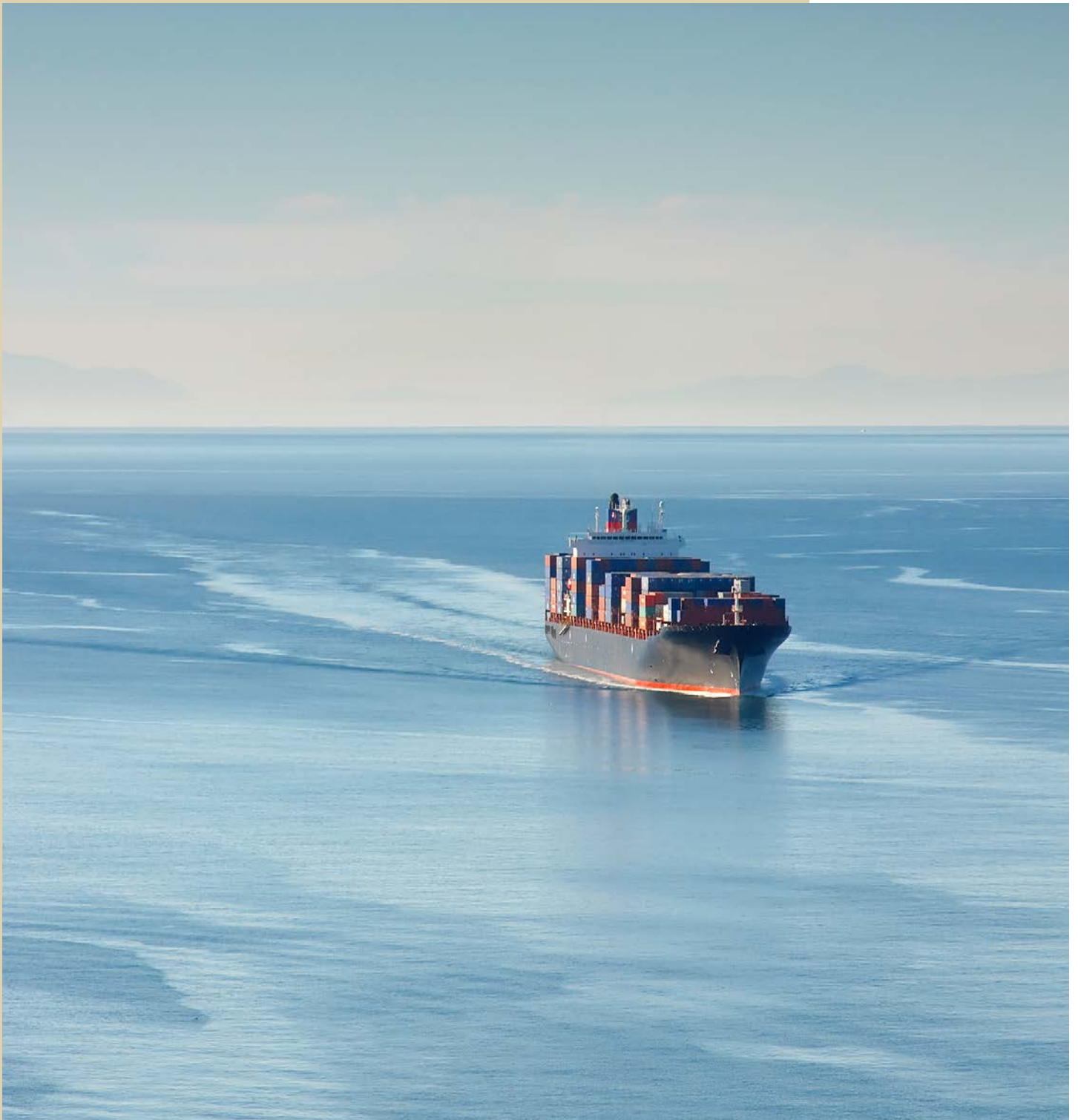


Case study

Moisture damage prevention
in agricultural commodities





Introduction

It's no walk in the park to protect agricultural commodities during shipping. A large part of food loss occurs during transportation due to inefficient moisture prevention solutions. This is something that we're determined to put a stop to. At Absortech we're experts at moisture damage prevention and we have helped companies avoid moisture damages and cargo losses for over 25 years.

In this paper we present solutions that were tested by a leading food and agri-business company on different agricultural commodity shipments.

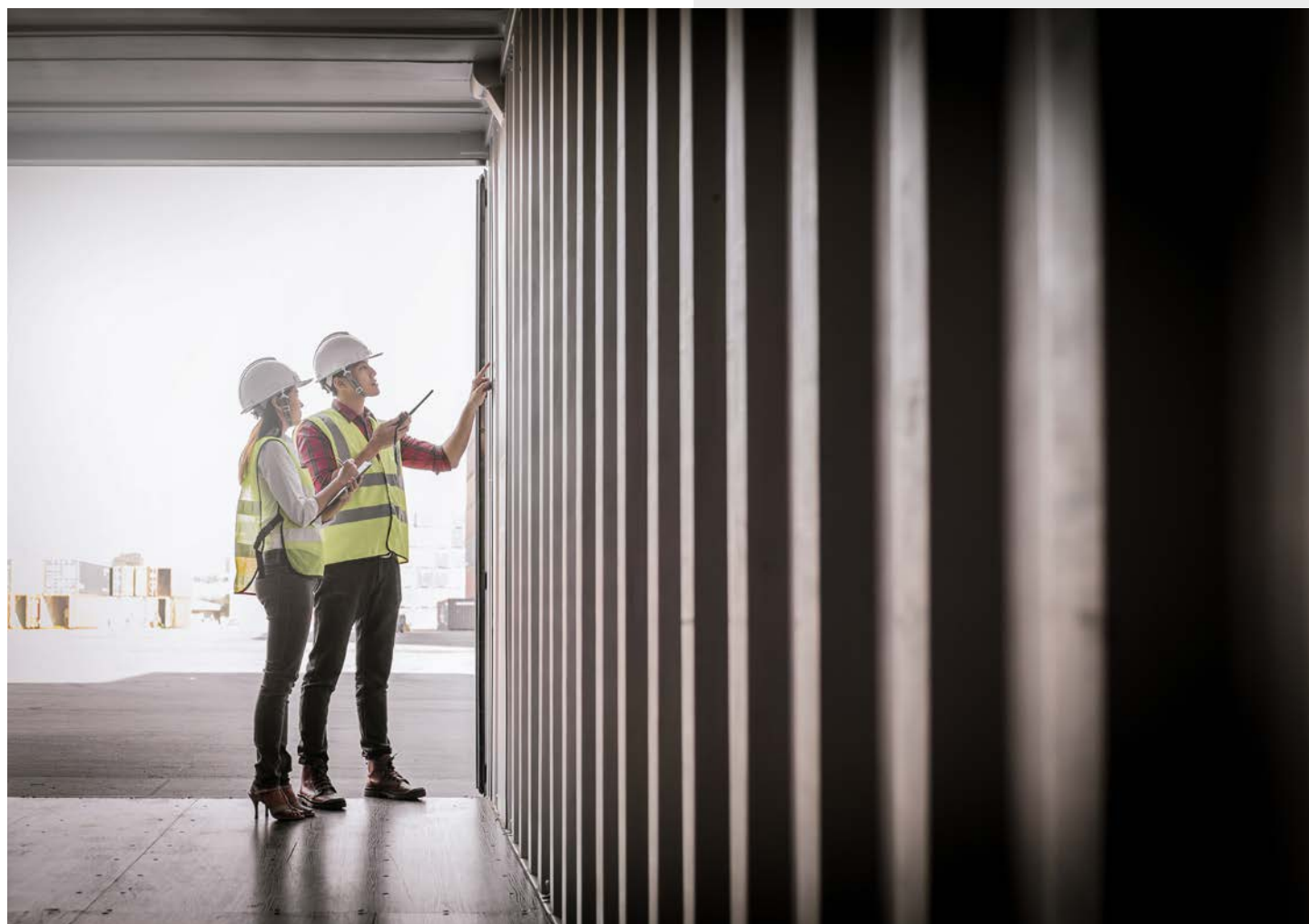
The test led to Absortech's desiccants helping the company improve its global supply chain processes and to protect its shipments from moisture damage. By reading this report you will better understand our moisture protection solution, why it was of great use to our client and better for the environment.

Moisture is the worst enemy for agricultural commodities

Some agricultural commodities are known as hygroscopic cargos. This means that they absorb moisture from the air, and therefore can contain a considerable amount of moisture. Hygroscopic agricultural cargos include cocoa, coffee, oil seeds, pulses, grain, and spices. These commodities are usually not shipped in reefer containers with a controlled atmosphere. Therefore, the amount of water available in agricultural products is much larger than in manufactured products.

Hygroscopic cargos can both emit and absorb moisture. A translocation of a small amount of the total moisture available in such a container loaded with hygroscopic cargo can cause a condensation problem. The major driving force for such condensation events is and always has been temperature changes. These will mostly occur on shipments that pass through different climate zones, but can also be caused by temperature variations between day and night.

So how do we prevent condensation? First, the relative humidity level inside the containers must be kept low. *The International Cargo Handbook* published by BMT – The world's leading independent marine consultancy and surveying company recommends the use of desiccants to absorb excess moisture from the surrounding air in container shipments. However, the different types of desiccants available on the market are complex and often lead to a false security.



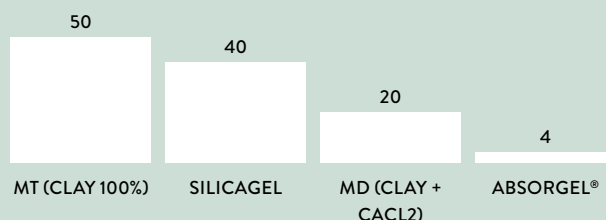
Moisture absorption solutions available in the market

In general, there are four types of moisture absorption technologies commonly used on the market: the packaging itself, clay, silica gel, and calcium chloride. In the following table, you can read about them, their absorption capacity and find a comparison with the solution developed and proposed by Absortech Group, AbsorGel®:

MOISTURE ABSORPTION TECHNOLOGY	DESCRIPTION	ABSORPTION CAPACITY IN FIELD CONDITIONS	IN COMPARISON WITH ABSORTECH SOLUTION
Over dimensioning	Consists of adding more packaging material, such as cardboard to protect against excess moisture.		Very low efficiency since cardboard has a very low capacity to absorb moisture.
Clay MT	Desiccants where the absorbing agent is natural clay.	20-25% at 90% RH	The absorption capacity is very low compared to Absortech desiccants, which makes a large amount of desiccants per container necessary for efficient protection.
Silica gel	Desiccants where the absorbing agent is silica gel.	25-30% at 90% RH	The absorption capacity is very low compared to Absortech desiccants, which makes a large amount of desiccants per container necessary for efficient protection.
Clay MD	Clay MD is Clay MT mixed with calcium chloride to enhance absorption.	50% at 90% RH	This desiccant can saturate quickly, creating the risk of a leakage which could damage the goods.
Calcium Chloride 77%	These desiccants are made of calcium chloride with 77% purity, often mixed with starch to create a gel and enhance prevention to leak.	~ 220% at 90% RH	77% purity is not the highest available in the market. Higher purity means higher absorption capacity.
AbsorGel® Calcium Chloride 94%	Made with 94% guaranteed purity calcium chloride and starch to prevent leakage and binds the absorbed moisture into a gel. It is the result of a unique blend to reach the maximum absorption capacity without the risk of leakage.	~ 250% at 90% RH	

A higher absorption capacity means that you can reduce the amount of kg desiccant you need to reach a satisfactory level of protection. In the chart, you can see how the absorption capacity affects the amount of desiccant's you need to absorb ten liters of water: 4 kg of AbsorGel® or 40 kg of silica gel.

KG DESICCANTS NEEDED TO ABSORB 10 LITRES OF WATER



The sustainable gain

Apart from the obvious reduction on the installation time that have the fact of having to install a tenfold part of desiccants (e.g. 4 kg of AbsorGel® desiccants instead of 40 kg of silica gel desiccants), choosing a more efficient desiccant solution leads also to:

On top of the obvious savings in installation time, having to install one tenth as many desiccants also leads to:

- **The reduction of the amount of desiccants to be transported, stocked and handled, leading logistics savings.**
- **The reduction of the quantity of plastics and other raw materials needed to produce the desiccants. This considerably reduces the carbon footprint of the moisture absorption solution, and therefore the overall carbon footprint of the shipping process.**

Costly consequences from a bad choice

The consequences of a poor choice of moisture prevention solution can be infestation, mould, and damaged goods. This often leads to having to scrap part of the cargo, which increases the problem of food loss and its environmental consequences.

Damaged cardboard, wet bags... the picture was taken during the unloading process of a container with sacks of grains. Even with the use of clay desiccants, the excess moisture damaged the cardboard protection on the walls, which caused damage to all bags next to the walls.

But damages and losses go beyond the direct scrapping costs:

Repacking costs, decontamination costs, bad will costs, environmental damages, missed business opportunities costs due to reasonable sales or lost revenue from cancelled deliveries.

To avoid these costs and situations that lead to profit and environmental losses - like the one in the picture - Absortech has developed an efficient solution. It improves the safety of hygroscopic agricultural cargos and preserves its quality.

Our solutions have been successfully tested by our leading food and agri-business client on challenging commodities and itineraries such as West Africa to South East Asia. These solutions have now become their standard moisture damage prevention solutions.

The results of one of those tests are explained in the following pages.





Protecting cocoa beans from Nigeria to Indonesia

Absortech Group has performed a test with a leading agri-business company, challengingly situated close to the Equator. The goal was to evaluate the performance of a choice of desiccants to prevent moisture damages during a shipment of cocoa beans from Lagos, Nigeria, to Jakarta Indonesia. Since then, this client uses AbsorGel® Max, a desiccant compliant with the Federation of Cocoa Commerce guidelines for the export shipments of cocoa beans.



Scope of the test

Four 40 ft containers participated in the test, equipped with dataloggers AbsorTrack, that logged the temperature, relative humidity (RH) and dewpoint throughout the entire journey. Each container was equipped with 10 AbsorGel® Max.

Our test data includes:

- **Temperature**
- **RH**
- **Dewpoint**
- **Absolute absorption**
- **Content of moisture in container floor**
- **Content of moisture in cardboard**
- **Desiccant weight upon arrival**
- **Moisture level in cocoa beans**
- **And the feedback from the visual inspection for signs of condensation and/or moisture related damages.**

The detailed test data can be provided upon request. In this case study, we've focused on the results and focused on the cargo arriving in good condition, which should be the priority when planning a moisture damage prevention solution.

The facts

It's well known that cocoa beans are a high valued product but also a delicate crop. Due to their natural condition, the use of desiccants on cocoa transport is mandatory in order to keep the bean's precious characteristic intact.

During long shipments like the ones below, where the test lasted for 77 and 92 days respectively, the temperature fluctuates every day and night. This continuously exposes the cargo to moisture damage risks. Many parameters can influence the appearance of excess of moisture, that will eventually condensate and cause moisture damages if there is no adequate prevention solution in place.

Testing conditions



PRODUCT TESTED



ABSORGEL® MAX-C 1,8KG

TEST



4 X 40' HC CONTAINERS

CARGO



25 MT OF COCOA BEANS
IN BAGS

DIMENSIONING



10 X ABSORGEL® MAX-C 1,8KG
PER CONTAINER

Results of the test

To calculate the efficiency of the proposed desiccant dimensioning, the desiccants were weighed upon arrival to destination to calculate how much water they had absorbed during the test. Thanks to the tracking device installed in every container, it was possible to watch the temperature, moisture, and dew point during the journey.

The table below shows some key indicators for every container and the condition of the cargo upon arrival. The data shows that all desiccants arrived in good or very good condition.



	ABSORBED LITERS OF WATER IN TOTAL	TEMPERATURE		RH	DESICCANTS CONDITION AND PERFORMANCE	CARGO CONDITION ON ARRIVAL	
		MIN.	MAX.	AVERAGE		NUMBER OF WET BAGS	NUMBER OF MOULDY BAGS
Container 1	51L	22,5°C	46,0°C	82,50%	High absorption, no leakage	0	0
Container 2	49L	24°C	48°C	86,20%	High absorption, no leakage	0	0
Container 3	53L	23,5°C	51°C	88,50%	High absorption, no leakage	0	0
Container 4	41L	23,5°C	53,5°C	82,90%	High absorption, no leakage	0	0

Maximized absorption capacity

AbsorGel® Max has an absorption capacity of approximately 250% in field conditions. In tests organized by the Ghana Cocoa Board, AbsorGel® Max has even reached an absorption capacity of over 325%. The capacity in climate chamber conditions reaches 400%, where temperature and relative humidity are set to be constant over time, an unrealistic situation in field conditions. In reality, day and night temperatures vary and the journey itself generates intense fluctuations over different latitudes.

Due to the extreme conditions of the shipment, absorption capacity reached 350% in some cases during the test. This proves that AbsorGel® desiccants are an efficient method of moisture absorption and an optimal choice to ward off unexpected shipment conditions, like higher relative humidity or unexpected longer journeys.

This shipment had an extremely long transport time. For a journey of those characteristics, long and with high absorption requirements, Absortech's recommendation was to use from 17 to 20 units of AbsorGel® Max. Nevertheless, the test was conducted with 10 desiccant units per container as per customer request.

The risk of under-dimensioning cannot be ignored. Unexpected conditions can expose the cargo and the desiccants to limiting situations that could endanger the cargo and their value. Because of that, our recommendation is to follow moisture damage prevention expert recommendations and test the proposed dimensioning.

Sustainability facts behind choosing AbsorGel®

As we stated in the introduction, calcium chloride desiccants have a higher absorption capacity than other traditional desiccants such as silica gel or clay desiccants. AbsorGel® desiccants - made with 94% purity calcium chloride and starch - can absorb up to 10 or 12 times more water than silica gel or clay desiccants in field conditions. Calcium chloride also performs better when the relative humidity is high, increasing its capacity to absorb water over time.

The higher performance and absorption capacity make our desiccants a sustainable choice. Since they absorb more water, you need fewer of our desiccant's than if you choose silica gel or clay desiccants.

Fewer desiccants lead to less plastic, less installation accessories and less raw material. It also leads to reductions of the resources needed to produce and source desiccants.

To sum up, if you choose AbsorGel® instead of traditional desiccants, the carbon footprint will be 90% less.

On the other hand, general figures point to the carbon footprint for calcium chloride being half of the carbon footprint of silica gel. This is due to the process of obtaining these materials and their readiness to be used in a desiccant.

Some other factors can affect the carbon footprint of silica gel desiccants. The amount of plastic and the source of that plastic is one of the most important ones, considering that all desiccants are made of plastic: non-woven, PE and PP. Therefore, to choose alternatives made with recycled plastic instead of virgin plastic or desiccants with optimized accessories can reduce the carbon footprint.



Absortech: Committed to Sustainability

At Absortech Group, we're committed to base our operations on sustainable principles and help businesses to implement sustainable solutions to prevent moisture damage. Continuously, we invest to improve the performance of our desiccants and to reduce the carbon footprint derived from its production and sourcing, reengineering different desiccant parts and sourcing new raw materials, such as recycled plastic with respect to the environment.

Absortech has released container desiccants made with recycled plastic and low carbon footprint calcium chloride. Sustainability is seamlessly integrated in all our operations, from people and management to our solutions and products, and it's one of our main decision drivers.



Our group has a globally certified management system ISO 9001 and ISO 14001, and holds a strong Code of Conduct based on our own Group Policy, the UN Declaration of Human Rights, the ILO Principles of Rights at Work and the OECD Guidelines for Multinational Enterprises.

We aim to reduce the impact on society, the economy, and the environment through an optimized moisture control. Our process Peace of Moisture Mind® is made of proven concepts used to lower the amount of moisture in the customer's supply chain, avoiding the waste of resources, and thereby minimizing the need for protection, leading to a reduction on the overall carbon footprint.

Summary

This is only one example of many tests performed with various branches of our leading agri-business client. In all tests, including this one, AbsorGel® desiccants have proven to be an efficient solution to avoid moisture damages. It's also clear that they preserve the quality of goods even during extremely challenging and long routes.

To choose AbsorGel® desiccants is a small investment and a smart choice to avoid the costs related to moisture damages. Go with us and protect your products, minimize consequences for the environment and climate that follow a poor moisture damage prevention strategy.

To learn more about the test and the products used, please get in touch with us.



Absortech helps you prevent moisture damage during transport. Our vision is zero waste in cargo supply chains, and we aim to be the trusted partner by providing innovative and sustainable solutions for moisture damage prevention in the cargo supply chain.

Our promise is to protect your brand, increase your savings, and lower the environmental footprint of your logistics processes. Based in Sweden, we have been pioneers in moisture damage prevention since 1996.

Our desiccant portfolio includes a variety of innovative solutions designed to meet diverse challenges in global shipping. Peace of Moisture Mind® is our moisture damage prevention concept, which includes steps like audits, tests and global supply chain solutions. We are committed to base our operations on sustainable principles and help businesses like yours implement sustainable solutions to prevent moisture damage.

LEARN MORE AT [ABSORTECH.COM](https://www.absortech.com)



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