W22

Control Indian meal moth *Plodia interpunctella* by gas treatment

Gyung Deok Han [a], Hyeok Kwon [a], Hyun Jung Jin [a], Ho Jung Kum [a], Bo Hwan Kim [a], Wook Kim [a,*]

[a] *Department of Biosystems and Biotechnology, Korea University, Seoul 02841, Republic of Korea*

Abstract

The Indian meal moth, *Plodia interpunctella*, is one of the most important pests of stored food in the food processing industry worldwide. To control the Indian meal moth, methyl bromide, phosphine, high carbon dioxide, sulfuryl fluoride and plant essential oil fumigation have been considered. However, these treatments have disadvantages. For example, depleting the ozone layer, showing resistance in insect, low control efficacy or need high cost for treatment. Chlorine dioxide (ClO_2) is strong disinfectant and insecticide. The gas caused a malfunction in enzymes. The oxidative stress induced by ClO_2 gas treatment damaged to a physiological system and all life stages of *P. interpunctella*. The gaseous ClO_2 is a convincing alternative to methyl bromide for controlling *P. interpunctella*. The gaseous ClO_2 was generated by a chlorine dioxide generator (PurgoFarm Co., Ltd., Hwasung, Korea). It generated highly pure ClO_2 gas and the gas blown out through a vent into a test chamber. Gas entry to the chamber was automatically controlled and monitored by a PortaSene II gas leak detector (Analytical Technology, Collegeville, PA, USA). The properly prepared eggs, larvae, pupae, and adults of *P. interpunctella* were used in this experiment. Data were analyzed using SAS 9.4. Percentage data were statistically analyzed after arcsine-root transformation. Analysis of variance was performed using general linear model, and means were separated by the least significant difference test at $P < 0.05$. Fumigation is an effective management technique for controlling all stages of *P. interpunctella*. We found that ClO_2 gas treatment directly effects on egg, larvae, pupae and adults of *P. interpunctella*. The gas treatment with proper concentration for over a day achieved 100 % mortality in all stages of *P. interpunctella* and short time treatment or low concentration gas treatment results showed that the egg hatchability, pupation rate, and adult emergency rate were lowered compare with untreated control. Also, abnormal pupae or adult rate were increased. Gaseous ClO_2 treatment induced insecticidal reactive oxygen species (ROS), and it resulted in fatal oxidative stress in *P. interpunctella*. Taken together, these results showed that exposure proper concentration and time of the gas control all stages of *P. interpunctella* by inducing fatal oxidative stress. Further studies will be required to apply the gas treatment under real-world condition and to understanding physiological reaction in *P. interpunctella* caused by oxidative stress.

Acknowledgement

This study was supported by Korea University, and Korea Institute of Planning & Evaluation for Technology in Food, Agriculture, Forestry & Fisheries (114063-03).

Keywords: Postharvest, Gas treatment, Oxidative stress, Stored porducts

Corresponding author*
Wook Kim
Address Department of Biosystems and Biotechnology, Korea University, Seoul 02841, Republic of Korea
Tel. +82-02-3290-3482
E-mail. kwook@korea.ac.kr