

Development and Growth of Moisture Absorbent Film Active Packaging

Koichi Haraguchi
 MARUTO SANGYO CO., LTD.
www.marutosangyo.co.jp



1. Introduction

One of the functions required of flexible packaging is the ability to obstruct the water content inside the package from degrading the product in order to extend shelf-lives and deliver a safe product to the consumer. This function is realized by coating or laminating gas barrier materials onto the packaging film, which slows the permeation of water vapor through the outside of the package into the product during the product's storage period.

Meanwhile, to further reduce deterioration beyond simply preventing external water vapor permeation, we must ask ourselves how to eliminate the moisture trapped inside the package during the packaging process. In other words, the packaging must actively absorb moisture from inside the package to maintain a low-moisture environment. Packaging that has this type of function is called active packaging, and is defined as packaging material that can detect and respond to changes in the internal package environment to maintain the quality, safety, shelf-life, and consumability of the contents.¹

Conventional active packaging includes desiccants, which are placed inside the package along with the contents. Recently, however, food and pharmaceutical producers have indicated the need to reduce the risk of accidental consumption of desiccants by consumers. In response to such demands, we have developed a moisture absorbent film that integrates the packaging film and desiccants.

In this article, we will introduce the technological details of our Moisture Absorbent Film.

2. Moisture Absorbent Film

2.1 Absorption Mechanism

Moisture Absorbent Film is a laminated packaging film that contains a moisture absorbing layer that has been formulated with desiccants. As such, the film absorbs the moisture in the package head space and reduces deterioration caused by moisture and water content released from the contents (Fig. 1).

The typical material structure of Moisture Absorbent Film is PET/Al foil/polyethylene/moisture absorbent layer/polyethylene (Fig. 2). Permeation of external moisture is blocked by the aluminum foil.

The moisture and water content trapped in the head space during packaging pass through the innermost polyethylene layer to be absorbed by the moisture absorbent layer, which is what keeps the inside of the package dry. The desiccants inside the moisture absorbent layer chemically adsorb the moisture so that the moisture does not separate and release back into the package again when exposed to heat.

Therefore, storage and transport of the packaged item is reliable, even in high temperature environments.

2.2 Characteristics of the Moisture Absorption Process

Our Moisture Absorbent Films can be broadly divided into two types, those that function to ensure a 0% (bone dry) relative humidity (RH) inside the package and those that function to maintain an RH of 20 to 30% (humidity control). When the contents are pills and capsules, humidity control types that do not

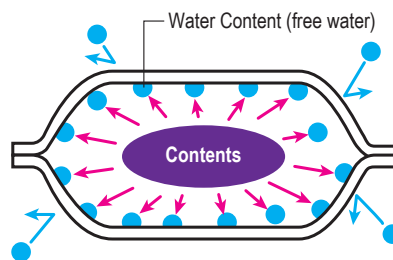


Figure 1 Moisture Absorbency Effect

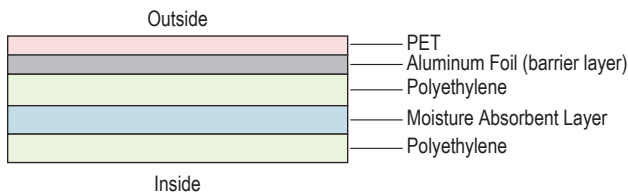


Figure 2 Cross-sectional Schematic

Table 1 Moisture Absorbency Capability by Type

Type	Moisture Absorption Capacity (g/m ²)
0%RH Standard Moisture Absorption	3
0%RH High Moisture Absorption	6
20% RH Controlled Moisture Absorption	9
30% RH Controlled Moisture Absorption	9

*Values are measured values and are not guaranteed

over dry the contents are best.

The films have three levels of moisture absorption capability: 3, 6, and 9 g/m² of film (Table 1). The moisture absorption capability per bag is calculated from the internal surface area. For example, in the case of a 140×180 mm (inside dimension) 0% RH high moisture absorbent bag, the internal surface area (front and back) of the film is 0.0504 m², so the moisture absorbency per bag is 0.3 g. During development, we conducted preservation tests after packaging to confirm the effect on the contents. When there is a high amount of moisture in a large head space and the moisture absorbency capability is insufficient, Moisture Absorbent Films can be used together with deaeration seals or inert gas (nitrogen, etc.) replacement.

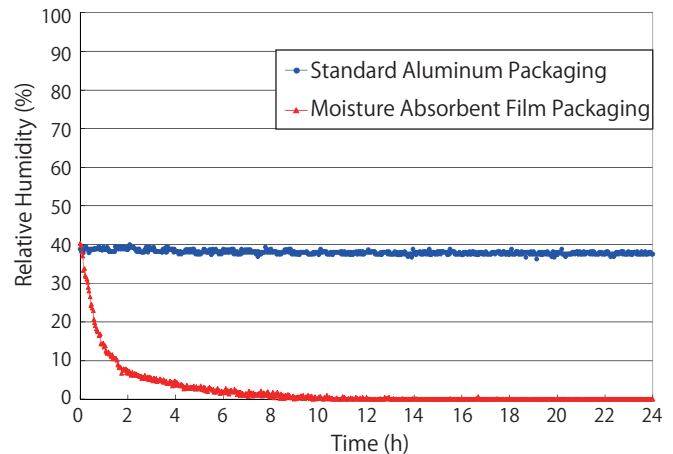
The moisture absorbency speed for 0% RH high moisture absorbent type films has been shown through testing to reach an RH of 0% after content filling and sealing in roughly 12 hours (Fig. 3).

Six month storage tests at an environmental temperature of 40°C and an RH of 75% after packaging—the stability testing standard required when applying to produce pharmaceuticals—confirmed that the effective life is equivalent to more than three years at room temperature (Fig. 4).

3. Future Outlook and Issues

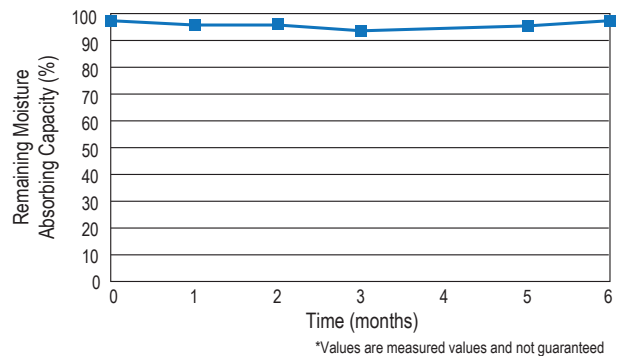
3.1 Characteristics and Benefits

The characteristics and benefits of our Moisture Absorbent Films are as follows.



*Values are measured values and are not guaranteed

Figure 3 Moisture Absorbency Effect Inside the Packaging



*Values are measured values and not guaranteed

Figure 4 Moisture Absorbency Capability After Packaging

- ① The bag itself absorbs moisture and water, so desiccants are unnecessary.
 - Can prevent accidental ingestion of desiccants to improve safety.
 - No risk of forgetting to insert desiccants, so eliminates the inspection process.
- ② Moisture control types are also available.
 - This type prevents excessive drying, so contributes to quality stability.
- ③ Can be used to provide a moisture absorbency function to small capacity bags into which it is difficult to insert desiccants.
 - Can improve the quality of small package items, such as stick packages.

3.2 Applications and Market Development

There are a broad range of applications for our Moisture Absorbent films, which include pharmaceuticals, health foods, condiments, foods, and electronic components (Fig. 5). In the pharmaceutical field, these films are effective in slowing dete-

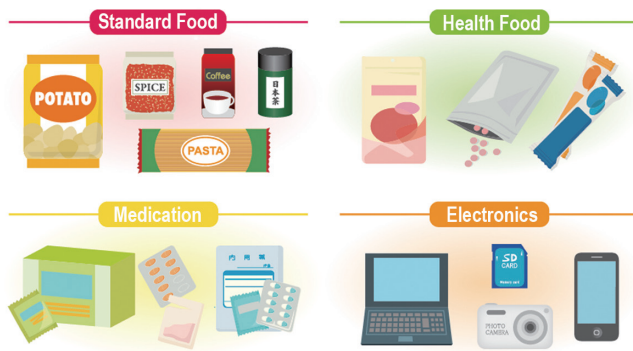


Figure 5 Moisture Absorbent Film Applications



Figure 6 Moisture Absorbent Film Bag Types

rioration of the shape and active ingredients (such as in pills, capsules, and powders) caused by moisture, as well as oxidation deterioration caused by moisture. Packages are sometimes vacuum sealed after inserting desiccants when packaging semiconductor devices, such as electronic components. Switching to packaging using our Moisture Absorbent Films eliminates the need to insert desiccants while preventing moisture caused quality deterioration.

Our Moisture Absorbent Films can be applied to a wide range of packaging sizes for dry content applications, from 1 gram to 30 kilograms. The films can also be formed into all types of bags, including three-side seal bags and stand up pouches (Fig. 6). Therefore, these films can be expanded to use beyond standard consumer sized health foods, food ad-

ditives, and powdered condiments, for example, to industrial sizes exceeding 1 kilogram. In addition, the films can be perforated as a straight tear line so that the bags can be opened in a straight line parallel to the top edge. In this way, the films allow for easy open packages.

The cost of packaging materials containing Moisture Absorbent Film is slightly more expensive than the cost of packaging materials when including conventional desiccants. In this respect, there is still room for improvement. When including the characteristics and benefits ①–③ into the equation, however, the films function to increase the value of the product inside the package and help improve the credibility of the product among consumers. In this way, the overall benefits of adopting our Moisture Absorbent Films are great.

4. Closing

Ten years have passed since we began working with Moisture Absorbent Film. Given that consumers are increasingly focused on safety and security, the past few years have seen growing demand for our Moisture Absorbent Films. Because consumers always demand the safest, easiest to use, most human-friendly packaging, such changes in society are expected to accelerate the penetration of universal design into daily life. In this respect, users of Moisture Absorbent Film have commented that adopting our films has increased the level of satisfaction in the product itself among their customers.

Going forward, we hope to increase the functionality of our Moisture Absorbent Films in hopes of spreading the use of easier to use, more advanced active packaging.

References

1. S. Kojima, et al.: *Technical Commentary on Packaging Related Keywords* (in Japanese), p. 22, Japan Packaging Institute, 2014