This article discusses the safety, product stability, and consumer convenience benefits of blister packaging for solid oral dosage pharmaceutical products.

Invented in the early 1960s and heralded for its convenience and security, the blister pack was designed to improve medication compliance. Indeed, for the birth-control pill, which became the first pharmaceutical product to leverage the blister-pack format, patient compliance was critical. For the pill to be effective in preventing pregnancy, Schering (now Bayer) needed a packaging format that made it easy for consumers to administer doses regularly over a set period of time. The development of polyvinyl chloride (PVC) and copolymers with good thermoforming capabilities, along with tempered aluminum foil as a lidding material, helped make commercialization of the blister pack possible [1].

More than 50 years later, the blister pack is becoming increasingly popular as a packaging format perfectly
suitable for today's security-minded consumers and regulators. Blister packaging not only works well with track-and-trace and serialization protocols but also helps with anti-counterfeiting efforts. And the blister pack remains the best packaging format for improving patient compliance, whether for an over-the-counter (OTC) pain reliever or a groundbreaking clinical-trial medication.

The global blister packaging market was valued at $16.71 billion in 2017 and is expected to reach a value of $24.21 billion by 2023—a compound annual growth rate (CAGR) of 6.31 percent during the forecast period (2018-2023) [2]. Nowhere is this growth more evident than in Europe, due in part to regulatory requirements and environmental incentives to limit packaging waste, which is minimized with blister packaging. Market factors, including population growth and the outbreak of new diseases around the world, are also expected to contribute to the increased use of blister packaging, as manufacturers meet rising demand for OTC and prescription drug products to keep growing populations healthy.

Today's increasingly well-informed pharmaceutical consumers prefer blister packaging for the safety, product stability, and consumer convenience the format provides.

**Product safety**

Safety and security are major factors driving growth in blister packaging worldwide. The pharmaceutical industry has long recognized the need for tamper-evident packaging to protect consumers throughout a drug product's life cycle. In 1982, the FDA published “Compliance Policy Guide Sec. 450.500 Tamper-Resistant Packaging Requirements for Certain Over-the-Counter Human Drug Products” [3]. The guide requires that most OTC drug products be packaged in tamper-resistant packaging that provides "visible evidence to consumers that tampering has occurred" even after purchase.

The pharmaceutical industry has heeded the call from consumers and regulators alike in adopting blister packaging. Security packaging, including tamper-evident formats, is expected to grow at a 5.3 percent CAGR between 2017 and 2022, reaching $3.6 billion by 2022 [4]. Tamper-evident technologies represent a third of the security packaging market, and blister packaging is the most popular form of tamper-evident packaging because the medications cannot be removed, re-applied, or re-inserted without obvious physical evidence.

By safeguarding individual doses up to the point of ingestion, blister packaging allows manufacturers to keep up with increasingly stringent global regulations. Despite recent political talk of trade wars, the overall global trend of extending trade zones has made it easier for counterfeit goods to cross international borders. This has created even greater demand for tamper-evident packaging. At the same time, continuing technological innovations in automated filling and sealing processes have reduced the risk of impurities and contaminants entering the supply chain, and new labeling technologies are helping to make products more traceable.

**Product stability**

Another important benefit of blister packaging compared to other packaging formats is its ability to protect drug products from moisture and gases. Packaged pharmaceutical products can be subject to large variations in humidity and temperature during shipping and storage, as well as in the medicine cabinets of consumers' steamy bathrooms. These environmental conditions can cause degradation in some bottled drug products, reducing shelf life or efficacy, but since each individual dose is hermetically sealed in a blister pack, the product is insulated from environmental conditions.

While being sealed in a blister pack offers a drug product significant protection from humidity fluctuations, recent blister packaging innovations take this protection a step further. For example, Activ-Blister solutions from CSP Technologies incorporates silica gel and molecular-sieve technology to actively control the internal atmosphere of individual blister cavities. This can help to optimize stability for moisture- and oxygen-sensitive products.

**Consumer convenience**

Since its entry into the market, blister packaging has proven to be a convenient and user-friendly packaging format for solid oral dosage medications. This can be particularly true for geriatric patients, who often find it difficult to open medication bottles. At the same time, blister packaging offers secure child resistance.

Packaging companies continue to design new blister packs with consumers in mind, such as slider packs that specify the exact day to administer each dose and trans-
parent plastic blister fronts that allow consumers to verify the presence and condition of each dose in a pack. By making prescription dosing easier, blister packaging can have significant advantages in countries whose populations aren’t used to self-administering medications. The format encourages medication adherence in a way that bottled pharmaceuticals cannot.

Clinical studies indicate that the most effective means of encouraging medication adherence is to provide patients with information on their adherence behavior, which is easy to do with “smart” blister packaging. New smart features for blister formats are possible by leveraging the cardboard used in blister packaging, which provides ample space for incorporating printed electronics. Blister packaging linked with sensors can send smartphone alerts to remind patients to take medicines, which can help improve compliance and mitigate the possibility of dosing errors.

Blister packaging can also contain sensors to monitor dosing activity, which is vital to ensure the accuracy of clinical trials. For example, WestRock’s CerePak blister packs feature hidden microprocessors and printed, conductive inks that record the date, time, and location each dose is removed from the package, which is important for regimens that include dosage changes or a mix of placebo and active drugs. The packaging also uses lights and vibration to prompt patients to take medications and an optional push-button questionnaire that allows users to record feedback (such as pain, insomnia, or thirst) with each dose.

As demand for tamper-evident pharmaceutical packaging grows, manufacturers are likely to continue to turn to blister packaging as a safe, reliable, and convenient solution.

References

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Photo 2: New blister-pack designs cater to consumers, including slider packs that specify the exact day when each dose should be administered and transparent blister fronts that allow consumers to verify the presence and condition of each dose in a pack.