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A REVIEW ON INNOVATIVE PACKAGING OF MEDICINE

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Abstract: Packaging in pharmaceutical company trade is associate in depth, comprehensive and multi-faceted task. From containment and protection to convenience, identification and delivery, packaging's role within the market can not be underestimated. it's a way of protective and protective things contained at intervals, further as human activity promoting and regulative info to shoppers. Earlier the necessities of those packaging targeted completely on protective the standard of enveloped product, whereas nowadays the packaging occupies a big portion of the general food and medicines markets. These ar extended to hide criteria like stability and shelf life; convenience and compliance of product use; interference of product meddling and counterfeiting; guaranteeing product safety; and whole identity. These merchandise ought to be designed in such how that it provides a soothing impact to the users; conjointly the medication itself has healing result, thus its packaging ought to complement its options further. whereas there's a drive for customisation at intervals packaging industries, there are issues that innovation is being hindered by factors like budgets and regulation. because the packaging trade continues to develop more and more refined ideas, industries ar beginning to embrace innovations during this field to boost patient adherence to drug regimens.

KEYWORDS: Packaging, convenience, tampering, counterfeiting, drug regimens, etc.

INTRODUCTION:

Packaging is outlined as a method that permits containment of pharmaceutical product from the time of production during a unit until its use. Role of pharmaceutical packaging is to supply life saving medicine, surgical devices, blood and blood merchandise, nutraceuticals, powders, poultices, liquid and indefinite quantity forms, solid and solid indefinite quantity forms. Packaging of prescription drugs basically provides containment, drug safety, identity, convenience of handling and delivery. Pharmaceutical packaging must balance ample advanced concerns. Leaving behind comparatively straightforward problems like developing smart styles and communicating with customers, pharmaceutical packagers ar concerned to a lot of pressing issues that embody fighting with counterfeiting, encouraging patient compliance, making certain drug integrity and equalisation

child-resistance and accessibility for the elderly. Issue of setting safety is additionally key concern for each developed and developing countries packaging business.

Pharmaceutical packaging corporations are a number of the industry's leading innovators evident by the recent advancement in technology. The current trends are results of continuous series of challenges featured by industry. Packaging could be a science that is unendingly evolving and is a major success contributor for pharmaceutical industries. (1)

CATEGORICALLY DIFFERENTIATING PHARMACEUTICAL PACKAGING:

- A. Primary Packaging:** this can be the primary packaging envelope that is in touch with the indefinite quantity kind or instrumentality. The packaging must be such there's no interaction with the drug and can give proper containment of prescription drugs. E.g. Blister packages, Strip packages, etc.
- B. Secondary Packaging:** this can be consecutive covering or package which stores prescription drugs packages in it for his or her grouping. E.g. Cartons, boxes, etc.
- C. Tertiary packaging:** this can be to supply bulk handling and shipping of prescription drugs from one place to a different. E.g. Containers, barrels, etc.

Primarily 2 forms of containers are used for packaging:

1. Glass Containers

2. Plastic Containers

[1] GLASS CONTAINERS: These got to be with chemicals inert, impervious, strong and rigid proving federal agency clearance.

Four forms of Glass is getting used in pharmaceutical business,

- i. **TYPE I-Borosilicate glass:** extremely resistant and with chemicals inert glass. Alkali's and earth cations of glass are replaced by atomic number 5 and/or aluminium and metallic element. These are wont to contain sturdy acids and alkalis.
- ii. **TYPE II -Treated soda-lime glass:** These are a lot of with chemicals inert than sort I glass. The glass surface is de-alkalized by "Sulfur treatment" that prevents blooming/weathering from bottles.
- iii. **TYPE III- Regular mixture glass:** Untreated mixture glass with average chemical resistance.
- iv. **TYPE IV- General Purpose mixture glass:** Glass isn't used for parenterals, used just for merchandise meant to be used orally or topically. Colored glass is employed to screen Ultraviolet rays and is therefore effective for safeguarding contents from light-weight. Amber glass and red colored glass is employed for this purpose.

Major disadvantage of glass as a packaging material is its fragility and weight.

[2] PLASTIC CONTAINERS : Plastic containers of prime quality will be simply formed with totally different styles. These packages are extraordinarily resistant to breakage and escape.

PRIMARILY PLASTIC CONTAINERS ARE MADE UP OF THE SUBSEQUENT POLYMERS:

1. SYNTHETIC RESIN (PE) : Provides smart barrier against wetness, relatively poor one against chemical element and different gases. High density polyethylene is employed with density starting from 0.91-0.96 resulting in four basic characteristics of instrumentation, (1) Stiffness, (2) Moisture-vapor transmission, (3) stress cracking and (4) clarity or clarity based on compound density used.

2. PLASTIC (PP): plastic has options of synthetic resin in addition it doesn't stress-crack in any condition. Hot aromatic or halogenated solvents soften the package. its high temperature making it appropriate for boilable packages and merchandise required to be sterilized. breakableness at vasoconstrictor is its major disadvantages.

3. POLYVINYL RESIN (PVC): will be made with crystal clear, can give smart gaseous barrier and stiffness. Reduction in residual vinyl chloride monomers had additional increased PVC quality. PVC is employed as coating on glass bottles providing shatter resistant coating.

4. POLYSTYRENE: Rigid and crystal clear plastic. Not helpful for liquid products. (2)

OBJECTIVES OF PHARMACEUTICAL PACKAGING:

1. CONTAINMENT:

The containment of the merchandise is that the most fundamental operate of packaging for healthful

products. the look of high-quality packaging should take under consideration each the wants of the merchandise and of requires the packaging: to not leak, nor permit diffusion and permeation of the merchandise, to be sturdy enough to hold the contents once subjected to traditional handling and to not be altered by the ingredients of the formulation in its final indefinite quantity type.

2. PROTECTION:

The packaging should defend the merchandise against all adverse external influences that will have an effect on its quality or potency, like lightweight, moisture, oxygen, biological contamination, mechanical harm and counterfeiting/ adulteration.

3. INFORMATION TRANSMISSION:

Labels and packages facilitate to produce adequate information associated with the medication and communicate however to use, transport, dispose and recycle of the merchandise. For prescription drugs, medical, chemical and food products, some styles of data square measure needed by governments.

4. IDENTIFICATION:

The written packs or its auxiliary written elements serve the functions of providing each identity and information.

5.CONVENIENCE:

The convenience is related to product use or administration e.g. a unit dose eye drop that each eliminates the requirement for preservative and reduces risks associated with infection, by administering solely a single dose. (3)

PROPERTIES OF PACKAGING MATERIALS:**1.MECHANICAL PROPERTIES:**

The materials used ought to possess ample mechanical strength to face up to whereas handling, filling, closing and process. Typical care is required throughout transport, storage and additionally at the time of usage by the consumer particularly just in case of glass containers.

2.PHYSICAL PROPERTIES:

- ☑ The packaging should have a suitable size, thus, rubber may presents issues if it perishes.
- ☑ the fabric should shield from light if necessary, that is, it must be ultraviolet absorbent.
- ☑ The instrumentality should not absorb substances from the products; e.g. absorption of water from creams in to cardboard box.

3.CHEMICAL PROPERTIES:

- ☑ the merchandise mustn't react with the instrumentality or closure , as might happen if alkaline substances square measure placed in aluminum containers.
- ☑ The instrumentality or closure should not yield substances to the product; for example, alkali from glass, plasticizers from plastics etc.

4.BIOLOGICAL PROPERTIES:

The material of the instrumentality should be ready to withstand attack by insects if this hazard is probably going to be encountered. The packing mustn't support mould growth. (4)

CURRENT TRENDS IN PHARMACEUTICAL PACKAGING:

“Need is mother of all Inventions”, phrase is best describing the emerging technologies towards pharmaceutical packaging. Indian Packaging market is predicted to become old to US\$ fifty five billion by 2020 from the 2009 levels of US\$ twelve.6 billion, as per a McKinsey & Company report titled "India pharmaceutical company 2020: dynamic access and acceptance realising true potential".

Counterfeit interference With counterfeiting accounting for annual losses calculable at \$75bn , packaging forever been at the guts of the industry’s strategy to guard . it's utilized associate degree array of security techniques to combat this issue, with varied success, together with : small text, debossing and embossing, bespoke varnishes, holographic materials, tamper-evident stickers, RFID (Radio Frequency Identification) track-and-trace tagging and customised graphics and fonts.(5)

INNOVATIONS IN PHARMACEUTICAL PACKAGING:

Innovations in pharmaceutical packaging have experienced thus very little reinvention or modification over the last few decades particularly the pharmaceuticals. While different packaging classes have enjoyed progressive modifications, there's very little variation within the packs of pharmaceutical merchandise from Fifties and 60s and also the packs of these days. However, the key role packaging plays in acquainting customers concerning the contents & the risks concerned in taking any prescription or over the counter medication, there's associate degree for contemporary pharmaceutical packaging to be delineate by sensible information graphics. While on one hand there is a challenge of creating packaging simple to open for folks aged over fifty five, UN agency reflects for concerning 3 quarters of all drugs users, the trade conjointly must create packs that square measure child-resistant. The external image of package should not solely compliment product confidence, however give clear & concise product identification & different feature. (6, 7)

[1] CYPAK'S ADVANCED MEDICATION MONITORING AND REPORT CARD SYSTEM :

The sophisticated medication monitoring and report card systems from cypak's advanced medication monitoring and report card system. Through printed technology, patients can converse with healthcare experts. When a pill is taken out of its blister pack, this records the date and time that it was consumed. Patients are now able to upload and log their feedback on therapy effectiveness and side effects.

With the help of this technology, patients and doctors could interact at new levels to choose the optimal course of therapy. Clinical trials are where sensor-based packaging designs are most effective. This aids in determining whether a drug is ineffective or simply not being taken correctly, which is important for drug development.

The clinical trials market is targeted by Cypak's cutting-edge drug technology since bad results from non-compliance can be financially costly. (8)



Fig. 1 : CYPAK'S ADVANCED MEDICATION MONITORING AND REPORT CARD SYSTEM

[2] BURGOPAK'S SLIDING CR BLISTER PACK :

Burgopak's slippery chromium packing material Burgopak tending and technology won the award for the "Most Innovative kid Resistant Packaging Design" at the Pharmapack Paris exhibition. The Burgopak's slippery chromium packing material will solely be opened by applying force at to completely different points on the packaging. The packing material & leaflets are coordinated with the outer box, that insures the merchandise is rarely packaging.



Fig. 2 : Burgopak's sliding CR blister pack

[3] ECOSLIDE –RX PROPERTY COMPLIANCE PACKAGING :

Ecoslide–RX property compliance packaging The pack is created from 100 percent recycled material mistreatment unbleached cardboard and clay coated surface designed to deal with blister packaging with an occasional of unsustainable film and foil. The slide package is incredibly useful and it meets trendy expectations for child-resistance and accessibility for seniors. It doesn't require heat protection within the producing method that reduces each value and energy usage.



Fig. 3 : Ecoslide –RX property Compliance Packaging.

[4] PHARMA TINY HANDS RESISTANT (SHR): A RE-CLOSABLE AND TEAR RESISTANT CARTON :

A reclosable and tear-resistant carton is right for highly virulent medication. Stora Enso and Hieronymus Bosch launched Pharma tiny hands resistant (SHR). Stora Enso Pharma SHR may be a kid resistant reclosable carton. It is ideal for extremely unhealthful medication and it's straightforward to use for senior adults. it's associate degree innovative poster board packagesystem it solely needs straightforward squeeze and pull manoeuvre. (9)



Fig. 4: Stora Enso Pharma SHR

[5] SYREEN PREFILLED SYRINGE STYLE :

Environmental awareness is even commencing to touch the syringe market. It replaces glass with cyclic olefine polymer (COP). This material has allowed secondary packaging altogether because the COP style forms its own outer shell. the power of packed syringes to clip into place eliminates the necessity for packing materials like cardboard.(10)



Fig. 5: Syreen Prefilled Syringes

[6] SMARTPHONE TECHNOLOGY :

The packaging contains writing by that customers will connect via sensible phone to product content additionally to what they will already see on a drug label, written packaging and inserts. this may not solely increase the patient compliance however additionally ascertains and establishes the legitimacy of the merchandise. there's additionally AN emergence of self-verification in less economically developed countries, enabling patients to evidence their own medication via a simple feature phone or smartphone, serving to to guard poorer populations from falsified and counterfeit medicines and alternative product. it's additionally necessary to use advances in technology to eradicate the hazards of accidental overdosing fully. Technology may be utilized in such how to imagine time-release mechanisms that might dispense solely the proper quantity at a pre-determined time of day (11, 12,13)



Fig. 6 : Smartphone Technology in complete Identification

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