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## **QuickPHlo – R Formulation Fumigant Generators : a New Safer and Environmentally Friendly Phosphine Fumigation Process**

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**Abstract:** Phosphine is the most commonly used fumigation fumigant worldwide. Aluminium phosphide has been the primary choice of commercial fumigators for decades. The use of phosphine is increasing with Methyl Bromide phase out. Conventional formulations of Aluminium Phosphide and Magnesium Phosphide have been used for more than the past half century without improvement in the method of application or formulation. There are many limitations to conventional phosphine formulations; manufacturing and application safety have continually been major concerns.

The QuickPHlo – R aluminium phosphide formulation and the QuickPHlo – R phosphine generator series were developed to overcome the conventional phosphine safety, environmental and consumer food contamination limitations. The formulation is very safe to use. The QuickPHlo – R phosphine generator is very operator friendly and safe. This generator has a built – in deactivation system and scrubber to treat the residue of aluminium phosphide, drastically reducing levels of active ingredient to safe levels for disposal. This new innovative technology has many advantages which guarantee safety, quality and precision fumigations.

### **Presentation**

Current Metal Phosphide formulation in use have an active ingredient of 56% – 66% , in the form of tablets/pellets/sachet/plates are used as a fumigant to kill stored grain insects. They are extensively used for fumigation of grains, cereals, dry fruits, ships, food, tobacco and other products/commodities. These formulations have been used since many years without much improvement in formulation or the method of application. Fumigators had no choice but to put up with the limitations of the product available.

Newer version is the Phosphine in cylinder with CO<sub>2</sub> as diluent or the pure form which dispense Phosphine gas with a device.

**QuickPHlo – R™ Phosphine Generator & Granular Aluminium Phosphide Formulation**

QuickPHlo – R™ Phosphine Generator is the latest device for fumigation with phosphine. This is the safest, accurate and most economical method for fumigation with phosphine.

The Generator consists of a pot, deactivation tank, scrubber & a control panel. All the equipment is mounted on a structure. The control panel performs all operations automatically. All that the fumigator has to do is press a button to start generation. The panel is very operator friendly and easy to operate.

A new granular formulation of Aluminium

Phosphide having an active ingredient of 77.5% is used. The formulation is free from ammonia and dust. The formulation is put in the pot and reacted with water. The rate of generation of phosphine does not depend on ambient conditions like temperature and relative humidity.

Phosphine gas generated is circulated through the structure/commodity to be fumigated. This ensures uniform gas concentration. All the phosphine is generated and distributed in the structure in less than 1.5 – 2.5 hours. After reaction is complete in the pot, the active content in the formulation is about 1%. The deactivation system reduces the active content in the formulation to less than 0.1%.

The generator has back up power, in case of power failure. In case of an emergency, it is has an emergency shut down button.

The generator can be moved from one location/site to another.

QuickPHlo – R Phosphine Generators are made in different sizes referred by capacity to generate the quantity of gas

- 56 Gms
- 112 Gms
- 0.5 KGS
- 1.0 KGS
- 2.5 KGS
- 5.0 KGS
- 10.0 KGS
- 12.5 KGS

15.0 KGS

20.0 KGS

25.0 KGS

The generator is designed to suit individual customer requirements.

QuickPHlo – R™ formulation is available in different pack sizes conveniently packed in aluminium foil packs.

Pack Size                  Phosphine Generation

GMS                                  GMS

125                                    250

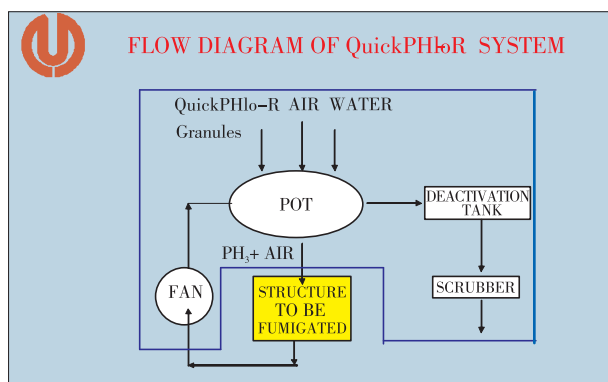
550                                    250

2200                                  1000

4400                                  2000

Schematic Diagram of QuickPHlo R™ – Gener-

ator



**Table 1. Benefits of new formulation vs conventional formulations**

Sr No	Activity	QuickPHlo – R™ Granules	Conventional formulation	Remarks
1	Active ingredient	77.5 %	56%	Less chemical used for generating the same quantity of Phosphine gas. The A I content is 40% higher. With less starting material, less residue is also generated
2	Operations	Automatic	All manual	The QuickPHlo – R generator has programmable Logic controller which controls all the operations, with built in check list. Where as in the conventional form, all operations are manual and the operator is exposed to dangerous working conditions.
3	Dust content in the product	0	0.5% – 1%	Very fine dust is in the tablets and pellets. This flies when the product is applied. Operator needs dust protection for respiratory system and for hands.
4	Product Packing	Al. foil	Al flask	Flasks are very cumbersome and laborious to open. Aluminium foil packing can be cut easily with a scissor/knife
5	Product use	No ignition	Sometimes ignition can occur	Occasionally, it is observed that when the conventional formulation pack is opened, it ignites. The granules never have an ignition on opening the aluminium foil pack.
6	Phosphine concentration	0/very low	>2000	Phosphine concentration on opening the flask is very high. The same with the granules is zero/very low – which is very safe for the operator.
7				on ground outside the structure. The granules are added to the reaction pot. This takes few seconds. The same with the conventional formulation, the product has to be carried to the top of the silo/storage structure and applied to the commodity manually. This takes much more time and is hazardous operation. Phosphine gas release starts immediately and concentration starts building up in the structure/commodity when the operator is still applying the product.
8	Application of product	Into reaction pot	To be carried to the top of the silo/structure	

Sr No	Activity	QuickPHlo – R™ Granules	Conventional formulation	Remarks
8	Application of product			The commodity fumigated gets contaminated with the product residue in the conventional formulation, whereas with the granular formulation, it remains in the reaction pot, only Phosphine gas enters the structure/commodity
9	Ammonia in the formulation	NO	YES	Ammonia is additional pollutant which is eliminated from the new granular formulation
10	Gas generation	2 – 3 hrs	4 – 10 days	The gas generation is immediate in the QuickPHlo – R generator and the time for gas generation is independent of the ambient conditions like temperature and humidity. The rate of generation of Phosphine gas from the conventional formulation is totally dependent on moisture in the atmosphere and the temperature.
11	Gas concentration	Uniform in the entire commodity	Not uniform	The QuickPHlo – R™ generator has a fan which pushes the gas in the entire structure and the gas is re circulated. The conventional formulation has highest concentration around it and least away from it. Most of the times, the gas concentration is not uniform in the structure.
12	Hazards	Very limited	More chances	In the conventional form, since the Phosphine gas generation is happening in the structure, there is fire hazard. The same does not happen with QuickPHlo – R generator, since all the generation of gas is outside the structure. There have been instances of fire in the commodity, due water condensation/water leakage
13	A I content after decomposition	<1%	3% – 4%	QuickPHlo – R™ granules, after reaction with water have an A I content of less than 1% (which is further deactivated) after 2 hrs of reaction. Whereas the conventional form has an A I content of 3 – 4 days in tropical climate/or higher when the temperatures are lower.
14	Residue	Liquid form	Fine dust	Fine dust handling is hazardous (still has high A I content)
15	Residue treatment	Part of the system	Separate infrastructure required	The slurry after reaction is taken to a deactivation tank, where the waste water is treated and the A I content of the product is further reduced. Gas generated during deactivation is scrubbed in a charcoal scrubber which is also part of the QuickPHlo – R™ generator. Whereas the conventional formulation needs separate treatment facility and the higher A I (3% – 4%) is treated. Whatever gas is generated is let into atmosphere.
16	A I content after deactivation	<0.1%	>1%	The residue in the conventional formulation needs 6 – 8 hours stirring to reach a level of >1%. Whereas the QuickPHlo – R™ formulation has an AI of <0.1% after deactivation in 3 hours.

Sr No	Activity	QuickPHlo – R <sup>TM</sup> Granules	Conventional formulation	Remarks
17	Residue withdrawal	No	Yes	Since the QuickPHlo – R <sup>TM</sup> granules are not applied to the commodity, they donot have to be withdrawn. Where as the conventional methods, the residue has to be withdrawn/ gets mixed with the commodity.

There are more advantages and all cannot be listed.

Since most of us are familiar with the con-

ventional form, the comparison is made with this form.

**Table 2. Similarly, Phosphine cylinders can also be compared with the new technology**

Sr No	Activity	QuickPHlo – RTM Granules	Phosphine cylinders	Remarks
1.	Logistics	Easy to handle	Very laborious	Cylinders are on steel racks
2.	Hazard Classification no	4.3	2.3	Safety requirements enhanced with phosphine cylinders
3.	UN No	1397	2199	More hazardous to handle
4.	Costs	No rentals	Pay Rentals	You pay rentals after certain time on retention of cylinders
5.	Phosphine	Generated when required	Always in the form of phosphine	Hazard increases with Phosphine. Where as the formulation is safe and generates phosphine only when required

Some Photograph of QuickPHIo – R generator :

