

Review Article

Novel Drug Delivery System & its Essence : A Review

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Article information	Abstract
<p>Received: 15 July 2017 Received in revised form: 22 Aug 2016 Accepted: 25 August 2017 Available online: 01 September 2017</p>	<p>The objective of writing this article is to highlight the intrinsic nature of Novel drug delivery system (NDDS) including its trend & movement in retrospective and prospective pharmaceutical era. Unlike other dosage form NDDS is also ment for its pharmacodynamic action, but it is designed & developed in such a way to have more specific and required therapeutic action. Looking prospectively a pharmaceutical establishment is more keen to have its buisness in NDDS so as to retain its dominance in the buisness sector. Like other different industries innovations and novelty plays balloning factor in growth of pharma industries economy. NDDS is prefered compared to the established generic dosage form due to its advantage over existing dosage form of same molecule. Though discovery and development takes nearly half decade along with huge market investement Pharma firms are firm on their mindset to explore in the NDDS segment. Drug delivery through advanced technology in form of device played a sugnificant role in various disorders like respiratory, transdermal, nasal etc. Intellectual property protection inform of trade dress & trade mark is prefered in current pharmaceutical envirimnt to retain unique identity in the competative market. Each NDDS left its essence which gives significant benifit and advantage to acheive target therapeutic action.</p>
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Introduction

Nowadays more emphasis given on novelty within the formulation by academic and industrial research to achieve desired therapeutic effect with processed dosage form, it is the need of hour as well. Future of NDDS appears very bright as advanced drug delivery along with technology within dosage form seems to have promising trends and movement across target therapeutic area. It should not be surprising if in recent future, conventional dosage form seemed replaced by novel delivery system. Determination of characteristics of novel system won't be that much known or exposed to normal population as it's just a type of medicine for them, but for NDDS starting from discovery till its practical availability in dosage formulation is like big challenge to the pharmaceutical or scientific industry. Life cycle management appears to be an auxiliary support to R&D in the industries where existing commercialized product reviewed and redeveloped for its better performance as well as to keep brand dominance in the market. Administration of NDDS will be major breakthrough in medicine sector in future and will help industries to prove themselves in worldwide competitive market and to excel in various regulated market by filing more ANDA and NDA as well. If we talk about Indian industries it is the need of hour to increase total R&D investment in NDDS to compete at global level¹

Drug delivery is the method or process of administering pharmaceutical compound to achieve a therapeutic effect in humans and in animals as well. Most common methods of delivery include the preferred non-invasive peroral i.e oral, topical (skin), transmucosal (nasal, buccal, sublingual, vaginal, ocular and rectal) and inhalation routes. The conventional dosage forms provide drug release immediately and it causes fluctuation of drug level in blood depending upon dosage form.

Characteristics of NDDS

- “Novel Drug delivery System (NDDS) refers to the approaches, formulations, technologies, and systems for transporting a pharmaceutical compound in the body as needed to safely achieve its desired

therapeutic effects. It may involve scientific site-targeting within the body, or it might involve facilitating systemic pharmacokinetics; in any case, it is typically concerned with both quantity and duration of drug presence”.

- Novel Drug delivery is often approached via a drug's chemical formulation, but it may also involve medical devices or drug-device combination products. Drug delivery is a concept heavily integrated with dosage form and route of administration.
- NDDS is advanced drug delivery system which improves drug potency, control drug release to give a sustained therapeutic effect, provide greater safety; finally it is to target a drug specifically to a desired tissue.

Need of NDDS

It is important to maintain the drug concentration within therapeutically effective range need novel drug delivery system. However the conventional dosage forms provide drug release immediately and it causes fluctuation of drug level in blood depending upon dosage form

Advantages of NDDS

- Decreased dosing frequency.
- Reduced rate of rise of drug concentration in blood.
- Sustained and consistent blood level within the therapeutic window.
- Enhanced bioavailability.
- To achieve a targeted drug release.
- Reduced side effects.
- Improved patient compliance
- Optimum dose at the right time and right location.
- Efficient use of expensive drugs, excipients and reduction in production cost.
- Beneficial to patients, better therapy, improved comfort and standard of living

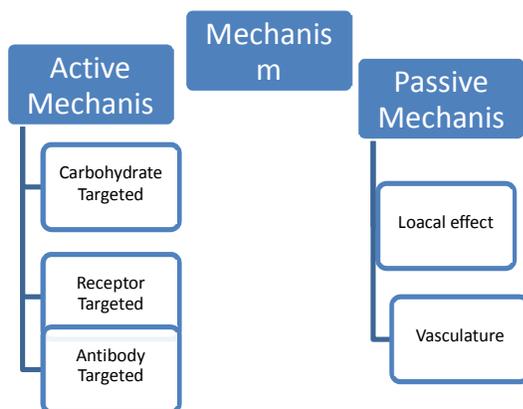
Types of Novel Drug Delivery System

Classification or Types of Novel Drug Delivery System²

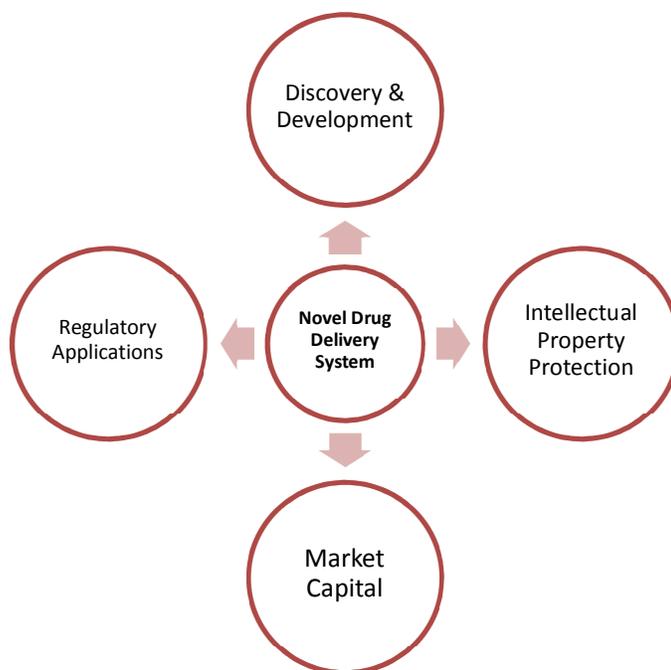
Sr. No	Based on Type of Carrier	Based on Route of Administration	Based on Application
1	Liposomes	Oral Drug Delivery Systems	Medical Device
2	Nanoparticles	Injectable Drug Delivery Systems	Topical Patch
3	Microspheres	Pulmonary Drug Delivery Systems	Matrix carrying Solid oral dosage form
4	Monoclonal antibodies	Transdermal Drug Delivery Systems	Semi solid Emulsion containing Carriers
5	Niosomes	In Situ gelling	Parenteral application using carriers
6	Resealed erythrocytes as drug carriers		Osmotic Drug Delivery

Sr. No	Classification based on release control	Sub classification / Example
1	Matrix Diffusion Types	Reservior Rigid & Swellable Matrix
2	Dissolution Matrix Type	Encapsulaiton
3	Diffusion Controlled Release System	Pore forming films
4	Water penetration / Osmotic Pressure	Osmotic drug delivery system
5	Chemically controlled NDDS	Chemical nature changes when Exposed to biological fluid
6	Hydrogels	Network Structure
7	Ion Exchange	Ionisation, Resin Control release

Mechanism of Drug release from Novel drug delivery system



Intrinsic Connection of NDDS (Associations with NDDS Development)



NDDS Market

There is a progressive growth in the market of novel drug delivery systems and based on current scenario and looking as forecast this growth will continue to grow at an impressive rate in future too.

The novel drug delivery technologies enable to formulate the novel drug delivery devices by incorporating the active ingredient into new delivery systems⁴, also it has triggered manufacturing of innovative as well as novel excipient too. “Over the last few years India has been an important hub for pharma developments¹³. By virtue of this, the industry here has been a seat for excipient usage and development as well. With novel drug delivery system (NDDS) and various innovative delivery systems being explored by pharma companies, the need for innovative and performance excipients is always on the rise. India is known for its quick adaptability to new excipients and associated technologies. Therefore it feels that the market for excipients in India is definitely growing on two counts 1) Organic from the market growth driven by strong exports and 2) Growth coming out of new excipients being employed in various advanced delivery technologies

With such demand for excipient, excipient companies has started developing Task force so as to get

healthy interaction with pharmaceutical manufacturing R&Ds as well as to provide excipient to achieve need of the formulation, recent example of Dow company. Dow has established task force separate functioning so as to collaborate and meets the expectation of innovation.⁵

Not only excipient companies are ready with their startegy for excel in to coming NDDS market but also Pharmaceutical industries are establishing their NDDS R&Ds to seek separate market identity few of this are listed below

Sun Pharma has started Sun Pharma Advanced Research for its all NDDS related works, Lupin invested in NDDS started separate facility Lupin Research Park Hetero health care did set up manufacturing in three different states with the view of separate facility and accountability as well for NDDS etc⁶

Drug maker Cadila Healthcare Ltd, which runs under the brand Zydus Cadila, has acquired entire 50 per cent stake in Zydus BSV Pharma Pvt Ltd (Zydus BSV) from its JV partner Bharat Serums and Vaccines Ltd, The company focuses on the niche segment of targeted therapies in oncology. It develops, manufactures and markets novel drug delivery system (NDDS) of anti-cancer agents for global markets⁷

Market Competition Assessment⁴

List of Pharma industries in the novel drug delivery systems (NDDS) market are (Key Players)

Abbott Laboratories Ltd	Amgen Inc	AstraZeneca Plc
Bausch & Lomb	Baxter International Inc	Bayer AG
Boehringer Ingelheim	Boston Scientific	Bristolmyers Squibb
Celgene Corporation	Cephalon, Inc	Genentech Inc
Genzyme Corporation	Glaxosmithkline Plc	Johnson & Johnson
Merck & Co	Novartis AG	Pfizer Inc
Roche Holding AG	Sanofi SA	Teva Pharmaceutical Industries Ltd

Key Market Movements⁴ (Global Updates)

- North America is expected to lead the global novel drug delivery systems market due to high disposable income, increasing research and development activities associated with development of drug delivery systems, high adoption rate of novel technologies and supportive reimbursement policies.⁸
- Projected market entry of several products and technologies during 2016 to 2022 in global novel drug delivery systems market are expected to provide an exceptional growth to the market¹²
- Novel drug delivery systems market is expected to intensify the market competition, ignition of price wars, and drive emphasis towards geographical expansion and penetration strategies to sustain in the competition

Conclusions

With these forecasted promises of NDDS, various critical issues need to be addresses collectively by public and private sector, some of which firstly . patient and physician counseling for efficient utility of these novel medicines should be in action as awareness and implementaion programm.

Considering challages and difficulties faced due to conventional dosage forms Now, this is the time to put in place combined efforts by academia, industry and government to integrate solution for these challenges and to develop various strategies for advance understanding of this emerging field by developing facilities in pharmaceutical industries with the help of collaborations, research and innovation to go one step ahead in arena of NDDS

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