

ABSORBOPAK MOISTURE CONTROL

Keep Your Container Cargo Dry

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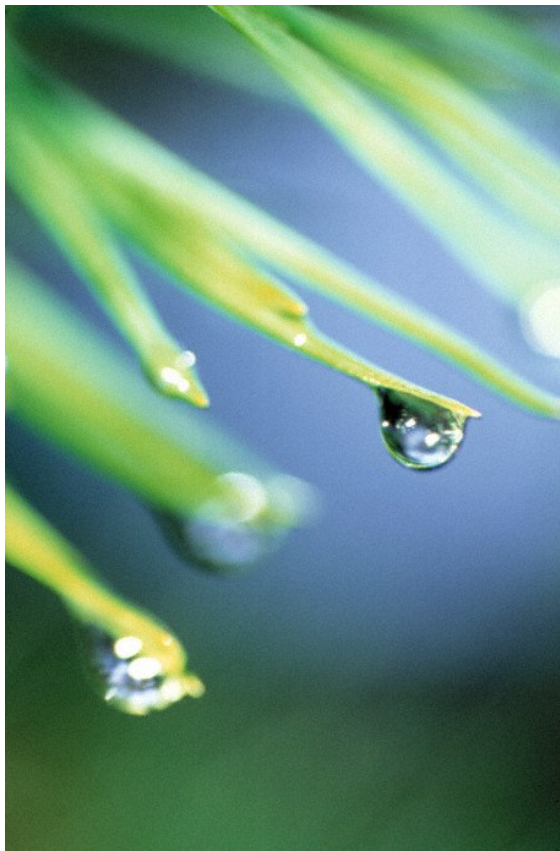
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Moisture Control in Shipping Containers

- Moisture damage happens in containers on every kind of voyage
 - Crumbeled, discoloured and peeling packaging
 - Bad smell, toxins, caking and reduced quality
 - Visible mold growth
 - Steel and metals corrode and loose shine
 - Physical damage from ice, glue deterioration, laminate separation etc.
- Absortech products are proven in the protection of:
 - Consumer goods, pharmaceuticals, body care products, tins etc.
 - Paper, wood, carpentry and furniture
 - Minerals, chemicals, plastics
 - Steel, metal and machinery
 - Food, agricultural products inc. coffee, cocoa, peanuts, beans
- Good moisture control in the container means savings in liners, packaging, oiling and in-box gels



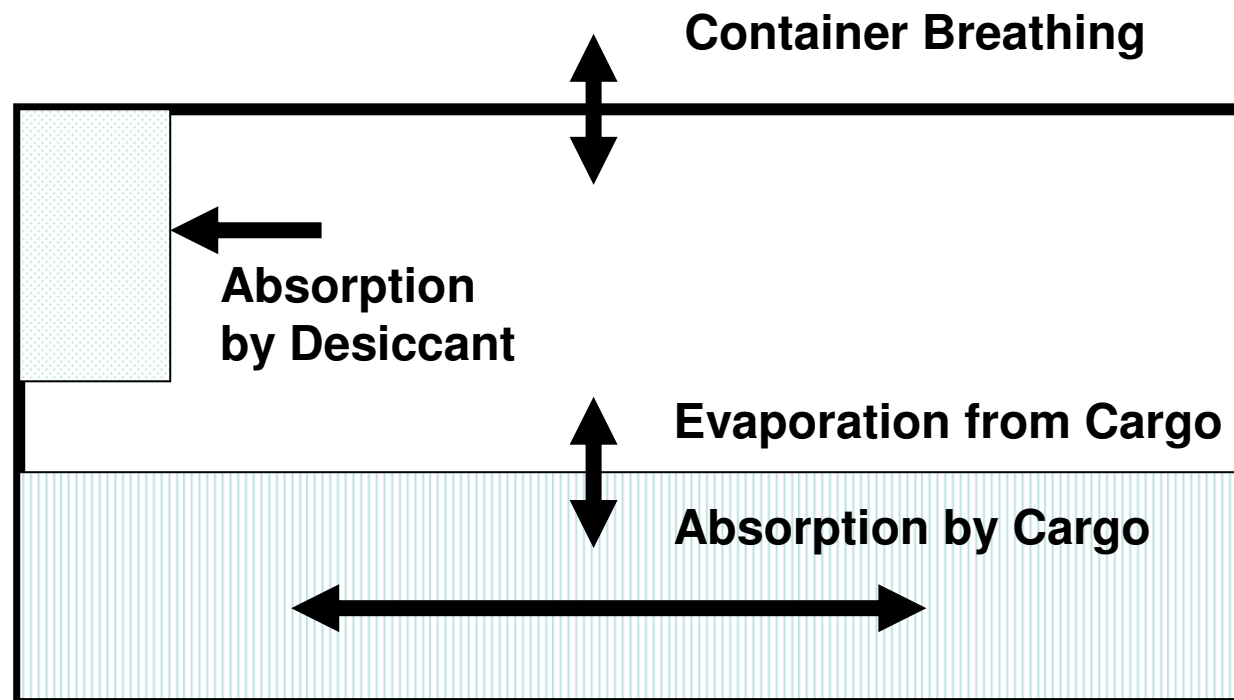
The Causes of Moisture Damage Happens in All Shipping Costing You \$\$\$\$\$

- Moisture damage is caused by:
 - Condensation
 - In the ceiling and the walls of the container (Container Rain)
 - On the cargo (Cargo Sweat)
 - Prolonged periods of elevated humidity
- Condensation takes place on the coldest available surface, often in the container ceiling
- Liners protect against container rain, but not against humidity

Moulds and Chemical Degradation

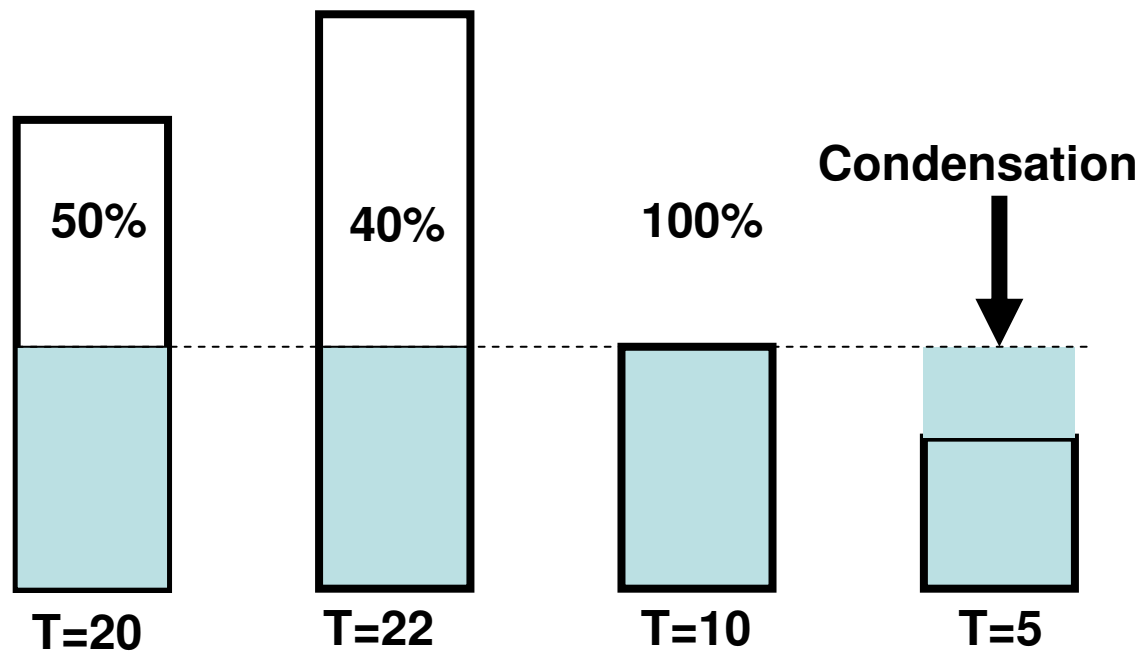
- There are more than 20,000 kinds of fungi, moulds and bacteria that may grow in your cargo. By the time you have bad smells and visible fruit bodies (green, orange or black spots) the fungus is already well established.
- Most fungi produce toxins. Rule of thumb: the more humid growing conditions, the more toxic the growth is.
- Most fungi require a short period of humid conditions (70-80%) to start growing, but will thereafter continue to grow at much drier conditions (60-70%) and even at freezing temperatures.
- Fungicides are mostly ineffective. If you kill one kind, another fungus will take over.
- Insects may appear as eggs hatch under moist conditions.
- Chemical reactions degrade glue (which then let go), causes discoloration and bad smells.

The Moisture Balance in a Shipping Container



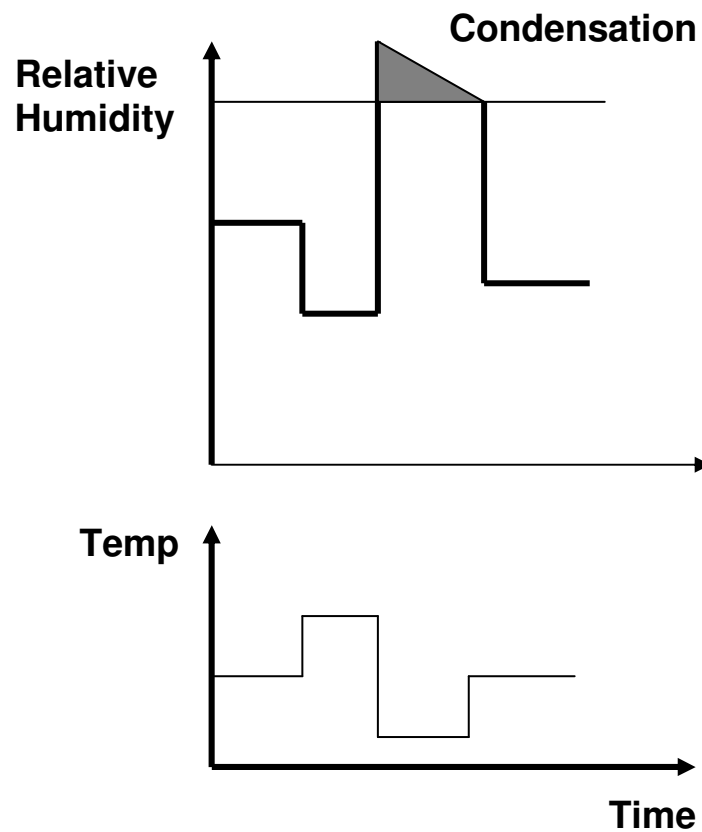
Moisture in the air in the container derives from the outside and from the cargo. Desiccants remove moisture from the air.

Temperature Changes Change Humidity

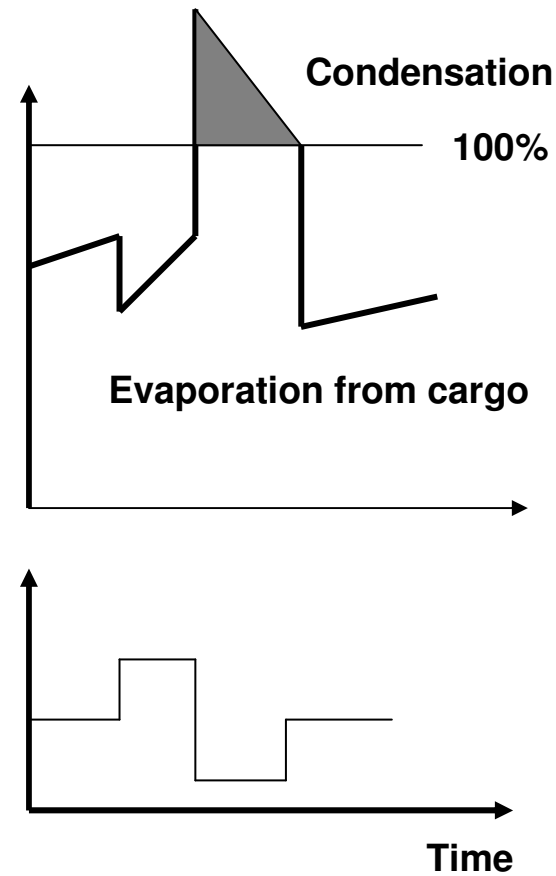


- Warm air can hold more moisture than cold air.
(Rule of thumb: $10\text{g}/\text{m}^3$ at 10 degrees, then double every degrees)
- The relative humidity measures the humidity as a percentage of the maximum amount of moisture air can hold at that temperature

Dry Cargo

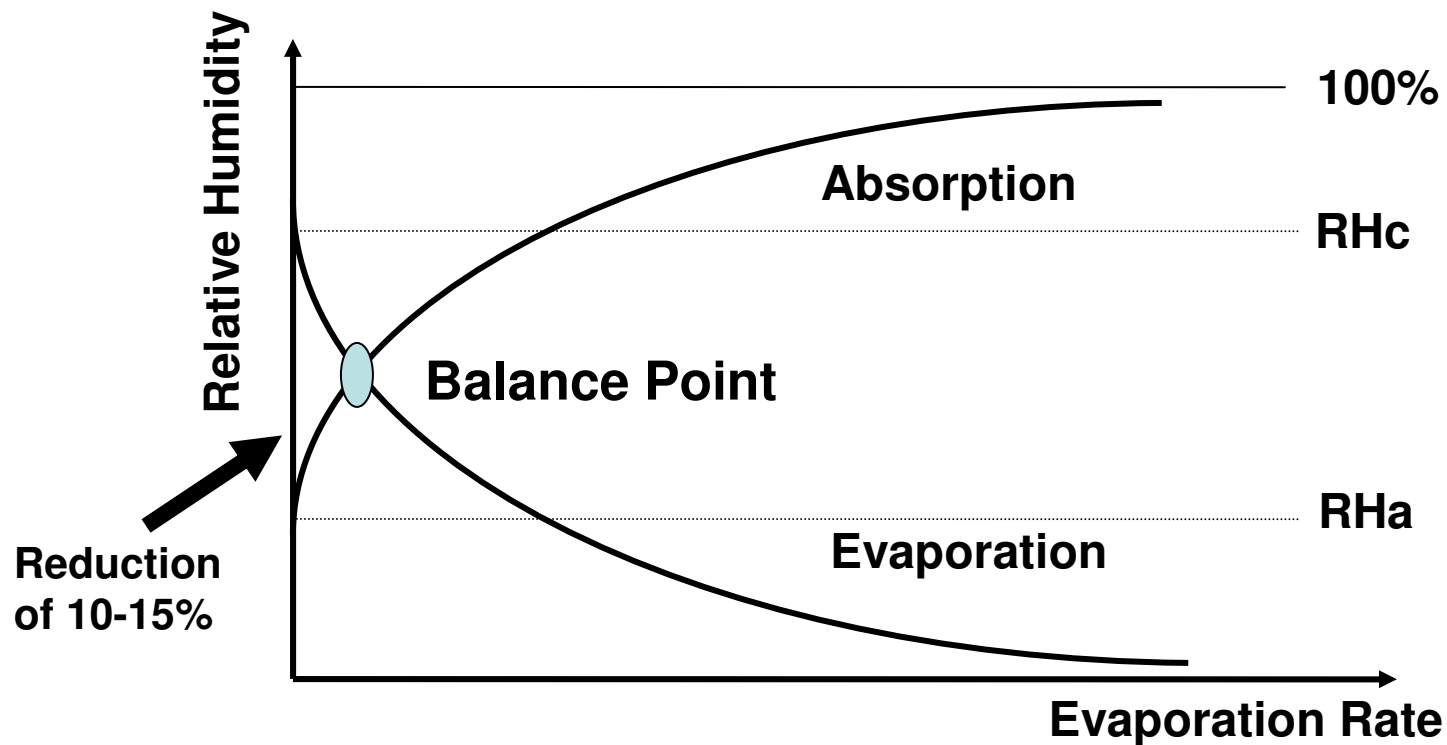


Moisture Containing Cargo



Even a dry cargo can have moisture problems, but when the cargo and packaging contains moisture the problem becomes greater.

Moist Cargo Balance Point – Evaporation and Absorption

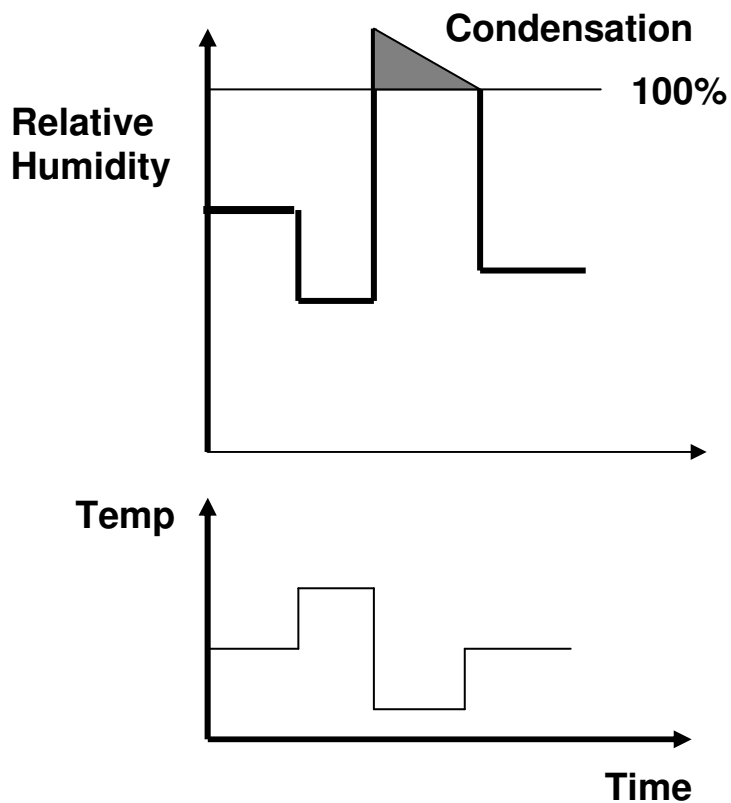


The cargo evaporates moisture and the Absorpole absorbs moisture. The balance point is at a low rate of evaporation => a slow & steady flow of water from cargo to poles.

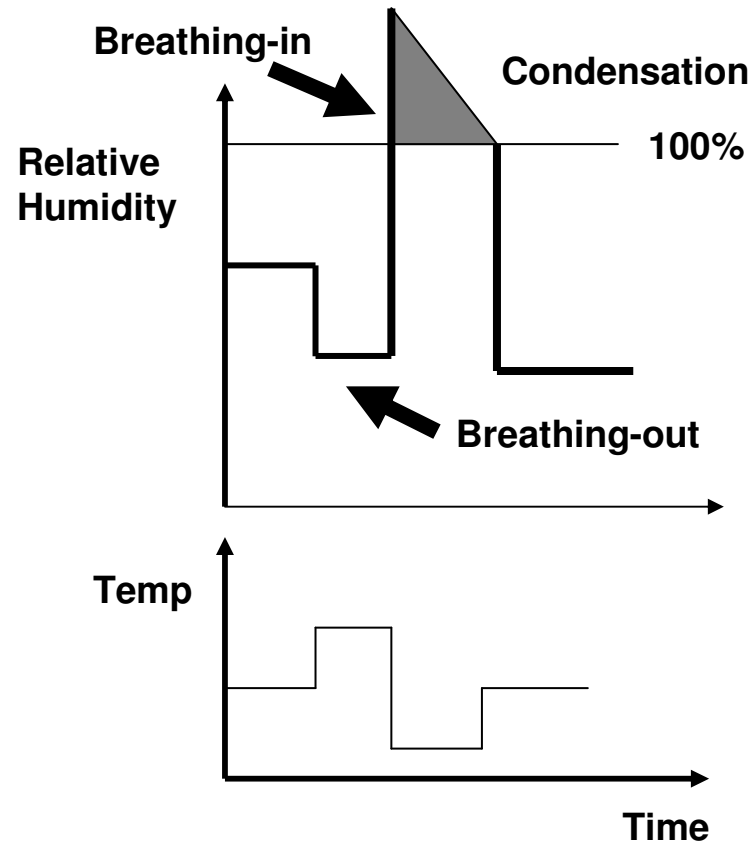
Temperature Differences Within the Cargo Cause Problems

- Temperature differences within a cargo may take weeks to equalise
- Different temperatures mean different humidity conditions in different parts of the cargo. RH differences of 10-20% within a cargo are not unusual.
- Many cargoes will absorb moisture from air above a certain level humidity and evaporate moisture into air below that level. In such cases large amounts of moisture may move from a warm part of the cargo to a cooler part of the cargo.

Dry Cargo

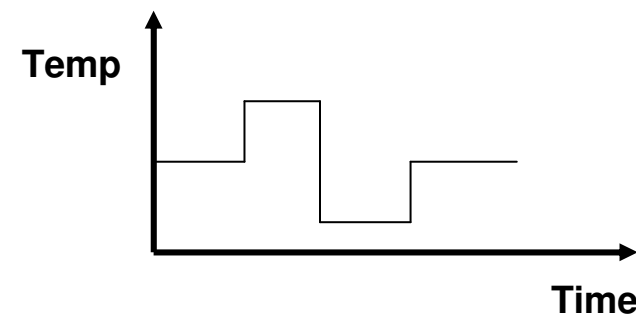
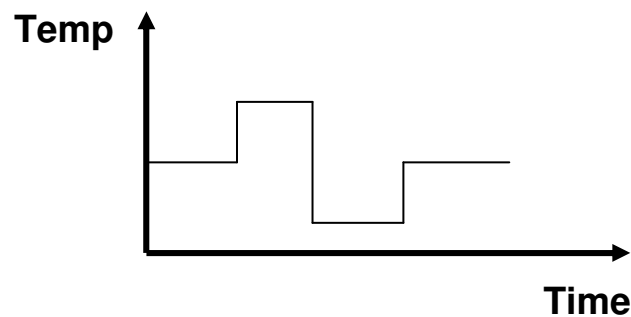
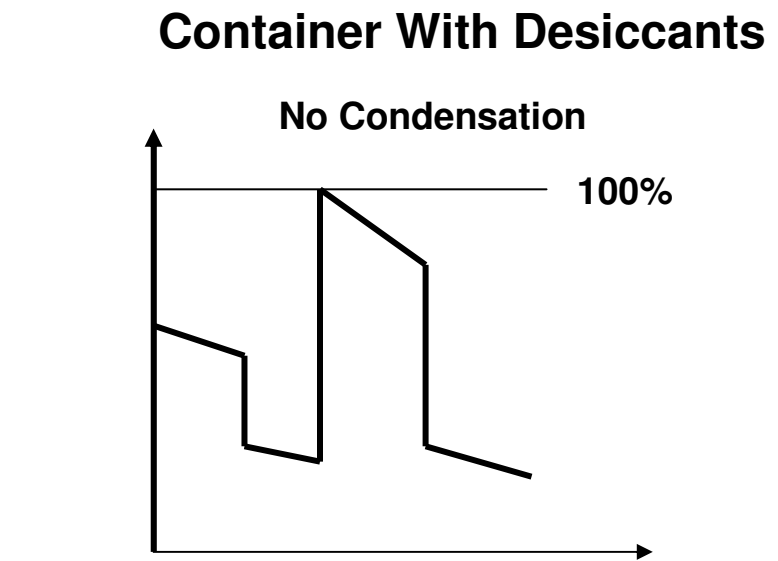
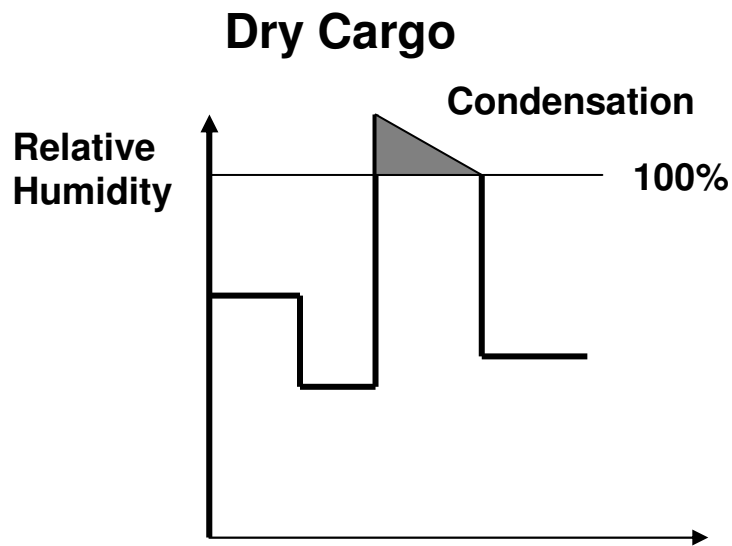


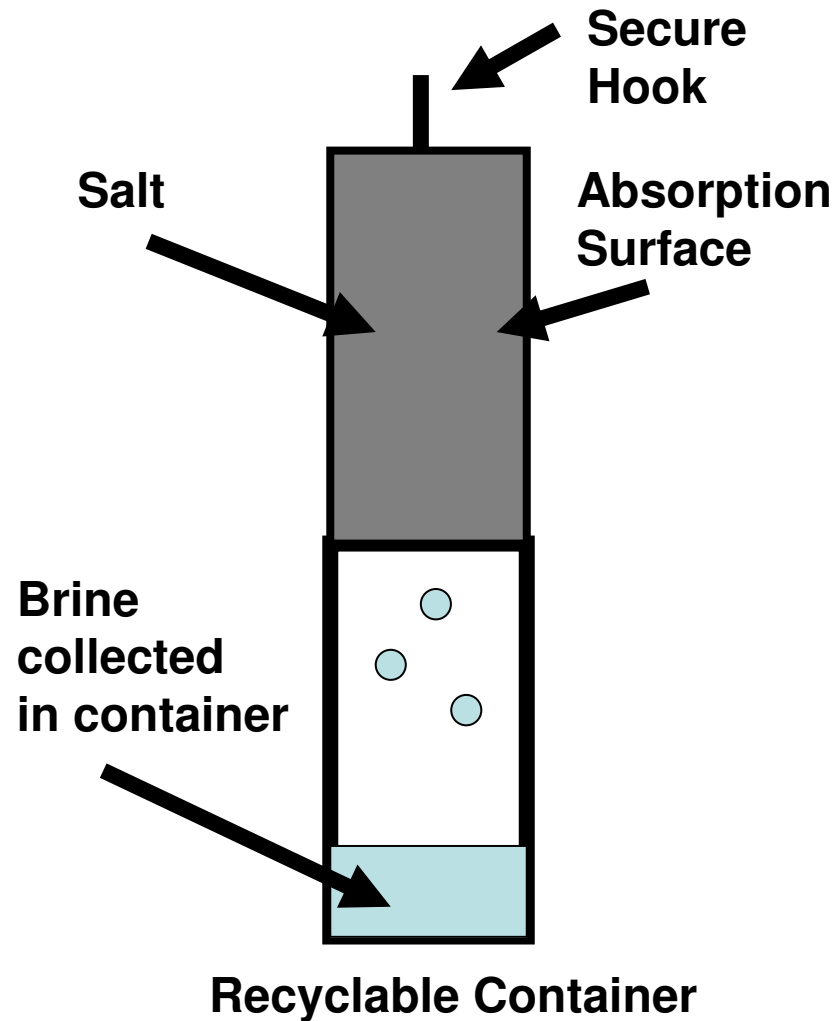
Moist Ambient Conditions



When the temperature drops, the pressure in the container drops, and air with ambient moisture content enters the container (breathing-in). When the temperature goes up, the opposite happens (breathing-out).

Desiccants Remove Moisture from the Air





Absorpole Protects Against Moisture

- Active substance Calcium Chloride
- High absorption capacity, more than 100 % of own weight
- High rate of absorption at all levels of humidity above 40 %
- Not prone to exhaustion at extreme events. Self limiting absorption rate.
- Does not re-evaporate moisture once absorbed
- Non-toxic, safe with food products and environmentally safe.
- Easily mounted and mechanically protected
- Fits into wall corrugation
- Suitable for all applications in shipping containers

Desiccant Checklist

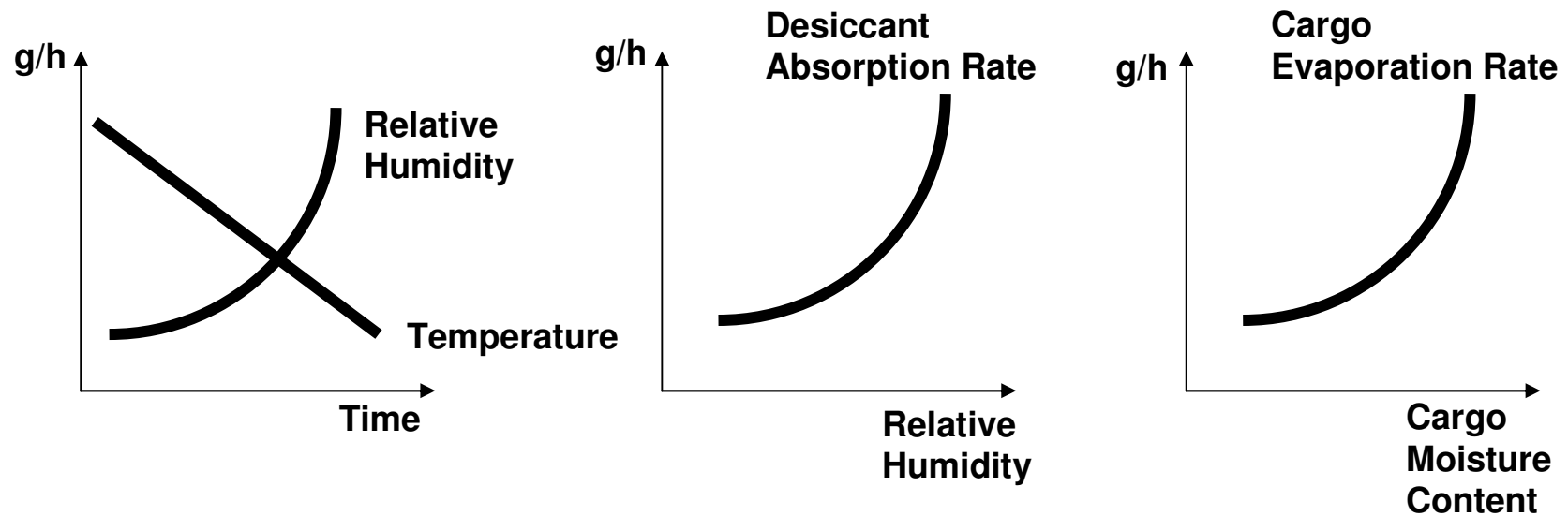
<u>Desiccant ></u>	<u>Absorpole</u>			
Absorption Capacity	>100%			
Absorption rate at Condensing	High			
Absorp. Rate at 70-80%Humidity	High			
Safe against Exhaustion	Yes (Selflimiting)			
Leaks	No			
Easy to install/ Physically Safe	Yes			
Environmentally Safe, Non-Toxic	Yes (recyclable)			

How Many poles do I need?

- The poles must have
 - A sufficient *Activity* (absorption rate) to protect against condensation and lower the humidity at the worst time
 - A sufficient *Capacity* (amount of salt) to last the voyage
- The number of poles required depends on
 - The length of the voyage
 - Temperature variations during the voyage
 - Ambient conditions during the voyage
 - The moisture content of the cargo and packaging
 - The desired level of risk
- Non-linear physics – A small change in conditions have a great effect on the outcome

Are moisture Problems Unpredictable?

Just about all physical moisture processes are strongly non-linear, often having an exponential character. Some examples:



This means that a small change in conditions can have a great effect on the outcome and that moisture behavior may seem unpredictable.



4-8 Poles in a Dry Cargo 20 ft, But...

- Make sure pallets, container flooring & crates are also dry.
- Consumer goods cargoes usually contain a lot of cardboard packaging which may release moisture.
- Some metal cargoes are at risk even at moderately increased humidity (>60 %) Many anti-corrosive oils and films contain water which may release moisture.
- A cargo with a small volume increases the volume of breathing.
- Mind the loading temperature – A cool cargo in warm surroundings may be a risk for weeks (even if the cargo is dry)
- For a short voyage, the number of poles can be reduced by using faster poles (Absortop Speed – To be announced)

6-12 Poles in a Moist Cargo TEU

- Examples of moist cargoes are seeds, beans, nuts, etc. Some wood cargoes, some paper cargoes etc. (or cargoes with moisture containing packaging).
- The conditions at the center of the cargo may differ a lot from those on the outside.
- Mind the loading temperature – A cool cargo in hot surroundings (e.g. when crossing the equator) or a warm cargo in cool surroundings are at risk for weeks.
- Daily temperature cycles may cause a pumping of moisture from the cargo and are a special risk.
- Container breathing is less of a concern.

Checklist at Shipping

- Close the vent holes with tape when you have a dry cargo. The container will still breathe, but more slowly. Moist cargo may be shipped with vent holes open or closed.
- Check that the container floor, pallets and packaging are dry. Softwood packaging should have maximum 18-19 % moisture.
- Cargo in pallets must be able to dry. Check that any shrink wrap or other plastic packaging does not cover completely.
- Check that the Absorpole are not covered. There should be at least a few cm of free space in front of most of the grille area.
- Check that all poles are securely hung and that any Absorbags will not be crushed by the cargo.