ECO₂FUME® PHOSPHINE FUMIGANT AS A PRIMARY ALTERNATIVE TO METHYL BROMIDE FOR QPS APPLICATIONS

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Presentation Overview

1. ECO₂FUME® Features and Benefits
2. Indonesia Methyl Bromide Phase Out Plan
3. 2012 ASEAN Workshop on Phosphine Fumigation
4. ECO₂FUME® Fumigation Protocols for QPS (Quarantine and Pre-Shipment)
5. Methyl Bromide Phase-out in Indonesia
6. ECO₂FUME® for QPS Applications in Turkey
7. ECO₂FUME® for QPS Applications in Korea
1 - ECO₂FUME Fumigant Gas

- Pre-mixed, Ready to Use
- 2% Phosphine & 98% CO₂ by wt. in high pressure cylinder
- Non-flammable, no explosion risk
- Simple dispensing equipment
- Variable dispensing rates 0.2-15 kg/min
- 31 kg - 620 g Phosphine per cylinder

ECO₂FUME
2% PH₃ (wt.) in 98% CO₂
ECO₂FUME Cylinders

• Net weight: 31 kg
• Cylinder weight empty: 64 kg
• Cylinder weight full: ≈95 kg
• Shipping rack of 16 cylinders
• Gross weight of Rack: 1,650 kg
• Shall be moved by forklift truck
Advantages of ECO₂FUME

SAFER

GREENER

FASTER
Advantages of ECO$_2$FUME

External application
- Eliminate Confined Space Entry
- Reduce worker exposure
- Eliminate retrieval of partially spent fumigant

No waste by-products or residues
- No waste deactivation or disposal
- No dust residues on commodities post aeration

Environmentally friendly
- Non Ozone Depleting
- Non-Phytotoxic - new opportunities (fresh fruit)
- Decrease amount of PH$_3$ applied - Lower dosages

Ease of Application and Control
- Quick establishment of lethal concentrations
- Effective control of target insects
- Only 24 hr approved PH$_3$ fumigant

SAFER
GREENER
FASTER
2 - Indonesia Methyl Bromide Phase-Out Plan

• MeBr usage for QPS application in ASEAN increased by 10%/yr. in 2003-08

• Indonesia is one of larger consumers of MeBr in ASEAN for QPS

• The Indonesia Agricultural Quarantine Agency (AQA) and the Indonesia Applied Research Institute of Agricultural Quarantine (ARIAQ) have plans to eliminate MeBr for QPS by end 2014 - from 450 tons in 2008.

• Indonesia through AQA and ARIAQ has established a list of alternative treatments for methyl bromide replacement including QPS applications.
ALTERNATIVE TREATMENTS

1. PHOSPHINE
2. HEAT TREATMENT
3. SULFURYL FLOURIDE
4. ETHYLENE OXIDE
5. ETHYL FORMATE
6. HOT WATER TREATMENT
7. VAPOR HEAT TREATMENT
8. CA WITH NITROGEN
9. IRRADIATION
10. RADIATION

Source: Dr. Tasrif, Arifin - 2012
Ranking of Methyl Bromide Consumption For QPS in 2008

Source: Ozone Secretariat Data Access Centre – 2012 : Reports by Parties pursuant to Article 7 of the Montreal Protocol
MeBr Consumption For QPS in ASEAN in 2008

Source: Ozone Secretariat Data Access Centre - 2012 : Reports by Parties pursuant to Article 7 of the Montreal Protocol
MeBr Consumption For QPS in Indonesia 2001 to 2012

3 - ASEAN Workshop on Applications of Phosphine Fumigation

• Conducted in July 2012 at the training and R&D center of Indonesia Applied Research Institute of Agricultural Research Quarantine (ARIAQ) in Benkasi, Indonesia.

• The objectives are to share the knowledge and experience in the application of phytosanitary treatments among members to explore the advantages and the potential of ECO₂FUME to treat agricultural commodities from tropical countries.

• Attended by 30 officials and officers of the quarantine agencies of the ASEAN member countries (Indonesia, Thailand, The Philippines, Vietnam, Singapore, Malaysia, Brunei, Laos).
Participants from Quarantine Agencies of ASEAN member countries.
## 4 - ECO\textsubscript{2}FUME QPS Fumigation Protocols

<table>
<thead>
<tr>
<th>No.</th>
<th>Commodity</th>
<th>Plant Pest Type</th>
<th>ECO\textsubscript{2}FUME Dose</th>
<th>PH\textsubscript{3} Concentration</th>
<th>Exposure Time</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rice</td>
<td>Sitophilus zeamais Tribolium castaneum Oryzaephilus surinamensis</td>
<td>70 g/m³</td>
<td>1000 ppm</td>
<td>36 hours</td>
<td>24 – 29 °C</td>
</tr>
<tr>
<td>2</td>
<td>Stored</td>
<td>Rhizopertha dominica</td>
<td>50 g/m³</td>
<td>700 ppm</td>
<td>9 days, 5 days, 3 days</td>
<td>20 – 24 °C, 25 – 29 °C, 30 °C or more</td>
</tr>
<tr>
<td>3</td>
<td>Coffee</td>
<td>Araecerus fasciculatus</td>
<td>20 g/m³, 35 g/m³, 50 g/m³, 70 g/m³</td>
<td>300 ppm, 500 ppm, 700 ppm, 1000 ppm</td>
<td>4 days, 3 days, 2 days, 1 day</td>
<td>24 – 33 °C</td>
</tr>
<tr>
<td>4</td>
<td>Cacao</td>
<td>Ephestia sp.</td>
<td>20 g/m³, 35 g/m³, 50 g/m³, 70 g/m³</td>
<td>300 ppm, 500 ppm, 700 ppm, 1000 ppm</td>
<td>4 days, 3 days, 2 days, 1 day</td>
<td>24 - 33 °C</td>
</tr>
<tr>
<td>5</td>
<td>Tobacco</td>
<td>Lasioderma serricorne</td>
<td>25 g/m³</td>
<td>350 ppm</td>
<td>12 days</td>
<td>23 – 32 °C</td>
</tr>
<tr>
<td>6</td>
<td>Pineapples</td>
<td>Planococcus minor</td>
<td>14.28 g/m³</td>
<td>200 ppm</td>
<td>7 hours</td>
<td>26 – 30 °C</td>
</tr>
<tr>
<td>7</td>
<td>Mangosteen</td>
<td>Planococcus minor</td>
<td>14.28 g/m³</td>
<td>200 ppm</td>
<td>7 hours</td>
<td>26 – 30 °C</td>
</tr>
<tr>
<td>8</td>
<td>Phalaenopsis orchids</td>
<td>Planococcus minor</td>
<td>14.28 g/m³</td>
<td>200 ppm</td>
<td>7 hours</td>
<td>26 – 30 °C</td>
</tr>
</tbody>
</table>

Source: ARIAQ, CYTEC, and Tropical Biology Institute, 2012
Indonesia Decree Approving ECO$_2$FUME For QPS Uses

DECREE OF THE HEAD OF AGRICULTURAL QUARANTINE AGENCY
No: 1645/Kpts/KT.290/L/05/2013

ABOUT:

TECHNICAL STANDARDS OF PHOSPHINE FUMIGATION TREATMENT OF LIQUID FORMULATION (LIQUID PHOSPHINE)

WITH THE GRACE OF GOD ALMIGHTY
HEAD OF AGRICULTURAL QUARANTINE AGENCY,

Consideration:

a. That the Minister of Agriculture Rules No. 09/Permentan/OT.140/2/2009 established the Requirements and Procedures of Quarantine Measures on Importation of Carrier Media Plant Quarantine Organisms Into Indonesian Territory;

b. That the treatment measures against the carrier Plant Pest can be done by physical and/or chemical;

c. That the chemical treatment is conducted among others through fumigation;

d. That after carried out a comprehensive study against the liquid formulations of phosphine (Liquid Phosphine) proved can be used as a fumigant material because it can effectively eradicate some types of insects with relatively low levels of phytotoxicity;

e. That based on the above matters, and to follow the mandate of Article 26 of Regulation of the Minister of Agriculture No. 09/Permentan/OT.140/2/2009 need to establish technical standards for phosphine fumigation Treatment of Liquid Formulations (Liquid Phosphine) with the decision of the Head of Agricultural Quarantine Agency;

Refer to:

1. Law No. 16 of the year 1992 concerning Animal, Fish and Plant (State Gazette No.56, State Gazette Supplement No. 3842);

2. Law No. 7 of the year 1994 on Ratification of the Agreement Establishing the WTO (World Trade Organization Agreement) (State Gazette No. 57, State Gazette Supplement No. 3564);

DECISION:

Setting :

FIRST : Technical Standards of Phosphine Fumigation Treatment of Liquid Formulations (Liquid Phosphine).

SECOND : Technical Standard of Phosphine Fumigation Treatment of Liquid Formulation referred to the FIRST dictum is listed in the appendix as an integral part to this decision.

THIRD : Technical Standards Treatment of Phosphine Fumigation of Liquid Formulations referred to the SECOND dictum constitute of guidelines for plant quarantine officers and Third Party that has been set by the Head of Agricultural Quarantine Agency as an implementer in carrying out fumigation treatment using phosphine fumigation Liquid Formulations (Liquid Phosphine) for the purposes of the action quarantine and pre-shipment.

FOURTH : This decision is effective from the date of determined.

Stipulated in Jakarta
At the date of May 28, 2013

HEAD OF AGRICULTURAL QUARANTINE AGENCY

Ir. BANUN HARPINI, M.Sc
NIP. 106010191985032002

Copy of this decision was communicated to the honorable:
1. Agriculture Minister (as reported)
2. Secretary General of the Ministry of Agriculture
3. Inspector General of the Ministry of Agriculture
4. Head of Plant Quarantine and Plant Biosafety Agriculture Quarantine Agency
5. Head of central / institution and station agricultural quarantine in all of Indonesia.
Indonesia ECO$_2$FUME QPS Fumigation Manual
5 - MeBr Phase-out using ECO₂FUME in Indonesia

1. Project on methyl bromide replacement (>150 tons) with ECO₂FUME on exported woodchips

2. ECO₂FUME for methyl bromide replacement of exported coffee and cocoa beans and other exported commodities with QPS protocols

3. Establishment of ECO₂FUME fumigation protocols for other export commodities with Indonesia ARIAQ

4. Registration of VAPORPH₃OS in 2014 to complement ECO₂FUME for large volume applications
6 - ECO₂FUME® for QPS Applications in Turkey

Cut Flowers

• ECO₂FUME efficacy trials conducted by Ankara University Faculty of Agriculture to establish QPS fumigation protocols for export cut flowers (carnation, gerbera and roses) against thrips (*Frankliniella occidentalis*) and mites (*Tetranychus cinnabarinus*)

• 100% mortality of all stages of thrips and mites was achieved using:
  – 1000 ppm for 24 hours at 4°C
  – 500 ppm for 72 hours at 4°C.

• The 24 hours protocol using 70 g ECO₂FUME/m³ at 4°C is useful with fixed cold chambers

• The 72 hours protocol using 35 g ECO₂FUME/m³ at 4°C can be used for in-transit fumigation in refrigerated container.
ECO₂FUME® for QPS Applications in Turkey

Dried Fruits

• Efficacy trials conducted in collaboration with Ankara University Faculty of Agriculture and Agricultural Research Institute in Turkey

• ECO₂FUME QPS fumigation protocols for export dried fruits established against saw-toothed grain beetle (*Oryzaephilus surinamensis*) and raisin moth (*Ephestia figulilella*)

• 100% mortality of all stages of saw toothed grain beetle and raisin moth was achieved with a protocol of 1000 ppm (70 g ECO₂FUME/m³) for 24 hours at 23°C or higher.
7 - ECO$_2$FUME for QPS Application in South-Korea

• Efficacy trials conducted in collaboration with Korea National Plant Quarantine Services (NPQS) and Dongbu AgroLife Research Institute

• ECO$_2$FUME QPS fumigation protocols established against eggs and adults

**Strawberries**
- 1,100 ppm for 24 hours at 2°C
- 600 ppm for 24 hours at 10°C

**Cherry tomato**
- 25 ppm for 24 hours at 13°C

**Paprika**
- 30 ppm for 24 hours at 13°C

**Cut flowers**
- 1,400 ppm for 24 hours at 8°C

**Nursery Trees**
- 1,400 ppm for 48 hours at 15°C
Any Questions?

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