

PHYTO EXPLO® FUMIGATION: IN TRANSIT GRAIN FUMIGATION IN THE HOLDS OF A TANKER/BULKER

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ABSTRACT

The procedure for in-transit fumigation of grain in ship-holds using the PHYTO EXPLO® fumigation system is described for a fumigation of maize in the tanker vessel "Marshal Grechko". A pre fumigation procedure to detect and seal leaks was followed by insertion of the perforated Phyto Explo shaft into the grain bulk. Fumigation was carried out by insertion of a band of aluminium phosphide into the shaft, after which the hold was sealed. Degassing is undertaken at the port of destination, decomposed residues are removed from the shaft and the shaft is then withdrawn from the grain.

PRE-FUMIGATION

Pre-fumigation is a quick and reliable way of testing the sealing integrity of holds in preparation for later treatments of the loaded grain bulk using fumigants. It is based on the introduction into the closed empty hold of a thermally produced insecticidal fog. This insecticide simultaneously destroys insects in the hold and permits any leaks to be detected. The most suitable insecticide for this purpose is dichlorvos (because of the high vapour tension obtainable).

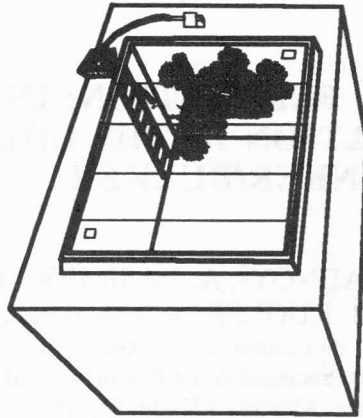


Fig. 1: Use of dichlorvos for testing seal integrity of ship-hold.

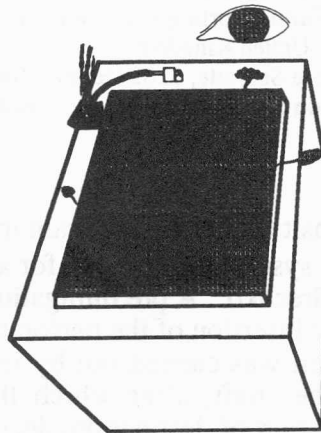


Fig. 2: Leak detection by visible inspection after introduction of dichlorvos.

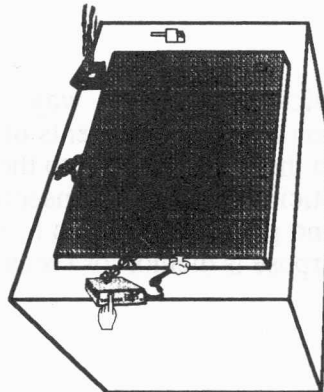


Fig. 3: Leak detection using ion-based device for detection of dichlorvos.

Leak detection begins with an initial rapid visual inspection to identify any major leaks that may be present

Leaks invisible to the naked eye can be traced using an ion-based detection device specially designed for this type of application. The area around the hold is inspected first, followed by the engine-room and forecastle.

FUMIGATION

The main advantage of the PHYTO EXPLO[®] system for the treatment of export grain in ships is that an effective fumigation can be carried out after the ship is loaded. If some insects are revealed during loading of the hold it is not necessary to unload the grain in order to carry out the treatment. Fumigation by the Phyto Explo system is carried out as shown in Fig. 4. The shaft is driven into the grain bulk by percussion and vibration. Then the direction of percussion and vibration is reversed enabling the Phyto Explo device to be returned to the grain surface while the shaft and cone are retained in the grain. During withdrawal of the Phyto Explo device the shaft consisting of a perforated tube expands.

Fumigation with phosphine (PH₃) is carried out after the insertion of the PHYTO SHAFT[®] into the hold. Then a long band of aluminium phosphide (ALP) is introduced into the shaft, the top of the shaft is closed, the hold is sealed and the ship is ready to sail.

At the port of destination, the hold is opened for degassing, the decomposed residue is removed, and the shaft can be used to sample for gas residues in depth of the grain bulk. If gas residues remain, the shaft can be used to aspirate them from the bulk. The shaft can then be removed manually by de-spiralization, or with the Phyto-pulley. In the latter case a portable winch termed a shaft-puller is employed. A hooked cable is inserted into the shaft and the hook attaches to the bottom of the shaft enabling the shaft puller to recompress the shaft as it is winched up through the grain bulk. If the grain is removed from the hold by aspiration, the shaft may be left in the grain and removed after the hold has been emptied. For phosphine treatment, the type of shaft employed is the perforated configuration.

Figs. 5-6 show insertion of Phyto-shafts for in-ship fumigation, and post-fumigation procedure in a hold of M/V "Marshal Grechko". Results of phosphine concentrations recorded during fumigation of a ship-hold are given in Fig. 7.

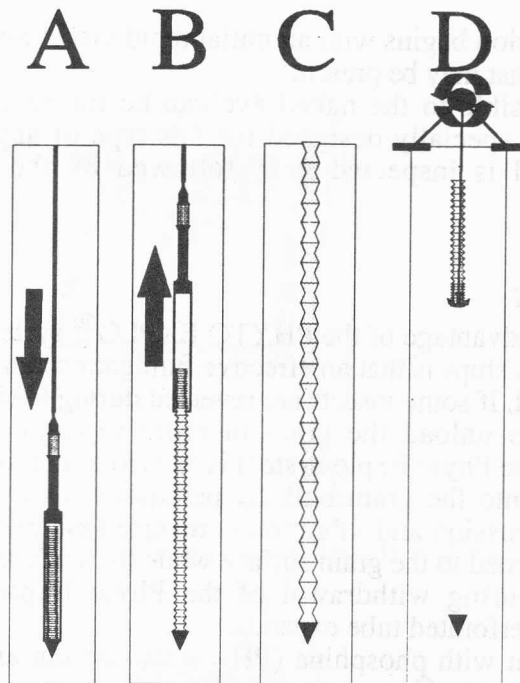


Fig. 4: Operation of the PHYTO EXPLO[®] mechanism; (A) PHYTO SHAFT[®] penetration into the grain mass by percussion and vibration; (B) withdrawal of the PHYTO EXPLO[®] device to enable expansion of the shaft, leaving the perforated tube in the grain mass; (C) the expanded perforated tube in position; (D) withdrawal of the collapsible perforated tube by the SHAFT PULLER using a winch.

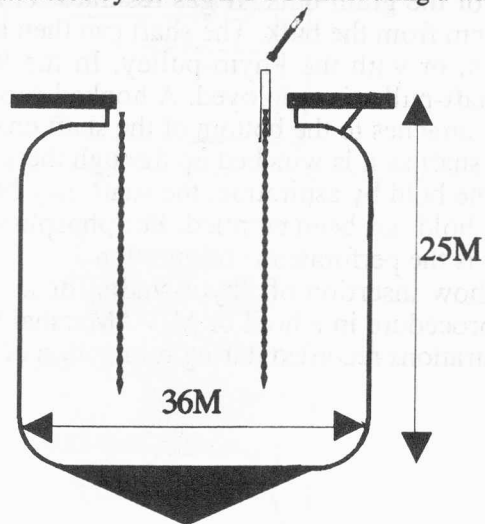


Fig. 5: Side view of a ship-hold and position of the PHYTO SHAFT[®] tubes in the grain mass ready for introduction of the aluminium phosphide package.

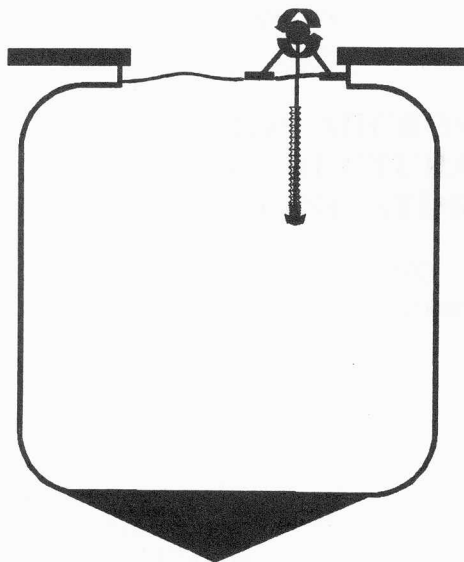


Fig. 6: Withdrawal of PHYTO SHAFT[®] tube using the SHAFT PULLER at the port of destination.

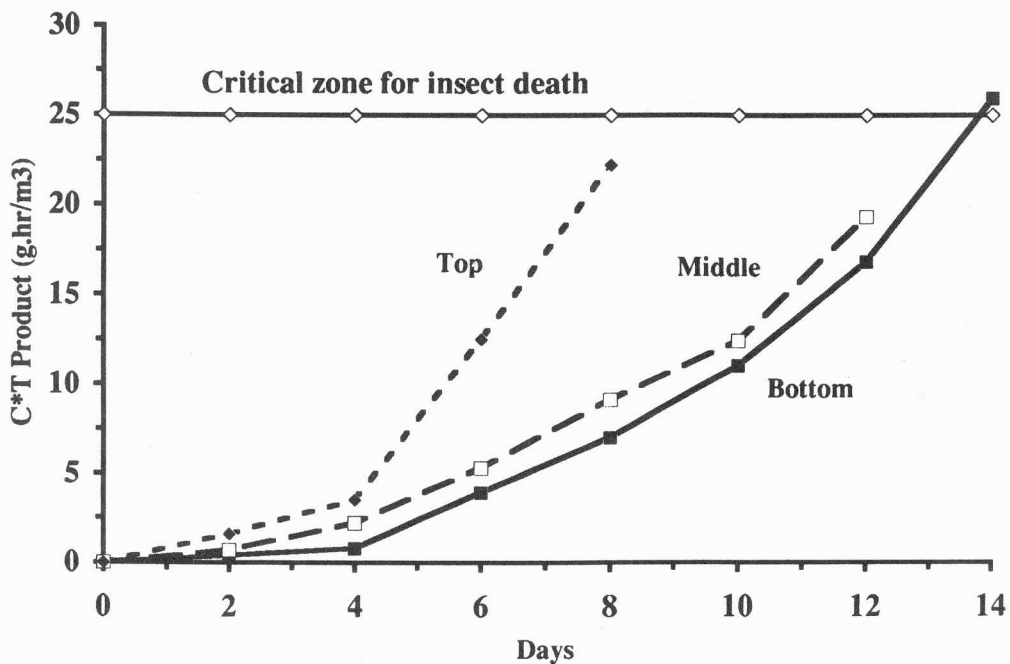


Fig. 7: Ct products of phosphine measured at three depths of a ship-hold containing wheat, after application of the fumigant through the PHYTO SHAFT[®] tubes.