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Introduction to Controlled Atmosphere

It is not feasible to store vegetables, fruits and grains in normal atmospheric conditions. This is because of the factors such as fungus, bacteria, insects and pests. In controlled atmosphere, such conditions are created that do not allow the above factors to live by controlling the CO2 levels, Moisture Levels, O2 levels and by keeping low temperatures. With CO2 levels above 30% and temperatures <15 ˚ most of the living entities do not survive. Typically for complete disinfection of the grains keeping moisture content of <13%, temperatures of 25˚ and CO2 Levels > 35% (V/V) for almost 15 days is created.

For the storage of fruits, a cold atmosphere has to be maintained with almost high moisture content (>90%) where the life is extended for considerable periods. Ethylene levels are to be maintained at 0% as it is also released by many fruits as an hormone for its own ripening.

Types of Controlled Atmospheres

- Cold Rooms
- Modified Atmospheres
- Humidity Packaging

The controlled atmosphere are set up on **turn key basis** and helps in saving grains, fruits and vegetables from getting destroyed. This will increase the shelf life of these perishable products and food materials.

We at Chemtron Science Laboratories provides solutions in both the forms, which includes Chambers and Transportable Controlled Atmosphere. Here we can control the temperatures, O2 levels, CO2 levels, ethylene levels, pressure and moisture levels as per the requirement.

General Functioning of the Controlled Atmosphere System

- Initially fruit will be kept in CA Chamber and desired controlled atmosphere i.e. O2 less than 5% , CO2 less than 1%, C2H4 less than 1 ppm & positive pressure inside CA chamber are once achieved PAS unit will be closed.
- Now once the fruit will generate CO2 from O2 via respiration, this will increase the CO2 level and decrease O2 level inside the container. When the CO2 level reaches above the CO2 set point the scrubber blower will activate and evacuate CO2 with the selective scrubber bed.
- In case the O2 level goes below the O2 set point the fresh air valve will open and let in compressed air (20,9% O2).
- In case the C2H4 level goes high the C2H4 set point the scrubber blower will activate and evacuate C2H4 with the selective scrubber bed.
- In case O2 level increases above the set point then N2 dosing will start in CA chamber till O2 comes below 3%.
- Scrubber: The unit consists of an activated carbon filter chamber, a low -pressure ventilator, an air-transport system, a control unit, and a buffer or lung system.
  - Scrubbers use advanced electronic control and a panel mounted Carbon Dioxide Analyzer to constantly monitor the status of the carbon beds. Through careful monitoring of CO_2 levels, the scrubber switches cycles only when needed, keeping the

cycles to a minimum and efficiency to a maximum. By filtering in the scrub air and the fresh purge air, carbon life is also kept to a maximum.

Controlled Atmosphere system consists the following:

1. PSA Nitrogen Generator with
   - Air Compressor & Air Dryer Chiller
   - Air Balloon
   - Pressure Transmitter mounted on CA Chamber & balloon
   - Safety valves mounted on CA Chamber side walls
   - CMS Vessel
   - Control Panel
   - N2 Reservoir Tank

2. Gas Analyzer & Controller with following:
   - Ethylene Indicator & Controller
   - CO2 Indicator & Controller
   - O2 Indicator & Controller
   - Humidity & Temperature Indicator

3. CO2 Scrubber consisting of CO2 Absorber, blower and valves.
4. Ethylene Scrubber consisting of Absorber, blower and valves.
5. O2 Scrubber consisting of CO2 Absorber, blower and valves.