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RECENT TRENDS AND FUTURE OF PHARMACEUTICAL PACKAGING TECHNOLOGY

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ABSTRACT

Pharmaceutical packaging is one market across the globe which is advancing at constant pace. It is expected that market will grow to worth $78.79 Billion by 2018. Packaging is a key for sale, safety and success. Like other packaged goods, pharmaceuticals packaging need to be in such a manner that it will provide speedy packaging, protection, identification, product quality, patient comfort, display and needs of security. Advancement in research of pharmaceuticals development had always being dependent on the packaging technology. Maintaining integrity of pharmaceuticals during storage, shipment, and delivery is assured by quality of packaging available. This article reviewing current pharmaceutical packaging trends and predicting the packaging outcomes in future.

KEYWORDS: Pharmaceutical packaging, Current pharmaceutical packaging trends, Speedy packaging.

INTRODUCTION[1-6]

Packaging is defined as a technique which allows containment of pharmaceutical product from the time of production in a unit till its use. Role of pharmaceutical packaging is to provide lifesaving drugs, surgical devices, blood and blood products, nutraceuticals, powders, poultices, liquid and dosage forms, solid and semisolid dosage forms. Packaging of pharmaceuticals essentially provides containment, drug safety, identity, convenience of handling and delivery. Pharmaceutical packaging has to balance lots of complex considerations. Leaving behind relatively simple issues such as developing good designs and communicating with customers, pharmaceutical packagers are concerned to more pressing

concerns which include fighting with counterfeiting, encouraging patient compliance, ensuring drug integrity and balancing child-resistance and accessibility for the elderly. Issue of environment safety is also key concern for both developed and developing countries packaging industry.

1. Selection of Packaging

The packaging materials used should possess the ideal characteristics such as

1. Protection from environmental conditions such as humidity, temperature etc.
2. The product packed in the container must be non-reactive to the container enclosing it.
3. The odor and the taste of the product must not be altered.
4. The packaging material must be non-toxic.
5. FDA approved packaging materials must be used.
6. Requirements such as tamper-resistance must be maintained.
7. The packaging material to be used should be easily adaptable to high speed packaging equipment

2. Advantages of Packaging

1. The product uniformity is maintained during packaging.
2. The integrity of dosage form is maintained.
3. The side effects are minimized and the inert environment is maintained and protected from contamination.
4. Packaging enhances the shelf life of the product preventing deterioration of the product, thus enhancing better stability.
5. Minimizes the side effects.

3. Objectives

1. Physical Protection
2. Barriers Protection
3. Information transmission
4. Marketing
5. Convenience

4. Types of Packaging

1. Primary Packaging
2. Secondary Packaging

3. Tertiary Packaging

1. Primary Packaging

The material that first envelops the product and holds it. This is the smallest unit of distribution or use and is the package which is in direct contact with contents.

Example: Ampules, IV containers

2. Secondary Packaging

It is outside the primary packaging used to group primary packages together.

Example: cartons box

3. Tertiary Packaging

It is used for bulk handling, warehouse storage and transport shipping.

Example: containers, barrel

5. Types of Primary and Secondary Packaging Material.

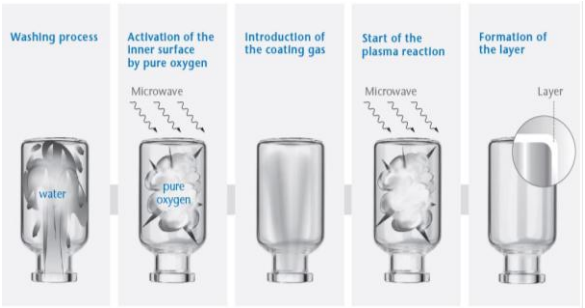
Sr. No.	Material	Type	USE
1.	Glass	Type I-Borosilicate glass	Strong acids And Alkalis.
		Type II-Treated soda-lime glass	Neutral aqueous preparations& acidic Preparations
		Type III- Regular soda lime glass	Dry Powders, Oleaginous Solutions
		Type IV- General Purpose soda lime glass	For Suspension &Emulsion
2.	**Plastic**	Polyethylene(PE)	Food Packaging (Fruit juices,Milk)
		Polypropylene(PP)	Textiles, Livinghinges
		Polyvinyl Chloride(PVC):	Blood bags,Plastic Wraps
		Polystyrene	Containers for Solid DosageForms.
3.	**Paper**	-	Labels, patients information leaflet

6. Current Trends In Pharmaceutical Packaging[6-11]

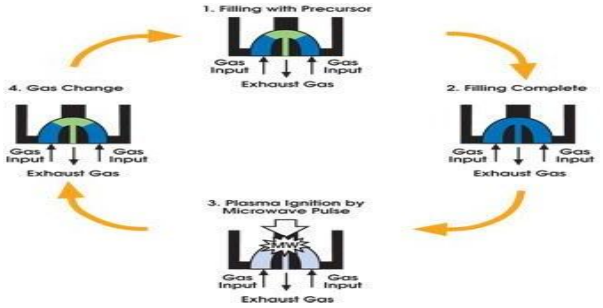
6.1. Materials can be Coated Using Plasma Impulse Chemical Vapor Deposition

Plasma Impulse Chemical Vapor Deposition has been effective in coating high volume glass products, such as pharmaceutical vials, ampoules & syringes, even though it was developed by Schott Glass. It succeeded very quickly in modifying the original PICVD process and applying bonded uniform coatings to a wide variety of plastics - glass-like SiO2 and TiO2 oxide coatings (e.g., PET, PMMA, PC, COC, PP and HDPE). The outcome is that all the positive properties of glass can now be accomplished by plastic. It is now possible to manufacture anti-scratch and anti-reflective coatings in the case of plastic lenses and display

covers, while in the case of plastic packaging, a PICVD coating produces an obstruction against the passage of oxygen gas that can no longer enter and carbon dioxide emitted can no longer escape. The contents therefore have a longer shelf life with no effect on their taste.



Plasma Impulse Chemical Vapor Deposition



Plasma Impulse Chemical Vapor Deposition Process

6.2. Child-Resistant Packaging

Child-resistant packaging (CRP) or C-R packaging is special packaging that is used to minimize the possibility of harmful products being swallowed by children. The CRP containers are immune to penetration by children, but adults may open them. The use of a special safety cap with a locking mechanism also achieves this. Drugs such as Elemental Iron, Aspirin, Paracetamol Contraceptives and many other drugs have been needed to be packaged in CRP.

Child-resistant packaging

6.3. Ziplock bags

Ziplock bags are recent common developments in package design, offering a lightweight and convenient way of securing both conventional and cannabis-based medicine. Ziplock packaging is a single-entry design requiring mature dexterity in order to open a zipper to reach the contents. Many designs also have a flap that, when the bag is closed, covers the zipper, disguising the entry point as an additional protection layer.

Packaging suppliers also have a responsibility to clearly mark child-resistant packaging for customers. This involves using full words such as "child-resistant packaging" rather than abbreviations and including the label's "how supplied/storage and handling section" detail in a designated location.

Ziplock bag

6.4. Eco-friendly Packaging

6.4.1. Green packaging

By using biomaterials our consumers contribute to the decrease of greenhouse gas emissions, thereby defending the environment and avoiding needless waste. Biomaterials are the renewable substitute to predictable PE/PET,"

Sugarcane is one of the materials used to make biomaterials. It produces a material with precisely the same features as conventional plastics which is also fully recyclable.

Green Packaging

6.4.2.Paper and board

Paper

& board

The main benefits of paper and board heir low cost for a given level of rigidity, and their Superb printability and promotional potential. They also have a good environmental image because they are characteristically biodegradable and their raw materials are renewable. Paperboard materials are admirably suited for highly decorated and promotional packages, widely used to give an excellent-quality image. Paper and paperboard are both made from cellulose fibers, obtained mainly from wood.

6.4.3. Glass

It requires high initial energy inputs to manufacture glass from its raw materials, sand and soda ash. In the manufacture of new bottles and jars, the use of recycled glass requires considerably less energy and is thus superior from the perspective of supply conservation. Its primary drawbacks are its weight and fragility, and its weakness in-stabilities to abrupt temperature.

Glass Bottles Used For Pharmaceutical Packaging

6.4.4. Steel

Steel has predictably been recycled worldwide, since as much as 40% of steel scrap goes into the creation of new steel. Every can produced contains, on average, 25% recycled steel.

Its main advantage over other packaging materials from an environmental angle is that it can be readily and cheaply separated from mixed waste using magnets. As much as 50% reduction in energy use can be realized by mixing a fraction of scrap with the virgin steel. Tinplate scrap can be recycled at levels of up to 100% for applications other than packaging.

Steel Cans Used In Pharmaceutical Packaging

6.5.5. Aluminum

Aluminum is an ideal material for recycling. It has high intrinsic worth, and hence scrap value. There is thus a substantial incentive to regain the metal from packaging waste. The economics of collection and recycling of aluminum for packaging applications are generally favorable. The fact that recycling does not destroy aluminum means that new aluminum can be made from 100%-recycled material.

Aluminum Tubes Used For Packaging of Creams

6.5.6. Wood

Wood is relatively heavy and can be expensive as packaging. It provides no effective barrier to gases or moisture and its use in food packaging is therefore restricted. As a result, the use of wood in packaging, although still widespread, is in decline.

6.5.7. Jute and bamboo

Jute and bamboo are no longer generally observed as suitable packaging materials for exporting foodstuffs, because of the contamination possibilities that their open package configurations such as sacks and baskets can present.

Fig. Jute Bags Used For Packaging

7. Talk-in-packaging

The talk Pack from Wipak walsrode GmbH in Germany a system which can be invisibly integrated into any printed image on any packaging material, but need a special scanning pen. A recent development by VTT technical research central of Finland using tags with NFC (Near Field Communication) based technology connected to NFC-enabled mobile phones to

download text, audio or web page product information, which can be played back on their handset.

7.1. Talk-Pack–WIPAC

A special pen –shaped reader is used to retrieve the stored information and to replay it as audio files and render speech, music or sound an audible and thus the consumer can obtain information on the manufacturer, brand, shelf-life or other information. Tack pack does not require any RFID or microchips.

The dot code is simply printed on top of images and texts using a special varnish. This technology can be used with all printing technologies

Talk-Pack –wipac pen –shaped reader

7.2.NFC Tags

NFC tags are added to any packaging so a consumer could touch the code on the packaging with their NFS-enabled mobile phone to download text, audio or information, which can be played back on his phone. Delivered vocal dosage instructions from pharmacy staff, to aid a visually impaired or blind person.

NFS-enabled mobile phone

NFSTAG

8. Dispensing caps[15, 17]

Dispensing caps or functional caps

Store dry or liquid supplements separately from the water- released by the consumer they

form an energy or vitamin Drinks or medicinal drinks. Everything from pharmaceuticals to nutraceuticals, from anti-aging to anti-oxidants, from vitamin to functional supplements, from male potency to functional supplements, from male every to relaxation and so on can be packed and properly dosed by a dispensed cap.

It is generally claimed that pills and capsules have a very short window of absorption Liquid absorption is much higher –around 80-90%

Different Types of Dispensing Caps

9. FUTURE OF PHARMACEUTICAL PACKAGING TECHNOLOGY[18-20]

A Changing pharmaceutical industry

Changes in pharmaceutical industry research and manufacturing technologies have driven significant developments in packaging and delivery systems. An increase in the number of large molecule, biopharmaceutical drugs in development pipelines has led to an increase in the need for injectable packaging and administration systems. The old glass and elastomer closure systems may not provide the effective barrier properties needed for high value, lifesaving therapies. Component manufacturers have responded with new materials and technologies that ensure extended drug product shelf life. Many new biotechnology derived drug therapies are unstable in liquid form and therefore are introduced as lyophilized or dry powder dosage forms. Lyophilized drugs need special stoppers for optimal performance in lyophilization chambers. The stoppers must solve the problem of the stopper sticking to the lyophilization shelf after the cycle is completed. In addition, lyophilized drugs typically are reconstituted at the point of care, thus requiring patient friendly administration systems.

The increase in self administered therapies

Decades ago, healthcare revolved around hospital care. Today, healthcare often revolves around the home a situation that has largely resulted from cost constraints and the introduction of maintenance type drugs for treating chronic conditions such as arthritis,

cancer, multiple sclerosis, and other diseases that require frequent medication. Many of these maintenance therapies are delivered by injection, spurring a need for patient friendly administration systems. These systems must ensure the potency of the drug, be tamper evident, help deter counterfeiting, promote compliance with a dosing regimen, ensure dosing accuracy, and be as safe, easy to use and painless as possible.

When self administered drugs are in lyophilized or dry powder form, manufacturers must find methods or packaging systems that help prevent accidental needle stick injuries, inaccurate.

CONCLUSION

At the time of globalization the packaging sector will be a challenge as the years ahead will see the opening of global networks and the matching of international standards and quality. In order to achieve a holistic approach to packaging that goes beyond the practical aspect of packaging, it is important that the packaging industry advance even further in research. Very few pharmaceutical firms are currently investing time and money on packaging on R&D. The standard packages that are available are not intended to provide Defense against falsification and consistency and, in taking technological innovations in packaging; the industry seems lenient, possibly due to a prohibitive cost factor. As the packaging of the pharmaceutical products is very important with regard to its stability, acceptance to patient, transport, etc. There is always scope for advancement and improvement of the pharmaceutical packaging. Therefore, new techniques like Child-Resistant Packaging, Talk- in packaging, Eco-friendly Packaging, Dispensing caps etc. seems to be promising in pharmaceutical products packaging.

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