

Fumigation with Carbon dioxide

Treatment of grain with food grade carbon dioxide (CO₂) in a sealed silo is one of the few acceptable ways of disinfesting and protecting commodities for the organic food market. The treatment is relatively simple and reliable if carried out in a sealed structure (one that passes the pressure test). The carbon dioxide concentration needs to be above 35% for 15 or more days for a carbon dioxide treatment to kill all stages of all insects likely to be found. This can be achieved by a single addition of gas in an adequately sealed white bin (i.e. one which passes the pressure test). Carbon dioxide of 98% purity should be used.

However, one can also use tarpaulin cover making it air-tight as in case of MB fumigation.

Dose: 2.4 Kg per cubic meter and exposure period could be 10 days at 15 degree centigrade. Exposure period could be varied as per the temperature. Higher the temperature; lesser the exposure period. However, dose and exposure period may vary as per the requirement of importing country.

TLV: 5000 ppm

Procedures for (CO₂) treatment of bulk grain in small bins (less than 300 M.Tonnes)

Equipment required:

- A sealed silo or a silo that can be sealed to a high standard of gas-tightness. The silo should be fitted with a gas inlets at top and bottom.
- Several lengths of plastic tubing (at least enough to go from the ground to the top of the bin and back)
- A few rolls of self-adhesive plastic tapes. 18 mm electrical tape and 50 mm duct tape are the most useful for making temporary seals and connections
- Sealing mastic in a putty gun cartridge. Silicone sealants are best. Butyl mastic can be satisfactory but is harder to apply.
- A mastic gun for the above
- An oil filled pressure relief valve or a U tube manometer
- A source of compressed air
- At least one 30 kg (G size) cylinder of food grade carbon dioxide (CO₂) per 20 tonne of storage capacity plus one extra cylinder
- CO₂ pressure regulator with a fitting to connect to flexible plastic pipe
- A method of estimating the approximate CO₂ concentration. There are various Commercial devices available for this purpose.

Treatment method:

1. Seal all openings to silo using tapes and mastics as appropriate. Examine silo for obvious leaks, with special attention to hatches and joints, and fill any potential leaks.

2. Carry out a pressure test. The bin leaks should be further sealed if the time it takes for the pressure to halve is less than:
 - 3 mins in a full or empty bin or an enclosure.
3. Ensure there is an opening at the top of the bin (vent).
4. Turn on the CO₂ cylinder valve and the flow regulator. The flow should be such that the inlet tube just becomes covered in frost. Continue gas addition until the concentration at the top of the bin reaches 60-80% CO₂ or until the cylinder freezes and the gas flow is reduced.
5. If the cylinder freezes, disconnect and add gas from another cylinder. The frozen cylinder will thaw with time and can be used later if needed. Better use Vaporizer for good and continuous flow of this gas.
6. When the concentration at the top of the bin reaches 60-80%, stop CO₂ addition and close the top of the bin.
7. If the pressure test was successful, the concentration should stay higher than 35% CO₂ for 15 days.
8. If the bin did not quite pass the pressure test, it is possible to add gas daily as required, so long as the concentration does not fall below 35%.
If the bin badly fails the pressure test even concentration make up will not be possible.