

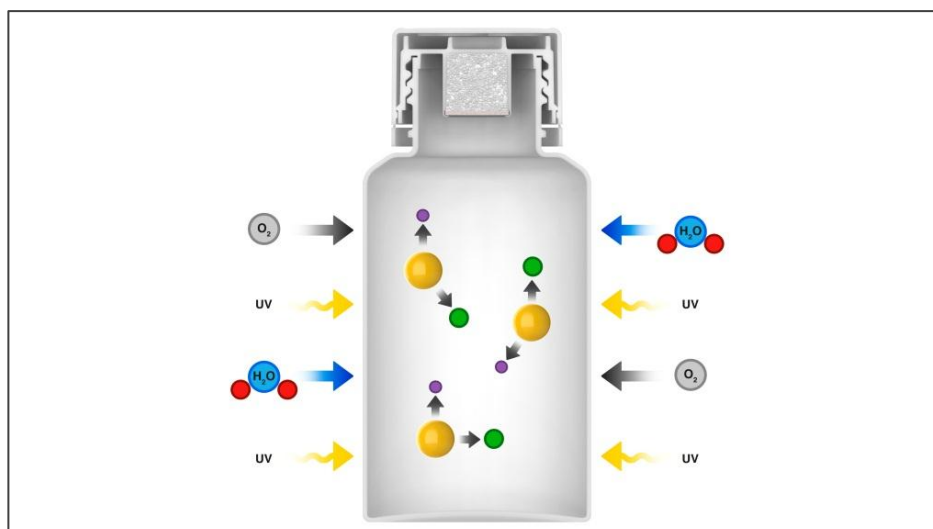
Primary desiccant packaging

## No chance for moisture and odors in pharmaceutical packaging

**While moisture in pharmaceutical packaging can have negative or even dangerous effects on its content, unpleasant odors are especially repellent to patients. Both can be systematically prevented using suitable adsorbents – provided the right aspects are taken into account.**

Many pharmaceutical products such as tablets and capsules, but also test strips or inhalers are sensitive to moisture. The effects of moisture are manifold and often pose a high risk not only to the drug but also to patients. In the case of tablets, powders and effervescent tablets, the properties and texture may change, whereas gel capsules might dissolve due to moisture. Blood or urine test strips may produce false or misleading results if the test chemical is influenced by too much humidity.

In the worst case, the efficacy of drugs is reduced, or the analytical results are falsified, which can lead to an incorrect medication and impede successful therapy. In addition, many

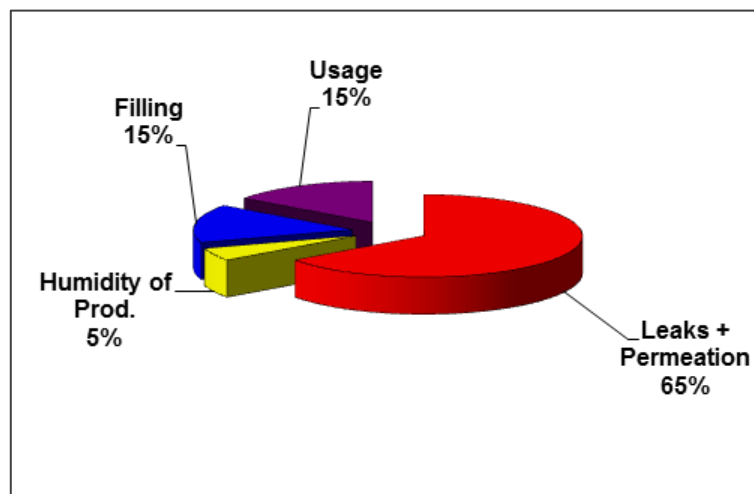


pharmaceuticals, especially analgesics such as acetylsalicylic acid, release specific molecules into the ambient air inside the packaging that can develop very unpleasant odors.

### Only real data provides reliable results

The amount of humidity that penetrates into the packaging is decisive for the stability of a moisture-sensitive drug. Around 65% of humidity ingress can be attributed to the packaging. Weak spots can be the packaging wall, the sealing surfaces between containers and closures, as well as the sealing seams of blister packs. Hence the choice of the primary packaging depends mainly on maintaining the optimum climate inside the packaging in order to ensure the required shelf life.

A holistic approach that takes all aspects of moisture ingress into a pharmaceutical packaging into account is indispensable. Relevant parameters such as material type, wall thickness, product moisture and production conditions, as well as differing climatic conditions in the target markets and consumer behavior must be



taken into account when designing the packaging. To obtain reliable data, tests should always be conducted with the actual packaging. Material data-sheets or databases provide data determined under very specific and ideal conditions. These cannot be transferred 1:1 to a specific packaging. Consequently, only real data and realistic analyses avoid unnecessary durability tests.

### Desiccants: silica gel or molecular sieves

Depending on the area of application, different desiccants such as silica gel or molecular sieves can be used. These hygroscopic desiccants attract moisture and keep it away from the packaging content. The most common desiccant is silica gel. It contains numerous small interconnected channels that open up into pores on the surface. Its structure resembles a sponge with a large inner surface, whose channels and pores adsorb water molecules. These pores can absorb up to 36% of their own weight without altering their structure. The higher the relative ambient humidity, the higher the adsorption capacity.

Molecular sieves, on the other hand, are synthetically produced zeolites with a uniform pore diameter and a crystalline structure. Molecular sieves adsorb moisture corresponding to between 20 and 22% of their own weight, almost independently of the relative ambient humidity. While silica gel brings moisture to a certain level, molecular sieves can achieve a climate of close to 0% relative humidity inside a closed packaging.



### **Activated carbon: far more than odor adsorption**

When it comes to odor adsorption, activated carbon is particularly efficient: the surface of just one kilogram of activated carbon equals a 160 kilometer two-line highway. Activated carbon is made of organic material with high carbon content such as peat, wood or coconut shell. This material is slowly heated in an oxygen-depleted or oxygen-free environment to remove water and impurities. The surface increases significantly through further physical and chemical processing and creates a submicroscopic network of pores.



The extremely hygroscopic surface molecules actively search for other molecules they can bind to. Activated carbon attracts numerous chemical compounds by adsorption and thus binds bad odors. Moreover, activated carbon can adsorb residual solvents as well as organic and inorganic impurities that reach the headspace of bottles by evaporation.

### **Drop-in sachets: eliminating risks right from the start**

There are many different ways to equip packaging with the right type and amount of desiccants and/or activated carbon. The fundamental difference lies in the way the adsorbents are inserted into the packaging. More cost-intensive, integrated desiccants are attached to the packaging, for example within the cap of a tablet tube or as a desiccant chamber in the

package bottom or in the wall. Drop-in desiccant solutions are added directly into bottles or containers in different forms. In general, a distinction is made between capsules or canisters and sachets.

The market for drop-in desiccants is estimated at 200 million U.S. dollars minimum; more than half of the turnover is attributed to sachets, the remainder to capsules and canisters. Desiccant sachets are particularly soft and flexible. They can be placed anywhere in the container without any risk of damaging the drugs. Due to their shape, patients can easily distinguish the sachets from the drug, leading to a low risk of accidental ingestion. Sachet packs are ideally made of Tyvek®. The dust- and lint-free material has several advantages compared to other materials: since it consists of 100% high-density polyethylene (HDPE), Tyvek® offers an excellent combination of durability and breathability. It is also particularly tear-resistant and puncture-proof, eliminating the risk of product contamination due to desiccant leakage during filling or usage.



### **Desiccant capsules for 360 degree moisture protection**

Desiccant capsules are small, cylindrical containers made of plastic and sealed with a cardboard disc. Desiccant canisters have a similar shape but are made entirely of plastic. Desiccant capsules that provide 360 degree moisture absorption are rarely to be found on the

market. Their unique grid structure in the capsule wall combines the advantages of conventional capsules and canisters. Even if the capsule ends up on the cardboard side within the container after filling, moisture adsorption is ensured without losing effectiveness. Desiccant capsules with 360 degree moisture absorption can thus adsorb up to 30% more moisture than conventional capsules. In addition, the tactile grid structure prevents confusion with drugs and thus accidental ingestion.



Drop-in capsules or canisters are available in different sizes and with different filling material. Depending on the moisture protection requirements of certain drugs, silica gel, molecular sieves or a combination of both can be used. A mixture of silica gel and activated carbon is the best choice for pharmaceuticals that require both odor adsorption and comprehensive moisture protection.

### **Holistic approach for ultimate product protection**

A holistic view based on real data is crucial. It is the only way to implement all technical and regulatory aspects quickly and efficiently. At the same time, it must be possible to produce large numbers while maintaining consistently high quality. Individual, integrated or drop-in – all desiccant packaging solutions must be smoothly integrated into existing processes of pharmaceutical manufacturers.

Regardless whether a product is to be protected against moisture by using silica gel, molecular sieves or a combination of both, or whether additional activated carbon is used for odor adsorption: all solutions must always be tested regarding suitability and regulatory compliance. Support is provided by partners with many years of experience and the required expertise in packaging production and in the application of different adsorbents.

For further information, please visit:

<http://www.sanner-group.com/en/>

<http://www.sanner-group.com/en/pharma-desiccant-packaging/>



**Author**

Ursula Hahn

Head of Product Management

Sanner GmbH

Germany

[u.hahn@sanner-group.com](mailto:u.hahn@sanner-group.com)