CURRENT PRACTICE IN FRESH FRUIT FUMIGATION WITH PHOSPHINE IN CHILE

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Abstract

This paper describes the current state of art in commercial fresh fruit fumigation using pure cylindered phosphine at low temperature as a mitigation fumigation as an alternative to methyl bromide. Some advantages of using pure phosphine, compared to methyl bromide, are that pure phosphine does not damage the fruit, does not leave residues in the fruits after treatment and that after liberated to the atmosphere, phosphine is oxidized into phosphoric acid by the action of sunlight, not affecting the ozone layer.

Phosphine fumigations are carried out at a temperature between –1.5 and 15 ºC with a concentration of pure phosphine free from ammonia, between 1,500 and 2,500 ppm (1-3.5 grams /m^3) in a sealed enclosure with a exposure time between 24 and 72 hours, depending on the target pest. The gas used for the described fumigations is VAPORPH_3OS, manufactured by Cytec, and the dispensing equipment used to dilute the gas with air is the HORN DYLUPHOS SYSTEM.

The gas is applied in fumigation chambers, cooling chambers or controlled atmosphere chambers of the Chilean fruit exporting companies.

At this moment more than 400 commercial fumigations have been realized in Chile during this year to different types of fruits.

The best way to do the treatment with phosphine is to fumigate the fruits directly in the cooling chambers where the fruit is stored after the selection process, leaving the cooling system working during the whole fumigation period.

The fruit are treated preferably at their cold storage temperature. For example, for apples, grapes, kiwis and berries, pears, nectarines, peaches, etc. it is preferred the treatment with temperatures from –1.5 to 2° C. Other fruits like avocados and citrus fruits are preferably treated between 6 and 8º C

The main condition to avoid damage to the fruit during the fumigation period is to maintain the temperature low, not warming up the fruits.

The cooling chambers are modified for the fumigation process, installing one phosphine-air-mixture injection pipe, that blows the gas into the chamber near the

fans of the cooling system in order to get a fast distribution of the gas inside the chamber, and a suction pipe, that suck the air from inside the chamber but far away from the injection point.

The air from inside the chamber is recirculated through the Horn Diluphos System (HDS), where the phosphine is added to the air flow. In this procedure, no increase of pressure is generated inside the enclosure to be fumigated.

Additionally, aeration systems are installed in the chambers, which allows for the aeration of chambers, depending of the size of the blowers, in less than 30 minutes.

The fumigations are monitored during the whole fumigation period using the FOSFOQUIM PHOSPHINE MONITOR reading and registering the concentration in the chamber every 4 minutes. Afterwards the customer receives a report with the phosphine concentration graph. If the concentration goes bellow a certain limit, additional phosphine is added.

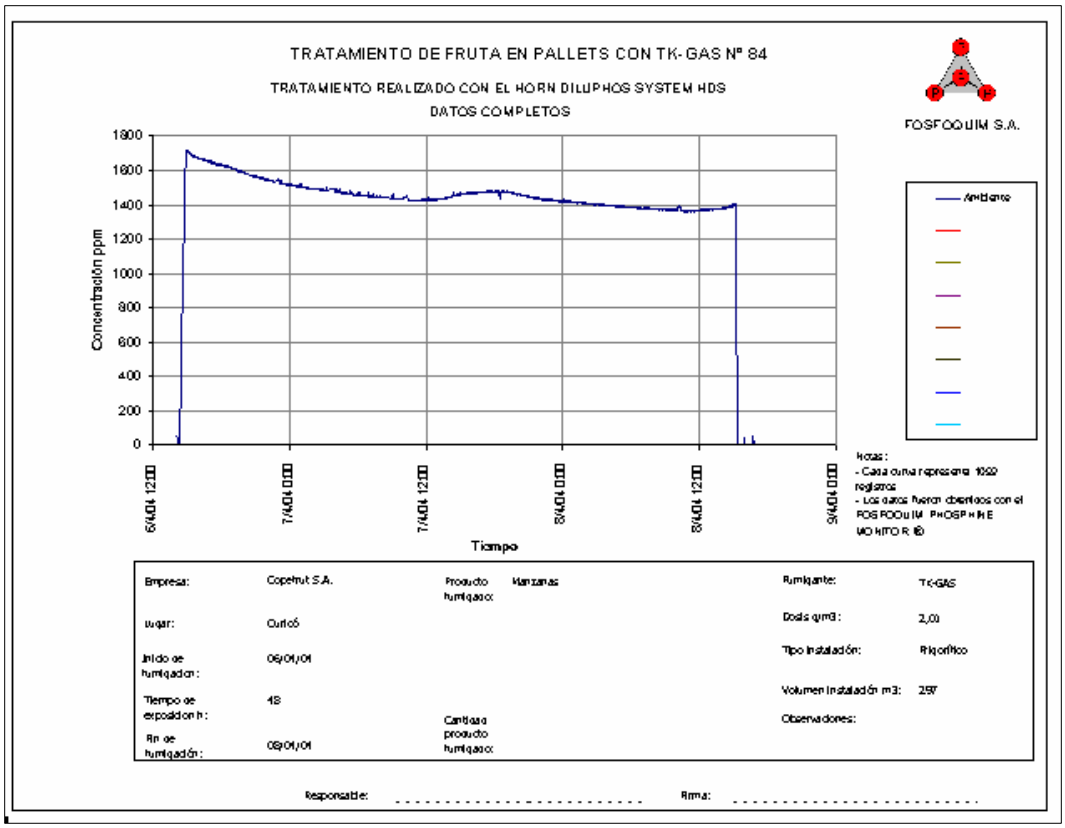
The method is used commercially as mitigation fumigation for the main pests of the fruit, such as the mealybugs, *Pseudococcus spp*; apple moth, *Cydia pomonella*; eulia, *Proeulia spp*; fruit tree weevil, *Naupactus xanthographus*; mediterranean fruit fly, *Ceratitis capitata*; fruit fly, *Rhagoletis spp, Bractocera spp, Anastrepha spp*; false Chilean mite, *Brevipalpus chilensis;* and *Thrips spp.*

Some considerations must be taken in order to assure a effective treatment.

A minimum gas concentration must be maintained during the whole fumigation period. If the chamber is leaky or the concentration goes bellow the limit, more gas must be added.

Different pests are more or less susceptible to phosphine. For that reason it is important to know prior to fumigation which is the target pest for each customer.

Heat exchangers of the cooling chambers should be in steel ratter than copper, since the copper will react with phosphine reducing concentration and damaging the heat exchangers.



Standard Phosphine concentration report during whole fumigation period.