants proposed claims; (B) its labeling and other materials comply with the requirements of FIFRA; (C) it will perform its intended function without unreasonable adverse effects on the environment; and (D) when used in accordance with widespread and commonly recognized practice, it will not generally cause unreasonable adverse effects on the environment.

The four criteria of the Eligibility Determination for Pesticidal Active Ingredients are satisfied by the science assessments supporting products containing the technical grade active ingredient, tagetes oil. Such products are not expected to cause unreasonable adverse effects. Therefore, tagetes oil as a technical grade active ingredient is eligible for registration for the labeled uses.

B. Regulatory Decision

The data submitted fulfill the registration requirements of tagetes oil for use as an insecticide and acaricide. Refer to Appendix B for product-specific information.

Conditional/Unconditional Registration

All data requirements are fulfilled, and EPA determined that an unconditional registration of tagetes oil is appropriate.

C. Environmental Justice

EPA seeks to achieve environmental justice—the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income—with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. At this time, EPA does not believe that use of tagetes oil pesticide products will cause harm or a disproportionate impact on at-risk communities. For additional information regarding environmental justice issues, please visit EPA's website at *http://www.epa.gov/compliance/environmentaljustice/index.html*.

VI. ACTIONS REQUIRED BY REGISTRANTS

EPA evaluated all data submitted in connection with the registration of the tagetes oil pesticide products and determined that these data are sufficient to satisfy current registration data requirements. At this time, no additional data must be submitted to EPA for these particular products. For new uses and/or changes to existing uses, EPA may require additional data.

Notwithstanding the information stated in the previous paragraph, it should be clearly understood that certain specific data are required to be reported to EPA as a requirement for maintaining the Federal registration for a pesticide product. A brief summary of these types of data are listed below.

A. Reporting of Adverse Effects

Pursuant to FIFRA section 6(a)(2), reports of all incidents of adverse effects to the environment must be submitted to EPA.

B. Reporting of Hypersensitivity Incidents

Additionally, all incidents of hypersensitivity (including both suspected and confirmed incidents) must be reported to the Agency under the provisions of 40 CFR Part 158.2050(d).

VII. Appendix A. Data Requirements (40 CFR Part 158-Subpart U)

*NOTE: Master Record Identification (MRID) numbers listed in the following tables are representative of supporting data/information for the original registration of the product containing this active ingredient. Subsequent to this registration, there may be additional MRIDs that support registration of other products containing this active ingredient.

TABLE 1. Product Chemistry Data Requirements for Tagetes Oil (40 CFR § 158.2030)

OPPTS Guideline No.	Study	Results	MRID
830.1550 to 830.1670	Product identity; Manufacturing process; Discussion of formation of unintentional ingredients	Acceptable; Confidential Business Information (CBI)	47868201
830.1700	Analysis of samples	Acceptable; CBI	
830.1750	Certification of limits	Limits listed in the CSF are adequate / acceptable.	47868201
830.1800	Analytical method	Acceptable; CBI	

TABLE 2. Physical and Chemical Properties of Tagetes Oil (40 CFR § 158.2030)			
OPPTS Guideline No.	**Property**	**Description of Result**	**MRID**
830.6302	Color	Yellow to orange	47868202
830.6303	Physical State	Liquid	47868202
830.6304	Odor	Bright, diffusive, fruity-floral	47868202
830.6313	Stability to Normal and Elevated Temperatures, Metals and Metal Ions	Stable under normal and elevated temperatures for 14 days. No evidence of instability under contact with metals and metal ions for 14 days at ambient and elevated temperatures. Some color and physical state changes to the metal ions were observed during the study.	48649812
830.6315	Flammability	Flashpoint = 63°C 43°C	47868203 47868202
830.6317	Storage Stability	Not required for TGAI.	
830.6319	Miscibility	Not applicable, the product is not to be mixed with petroleum solvents.	
830.6320	Corrosion Characteristics	Not required for TGAI.	
830.7000	pH	3.79 (neat oil) 4.43 (1% dilution)	47868203
830.7050	UV/Visible light absorption	UV profiles are similar under all pH conditions. No significant molar absorbance (ε) at the wavelength range of 290-750 nm. Neutral pH: ε = 44.52, 45.98 at wavelength 237 nm Basic pH: ε = 40.13, 44.80 at wavelength 237 nm Acidic pH: ε = 45.38, 47.81 at wavelength 237 nm	48649806
830.7100	Viscosity	1.5-4.05 mPa at shear rates of 5-200 rpm at 20°C	47868202
830.7200	Melting Point/Range	Not applicable, the product is a liquid.	
830.7220	Boiling Point/Range	190°C	47868202
830.7300	Density	Specific gravity = 0.870 at 20°C	47868202
830.7370	Dissociation Constant in Water	Does not dissociate in water.	47730401 47730409
830.7550 830.7560 830.7570	Partition Coefficient (n-Octanol/Water)	Values estimated using KOWWIN version 1.68 (US EPA) were submitted for the major components of tagetes oil, as the oil itself is not amenable to testing. Limonene: Log K_{ow} = 4.83 Ocimene: Log K_{ow} = 4.80 Dihydrotagetone Log K_{ow} = 2.92 Linalool Log K_{ow} = 3.38	48649802
830.7840	Water Solubility	Insoluble	47868202
830.7950	Vapor Pressure	Approximately 59% volatilization (measured via weight loss) in 48 hours in laboratory study.	48329208

Table 3. Mammalian Toxicology Data Requirements for Tagetes Oil (40 CFR § 158.2050)			
Study/OPPTS Guideline No.	**Results**	**Toxicity Category/Description**	**MRID**
Acute oral toxicity (rat) (870.1100)	LD_{50} >5,000 mg/kg (females)	IV	47868213
Acute dermal toxicity (rats) (870.1200)	LD_{50} >2000 mg/kg for males, females, and for both sexes combined	III	47868214
Acute inhalation toxicity (870.1300)	LC_{50} > 5.20 mg/L	IV	48329203
Primary eye irritation (870.2400)	Minimally irritating: positive conjunctival irritation and moderate reddening of sclerae were noted on 3/3 rabbits one hour post-instillation with clearance by 24 hours.	IV	47868215
Primary dermal irritation (rabbit) (870.2500)	Moderately irritating: well defined erythema on 3/3 rabbits one hour after patch removal with clearance on one rabbit by day 7, with reduction to very slight erythema on the second rabbit by 72 hours and clearance by day 7, and with reduction to very slight erythema on the third rabbit by day 7 and clearance by day 10. Very slight edema on 3/3 rabbits one hour after patch removal with clearance by 24 hours. Scaling on all rabbits on day 7 with clearance on two rabbits by day 14 and persistence on one rabbit through day 14.	III	47868216
Dermal sensitization (guinea pig) (870.2600)	Not a sensitizer. No positive signs of reactivity at 24 and 48 hours after challenge in test and naïve control animals after three consecutive weekly inductions.		47868217
90-Day oral toxicity (870.3100)	Rationale was provided in lieu of a 90-day oral study. Tagetes oil is exempt from the requirement of a tolerance as a minimal risk active ingredient under 40 CFR 158.950(c). Significant exposure is not expected based on low application rates and rapid degradation in the environment. Tagetes oil is an edible oil and is already consumed in the human diet as it is used as a food additive in alcoholic beverages, baked goods, condiments, frozen dairy, gelatins, puddings, candy, and nonalcoholic beverages.		48339002
90-Day dermal toxicity (870.3250)	Waived: prolonged dermal exposure not anticipated based on use pattern, volatility (anticipated volatility-vapor pressure data must be submitted) of active ingredient and appropriate PPE requirements on label.		
90-Day inhalation toxicity (870.3465)	Rationale was provided in lieu of a 90-day inhalation study. Significant repeat exposure to humans to tagetes oil as a gas, vapor or aerosol is not anticipated based in the use pattern. Additionally, significant exposure is not expected based on low application rates and rapid degradation in the environment.		48339002

Table 3. Mammalian Toxicology Data Requirements for Tagetes Oil (40 CFR § 158.2050)			
Study/OPPTS Guideline No.	**Results**	**Toxicity Category/Description**	**MRID**
Mutagenicity (Ames) (870.5100, 5300 and 5375)	Not mutagenic with or without metabolic activation in *Salmonella typhimurium* strains TA 98, TA 1537, TA 100, TA 1535 and *Escherichia coli* strain Wp2uvrA. Rationale was provided in lieu of an *in vitro* mammalian cell assay. Significant exposure to humans is not anticipated based on low application rates, appropriate PPE requirements on the label, and rapid degradation in the environment. Additionally, humans are already exposed to tagetes oil in the diet, as it is an edible oil and is used as a food additive in alcoholic beverages, baked goods, condiments, frozen dairy, gelatins, puddings, candy, and nonalcoholic beverages.		48329205
Developmental toxicity (870.3700)	Rationale was provided in lieu of a developmental study. Significant exposure to female humans is not anticipated based on low application rates, appropriate PPE requirements on the label, and rapid degradation in the environment. Humans are also already exposed to tagetes oil, as it is an edible oil and is used as a food additive in alcoholic beverages, baked goods, condiments, frozen dairy, gelatins, puddings, candy, and nonalcoholic beverages.		48339002

Table 4: Nontarget Organism Toxicity Data Requirements for Bug Oil Food Use (40 CFR § 158.2060)			
Study/OCSPP Guideline No.	**Results**	**Toxicity Category/Description**	**MRID**
Avian acute oral toxicity *Colinus virginianus* (850.2100)	LD_{50} > 10,000mg/kg NOEL = 10,000 mg/kg	Practically non-toxic[1]	47868219
Avian dietary toxicity *Colinus virginianus* (850.2200)	NOEL = 12,945 mg/kg bw-day (50,000 ppm)	Practically non-toxic[1]	47868220
Aquatic invertebrate acute toxicity *Daphnia magna* (850.1010)	EC_{50} > 1000 mg/L	Practically non-toxic[1]	47868223
Freshwater fish LC_{50} *Oncorhynchus mykiss* (850.1075)	LC_{50} > 1000 mg/L	Practically non-toxic[1]	47868222
Non-target plant studies (850.4000-4800, as applicable)	Adequate information to support data requirement: non-phytotoxic to a variety of ornamental and edible plants including tomato, chrysanthemum, lemon, zucchini, lantana, pansy and impatiens in efficacy trials.	Not phytotoxic[1]	47868237
Non-target insect testing (880.4350)	*Apis millifera* (honeybee): oral LD_{50} > 9.4 μg a.i./bee. *Apis millifera* (honeybee): contact LD_{50} > 12.01 μg a.i./bee. *Coccinella septempunctata* (ladybird beetle): mortality: 12.5% and 20.0% at 2 L/ha and 4	Moderately toxic to honeybees[1]	47868224 47868225 47868226

Table 4: Nontarget Organism Toxicity Data Requirements for Bug Oil Food Use (40 CFR § 158.2060)			
Study/OCSPP Guideline No.	**Results**	**Toxicity Category/Description**	**MRID**
	L/ha, respectively; reproduction: decrease in viable eggs/female/day at 2 L/ha and increase in viable eggs/female/day at 4 L/ha. *Aphidus rhopalosipi* (parasitic wasp): mortality: 80.0% and 95.0% at 2 L/ha and 4 L/ha, respectively at 48-hours. *Aphidus rhopalosipi* (parasitic wasp): 48-hour LR_{50} > 64 L/ha, NOER ≥ 64 L/ha (mortality and reproduction), LOER > 64 L/ha (mortality and reproduction). *Typhlodromus pyri* (parasitic mite): mortality: 98.0% and 99.0% at 2 L/ha and 4 L/ha, respectively after 7 days. *Typhlodromus pyri* (parasitic mite): 7-day LR_{50} > 64 L/ha, NOER = 32 L/ha (mortality), LOER = 64 L/ha (mortality), NOER > 4 L/ha (reproduction), LOER = 4 L/ha (reproduction).		47828227 47868228 47868229 47868230
Algal Toxicity (850.5400)	*Pseudokirchneriella subcapitata*: 96-hour EbC50 (biomass), ErC50 (growth rate), and EyC50 (yield) > 1000 mg/L, NOEC = 1000 mg/L		47868231

[1] Studies were conducted using the proposed EP. Request to bridge data from EP to tagetes oil is acceptable.
[2] Studies were conducted at application rates well below the recommended application rates on the proposed EP label (maximum rate on label = 41 L/ha).

VIII. Appendix B.

For product specific information, please refer to http://www.epa.gov/pesticides/pestlabels.

IX. Appendix C.

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X. GLOSSARY OF ACRONYMS AND ABBREVIATIONS

a.i.	active ingredient
BPPD	Biopesticides and Pollution Prevention Division
BRAD	Biopesticide Registration Action Document
bw	body weight
CBI	Confidential Business Information
CFR	Code of Federal Regulations

cm^3	cubic centimeter
CSF	Confidential Statement of Formula
°C	degrees Celsius
EC_{50}	median effective concentration. A statistically derived single concentration in environmental medium that can be expected to cause an effect in 50% of the test animals when administrated by the route indicated (inhalation). It is expressed as a concentration in air or water (e.g. mg/L).
EDSP	Endocrine Disruptor Screening Program
EDSTAC	Endocrine Disruptor Screening and Testing Advisory Committee
EP	end-use product
EPA	Environmental Protection Agency (the "Agency")
FDA	Food and Drug Administration
FFDCA	Federal Food, Drug, and Cosmetic Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FQPA	Food Quality Protection Act
FR	Federal Register
g	gram
ha	hectare
kg	kilogram
Kow	octanol-water partition coefficient
L	liter
LC_{50}	median lethal concentration. A statistically derived single concentration in air or water that can be expected to cause death in 50% of the test animals when administrated by the route indicated (inhalation and environment). It is expressed as a concentration in air or water (e.g. mg/L).
LD_{50}	median lethal dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral and dermal). It is expressed as a weight of substance per unit weight of animal (e.g., mg/kg).
MRID No.	Master Record Identification Number
mg	milligram
mPa	millipascal
mL	milliliter
MP	manufacturing-use product
N/A	not applicable
NE	"No Effect"
NIOSH	National Institute for Occupational Safety and Health
nm	nanometer
NOEL	no-observed-effect-level
NOF	notice of filing
NOR	notice of receipt
OPP	Office of Pesticide Programs
OCSPP	Office of Chemical Safety and Pollution Prevention
pa	pascal
PPE	personal protective equipment

PR Notice	Pesticide Registration Notice
TGAI	technical grade of the active ingredient
ug	microgram
USDA	United States Department of Agriculture
UV	ultra-violet