InnoVationInfo

International
Journal of Food and Bioscience

Int J Food Biosci 2018
Volume 1: 1

Safe Storage of Durable Food Products

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Keywords: Storage, Insects, Modified atmospheres, Hermetic storage, Vacuum.

Case

Today, grains, spices, nuts, breakfast cereals, dry fruits and vegetables, pasta, noodles, tea, dry herbal products, and other durable agricultural commodities are commonly stored in synthetic polythene bags. Fungi and insect infestations cause significant damage to the quality of grains during storage and tend to speed up undesirable chemical changes and accumulation of fugal toxins among stored crops and their food products [1,2]. Therefore, quality deterioration of durable food commodities is unavoidable under common package or storage systems. Physical control techniques such as high pressure, vacuum, controlled/modified atmospheres (CA/MA), radio frequency, microwave and high temperature have the advantages of being free of chemical residues, although there is variation in insect and fungal susceptibility to physical control techniques [3,4].

Stored insect's resistance to pesticides and consumer aversion to pesticide residue have encouraged research into promising alternative pest control techniques. Also, due to the growing demand of organically produced food products among modern consumers throughout the world, organic non-chemical food preservation methods are also being considered to preserve those products. Because high quality, organic food products return a high price at modern supermarkets and international markets, non-chemical preservation systems like CA/MA have gained more attention by food processors, and are generally considered to be promising alternative methods to pesticide applications or chemical fumigation for storage systems under tropical conditions [5].

Hermetic storage system uses airtight containers or packages to modify the storage atmosphere, obtaining a low oxygen (O_2) and high carbon dioxide (CO_2) atmosphere after a few weeks of storage [6,7,8]. The alteration of the storage atmosphere is achieved through the respiratory metabolism of the live foods (i.e.: grains, nuts etc.), insects and microorganisms present in the storage environment (Figure 1), and results in insect mortality and inhibition of aflatoxin-producing fungi due to lack of oxygen and high carbon dioxide levels [9, 8]. Changes in the quality of commodity in stored food could be predicted from knowledge of the storage temperature, moisture, atmosphere and initial quality of the product [7,8,9].

CA storage is more or less similar to MA storage but obtains a specific level of high CO_2 and/or low O_2 by adding specific atmospheres, which are maintained throughout the storage period. Despite the efficacy of CA to control storage pests of durable food commodities, it is a fairly expensive system for local industries. Therefore, development of a low-cost effective pest and fungi control method is important. Low-pressure

Article Information

Article Type: Case Report
Article Number: IJFB101
Received Date: 17 April, 2018
Accepted Date: 27 April, 2018
Published Date: 04 May, 2018

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Citation: Prasantha BDR (2018) Safe Storage of Durable Food Products. Int J Food Biosci Vol: 1, Issu: 1 (01-02).

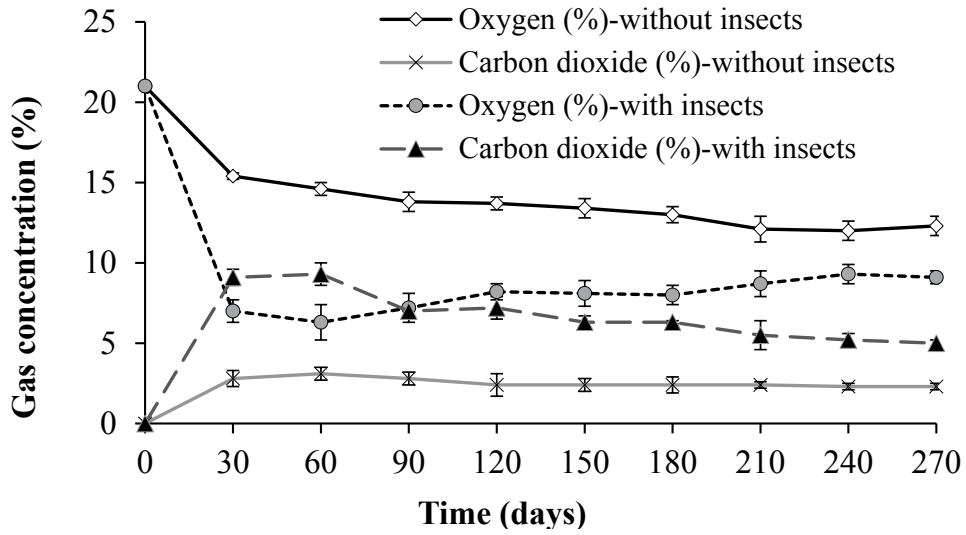

Figure 1: Average O_2 and CO_2 concentrations (%) of all four paddy varieties with or without infestation of insects during 9 months of storage in IRRI hermetic bag [8].

vacuum food storage or packaging systems are effectively providing low oxygen environments through the use of simple vacuum pumps to evacuate the atmosphere within storage containers or packages. Vacuum may also be used in combination with low O_2 and create high CO_2 environment within the storage or package atmosphere. Previous studies [10,11] have showed that low-pressure (vacuum) treatment could effectively be used to control storage pests of tree nuts without affecting to the quality.

Conclusion

However, mortality rates of insects under hermetic or vacuum storage depend on the type of the insects, CO_2 susceptibility, product type, temperature and whether infestation occurs inside or outside of the treated commodity. Information on the rate of change of stored commodity quality is necessary for cost-benefit analysis of the pest control system. Therefore, information and understanding about moisture and gas diffusion, isothermal characteristics, physicochemical and structural changes of the MA/vacuum treated dry food commodity is essential to establish proper control of stored product pests, fungi and obtain optimum quality of the durable food products.

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