EFFICACY OF A MIXTURE OF PHOSPHINE/CARBON DIOXIDE ON STORED PRODUCT INSECTS

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One of the disadvantages of phosphine (PH_3) as a fumigant is the long exposure times required for efficacy. This is especially true at lower temperatures. Phosphine, generated from metallic formulations, may take up 24 hours or longer to reach peak concentrations. Because of this process, the exposure time minimally recommend is generally 48 hours which eliminates quick turn around time for commodity fumigations and shipment as needed.

In this work, we determined efficacy on several stored product insect species using PH_3 directly from a gas cylinder mixture, carbon dioxide 98% and PH_3 2%, (ECO2FUME Fumigant Gas by Cytec Industries Inc.). In these studies, we replaced the first 24 hours formally required for reaction time with maximum concentrations of PH_3. Starting dosages tested were 250, 500 and 1000 ppm. The egg stage was most resistant to PH_3 fumigation. However, at 26.7 ^{O}C for 24-hour exposure and a CT Product (ppm·hr) of ≥4500, an average of 85 % mortality to eggs (1-3 days old) of the seven species tested were obtained. Under the same conditions with CT Products of ≥10,000 and ≥21,000, average mortality was 90.5 % and 98 % respectively. For post-embryonic stages, 95-100% mortality to pupae was obtained, 99.5 - 100% to larvae and 100 % to adults was obtained. When fumigation exposure times or temperatures were increased percent mortality increased. For instance, a 36 hours exposure with a temperature of 26.7°C, and CT Products (ppm·hr) of ≥7,000, ≥14,700, and ≥30,800, produced an average of 92 %, 95.5%, and 98% egg mortality respectively. Temperatures of 30°C, 32.5°C, and 35°C for 24-hour exposure and a CT Product (ppm·hr) of ≥5700 produced an average of 93.8%, 96.9 % and 99.7 % mortality to eggs respectively.

Species tested: Indian meal moth *Plodia interpunctella,* navel orangeworm *Amyelois transtella*, red flour beetle *Tribolium castanium,* confused flour beetle *Tribolium confusum,* warehouse beetle *Trogoderma variabile,* sawtoothed grain beetle *Orzaephilus surinamensis*, cigarette beetle *Lasioderma serricorn,* dried fruit beetle *Carpophilus hemipterus.*