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Controlled Atmosphere and Fumigation in India a Professional Pest Managers View Point

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Abstract: In India use of Controlled Atmosphere (CA) is limited at the present as compared to methyl bromide or phosphine. This paper discusses current applications for CAs and the potential For future applications. Compared to CAs, fumigants are much more extensively used. Use of Methyl Bromide in India is subject to control by the Montreal Protocol with An eventual phaseout for all uses other than quarantine & pre shipment applications by January 2015. The only other fumigant currently registered for use in India is Phosphine, which is extensively used for disinfestation of stored grain. Resistance to phosphine is a matter of serious concern and requires for extended exposure periods which are not always achieved. Potential uses of CAs as a Substitute to fumigants are discussed.

Key words: controlled atmosphere, fumigation, methyl bromide, phosphine, professional pest manager, India.

Introduction

This paper reports on use of fumigants and controlled atmospheres (CA) from the viewpoint of professional pest managers. Our business, Pest Control M. Walshe, was established 52 years ago in Mumbai. Since then our fumigation activities have extended from fumigation of stored bagged grain, to treatment of containerised cargoes, structures, and ships carrying bulk grains. This work may involve curative instorage, pre-shipment, and quarantine fumigation treatments.

The only fumigants currently registered for use in India are methyl bromide and phosphine. Use of the former is restricted to licensed fumigators, while phosphine is freely available to farmers and others, who grow and store food grains as well as licensed fumigators. Ethylene oxide, while not registered as a fumigant, is used commercially to sterilise a range of products and commodities.

All non quarantine and pre-shipment uses of methyl bromide in India are scheduled to be phased out by 1 January 2015, which will leave phosphine as the only fumigant available for infestation control in stored food and feed grains, and other commodities. This is likely to present a serious challenge to pest management professionals because of the high levels of resistance that have been reported in some strains of stored product insects commonly found in India.

While controlled or modified atmospheres have been used in India on a relatively smallscale with high value commodities for some 30 years, we have not used them on a commercial basis.

Fumigants-Methyl Bromide

Methyl bromide has primarily been used by commercial pest management businesses. Recently a number of state owned business enterprises including the Central Warehousing Corporation (CWC) and some State Warehousing Corporations (SWC) have been using methyl bromide.

We use this methyl bromide to treat:

· bagged stored grains enclosed under gas-tight enclosures

· wood packaging materials including pallets, dunnage in accordance with the requirements of ISPM 15

· machinery

· the crew accommodation and ship′s stores of sea going vessels

· cargoes in ships-for in-ship, in-transit disinifestation of commodities, particularly rice.

In-ship, in-transit disinifestation is required by quarantine authorities in some of the countries, to which such cargoes are exported. The effectiveness of such treatments is very much dependant on the use of effective recirculation systems that ensure the fumigant is evenly distributed so it can penetrate the entire grain bulk.

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Fumigants-Phosphine

The principal application for phosphine is disinifestation of stored food and feed grains and their products. Almost all of this work is undertaken by the Food Corporation of India and the Central and State warehousing corporations or on their behalf by pest management businesses.

We use phosphine to disinfest:

· cargoes in ships, mainly wheat, rice, maize, and animal feeds manufactured from these grains

· food grain under gas-tight enclosures

· bulk food grains in silos

· high value commodities (e. g., nuts-almonds, cashews; dried fruit-dates, figs) under gas-tight enclosures

Most of the phosphine that we use is generated from aluminium phosphide preparations. However, two types of generators manufactured by United Phosphorus Ltd are now commercially available in India. In addition to providing an instant' source of phosphine, these devices also have the advantage of eliminating the possibility of contaminating the commodity fumigated with spent residues of aluminium phosphide.

Fumigants-Ethylene Oxide

Ethylene oxide finds application in India a sterilizing agent. It is specifically used to sterilise spices and medical equipment in purpose built vacuum fumigation chambers.

Discussion

As mentioned above phosphine is the most extensively used fumigant in India. It's free availability to any person who chooses to purchase aluminium phosphide preparations and the widespread failure to understand how it should be used effectively has lead to the development of high levels of resistance. This should be a matter of concern to all people involved with infestation control in India because phosphine is now the only fumigant available for this purpose. We perceive the problem of resistance as the greatest challenge to for professional pest managers in India.

How has it come to this situation In terms of fumigation practice, we are all aware that it due to the abuse of fumigants. We define abuse in terms of the following fumigation malpractices:

· failure to apply the correct dose of phosphine

· failure to use the correct exposure period

· failure to ensure that phosphine is used in well sealed enclosures.

What factors have led to this situation We feel that free access to aluminium phosphide preparations by people untrained in its proper use has contributed heavily to this situation. In addition, a number of social' issues and economic pressures frequently affect the manner in which phosphine is used, as described above. So what is happening are the farmers to blame because they are not taught how to use phosphine correctly at the farm level Then, even if they were informed', do they choose to underdose because they choose to save money or do not have enough.

Their harvest is then moved to the warehouse level owned/managed either by private traders or the government. Are the malpractices listed above responsible for the development of resistance to phosphine.

What then is the role of pest managers? Do they, despite their training, concede to pressures' to the point where it becomes economically impossible to perform the fumigation treatment effectively, and respond to suggestions that the exposure period can be reduced.

The clients-well they always want the cheapest treatment possible and play off the pest managers against each other. Who is responsible here. Do professional pest managers spend any time educating' their customers in the effective use of phosphine, and work to the standards that they were trained to use.

If professional pest managers and their clients ignore the fact that in-the not very long-term-they might lose their ability to use phosphine then what will they use to save their goods when they are infested. Ignoring the fact that the costs of the raw materials required to manufacture aluminium phosphide are set to increase dramatically-what alternatives are there.

It is our opinion that the main contributor to the rise in resistance has been economic in nature because everyone wants the cheapest job done, notwithstanding the consequences.

It has very often been explained to clients that in terms of value for money that the cost of effective fumigation is literally pennies. This may be illustrated by the following example with rice.

Selecting one of the higher charges for fumigation, the tables below provides an idea of the cost of fumigation.

Example – using a recirculation system	
Shipload of 20 000 tons rice costed @ approx us $ 1 000.00 ton	US $ 20 000 000.00
Cost of fumigation using phosphine @ US $ 1.25/ton	US $ 25 000.00
Percentage cost of fumigation to value of cargo	0.001 25 %
Cost of a proper fumigation.	Minimum cost to be paid in case of refumigation.
US $ 25 000.00	Vessel standing charges Vessel shifting/port charges, etc not taken into account Min 5 days@ $ 10 000/day $ 50 000.00 Re – fumigation charges $ 20 000.00
TOTAL US $ 25 000.00	Total minimum cost to be paid $ 70 000.00

Similarly for wheat – selecting one of the higher treatment charges for fumigation, the table below provides an idea of the cost of fumigation.

Example – using the re – circulation system of fumigation	
Shipload of 20 000 tons wheat @ approx US $ 380.00/ton	US $ 7 600 000.00
Cost of fumigation using phosphine@ US $ 1.25/ton	US $ 25 000.00
Percentage cost of fumigation to value of cargo	0.003 %

In addition to this the professional pest manager has to endure a lack of effective infrastructure. All procedures, rules and regulations are in place for the fumigants currently in use require, for example, proper flooring at work sites, adequate space in which to treat containers, and proper security.

In India fumigation is quality controlled by two Indian standards for Fumigation (NSPM 11 & 12), and through its participation in the Australian Fumigation Accreditation Scheme (AFAS). Thus treatments with methyl bromide are monitored in accordance with these standards, e. g. at least twice during a 24 hour exposure period, and at least three times during a 48 hour exposure period.

We frequently face severe infrastructure constraints when carrying out fumigations. For example, the fumigation floor is very clearly not gastight as required by the standards, which leads to delays in carrying out the job as measures have to be taken o ensure that such sites comply with the standards-to ensure that the fumigation treatment can be carried out effectively.

We are always under pressure from clients, who want a job done in short time without giving consideration to the full exposure period as required by the standards. While previously, it was possible double up the dosage of methyl bromide and half the exposure period, this is no longer permitted by the standards.

At the end of the exposure period we are frequently under pressure to release goods immediately after the enclosure has been opened-without the full ventilation and clearance process being carried out. It is very difficult to convince clients that this practice is no longer permitted. The willingness to comply with these and other shortcuts demanded by clients make all too often decide a contract.

For treatments carried out with phosphine there are no specific guidelines. However, we monitor fumigant concentrations in accordance with internationally norms. In this respect the use of a phosphine generator is of immense help to us as it allows us to safely top up the gas concentration to the required level without the OH&S hazards of having to enter' an enclosure.

Customer awareness/understanding of the modern requirements for effective fumigation, and the dangers associated with fumigation is something that needs to be enhanced.

We are aware of cases when customers have removed fumigation sheets from goods under being fumigated without any PPE because they required the goods for either production or for shipment. In such cases not only has the customer risked put his employees at risk by degassing an enclosure without adequate protection but has also then shipped the goods inadequately fumigated which may cause a problem at the destination because of infestation being found-and a fumigation failure is always the responsibility of the fumigator.

Commercial considerations unfortunately lead to many corners being cut, which can be very dangerous. We are under constant pressure to reduce our prices. However, when it is explained that is very dangerous, such advise is

often disregarded. We very often are forced to let go of jobs as we are unwilling to take such risks.

Controlled or Modified Atmospheres

The use of controlled or modified atmospheres (MA) in India to control infestation is extremely limited. There is history dating back to the 1970s of small-scale use with a number of high value commodities such as cashew nuts packed in tins for export. However, the technology for these methods do not yet really exist in India, and as a consequence there is limited awareness or understanding of it amongst professional pest managers and their clients.

A few techniques such as the grain bags using vacuum to reduce oxygen content have had limited success in India. In the latter case, the manufacturers claimed that a hard to kill species such as *Rhyzopertha* spp. can be killed in 72 hours. Validation has been difficult, and we as Pest Managers have yet to be convinced that this treatment regime is effective before we start to sell' it. Added to this is the ever present client aversion to increased cost that mitigates against adoption of new techniques.

It appears that controlled or modified atmospheres, and similar disinifestation techniques will be much more expensive than the current use of phosphine and we have not yet started to seriously investigate their application to our requirements in India. If controlled or modified atmospheres treatments are to adopted in India there is need for the technology to be cheaper before it will be accepted in India. However, we believe that such disinifestation techniques hold good potential for use in India, specially in view of the fact that Methyl Bromide will be phased out by 2015. This opportunity may have led a Netherlands based company that provides disinifestation services using CAs to establish a branch in India.

There is a possibility that methyl bromide usage, whether for disinifestation up to 2015 or for quarantine and pre-shipment treatments thereafter will be reduced as a result of end user demands in our markets in the industrialised world. This may result in a requirement for safer' treatments, which may be satisfied by application of controlled or modified atmosphere technology. None the less the long exposure periods of such treatments will not be readily accepted by our clients.

Summary

The future for controlled or modified atmosphere disinifestation techniques, including heat, appears to us to be bright in a world that will have limited access to methyl bromide provided this technology is cost effective.

Companies researching/selling such technologies should look to sacrifice some of their profits for the good of mankind as use of this technology will surely save the ozone layer and the scarce resource called food.