iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.69694

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

A Review On: Novel Drug Delivery Systems

Mr. Pavan Sayaji Sagare[1], Mr. Nikhil Jadhav[2], Mr.Nitin Gawai[3], Mr. Vinayak Devidas Jadhav[4], Mr.Sudhanshu Dhananjay Kapase[5]
B. Pharmacy Department, Mahadev Kanchan College of Pharmaceutical Education and Research, Uruli Kanchan, Pune, Maharashtra, India

Abstract: Changing from a conventional administration approach to an innovative bone can significantly improve the efficacy, safety, and patient adherence of a validated pharmacological combination. Reviving an old medication patch is possible with a Novel medication Delivery System. Innovative drug delivery systems solve the drawbacks of traditional drug administration methods, providing a new method of administering medications. A new and well-designed drug delivery system can significantly increase the ability to release a medicine at a controlled rate and at a specific place. Pharmaceutical firms are developing novel drug delivery technologies that effectively deliver medications to patients while lowering adverse affects. This composition covers the types and principles of novel medication delivery systems.The scientific requirements for novel drug delivery systems, such as solid dispersions, liposomes, microemulsions, nanoparticles, and solid lipid nanoparticles, can be satisfied by modern phytopharmaceutical research by examining pharmacokinetics, mechanisms of action, sites of action, and the required particular tablets and other products.

Keywords: Include improved medication delivery, liposomes, phytosomes, nanoparticles, and herbal specificity.

I. INTRODUCTION

The way a medicine is administered can greatly impact its effectiveness. Certain specifics retain an ideal attention range where their benefits are maximized, while situations outside this range can lead to toxin or warrant any remedial effect. Again, the sluggish advancements in treating severe ails have indicated a rising necessity for a cooperative approach to delivering curatives directly to specific towel targets. This has led to innovative generalities in managing pharmacokinetics, pharmacodynamics, nonspecific toxin, immunogenicity, biorecognition, and medicine efficacity. These new styles, frequently appertained to as medicine delivery systems(DDS), are grounded on interdisciplinary ways that integrate polymer wisdom, pharmaceutics, bioconjugate chemistry, and molecular biology. To reduce medicine declination and loss, avoid adverse side goods, and enhance medicine bioavailability along with the volume of the medicine localized in the intended area, colorful medicine delivery and targeting systems are laboriously being developed.Controlled and Novel Drug Delivery, which was formerly thought to be a pipe dream or at most a far possibility, is now a reality. Over the once fifteen times, pharmaceutical experimenters and other scientists have conducted comprehensive and thorough studies in this sphere of medicine research.Advantages of new medicine delivery system[1]

1) Shielding against physical and chemical deterioration.
2) Dragged release.
3) Advanced distribution of towel macrophages.
4) Increased stability.
5) Boosted pharmacological goods.
6) securing against toxin.
7) Enhanced bioavailability.
8) bettered solubility.

II. IMPORTANCE OF NOVEL HERBAL DRUG DELIVERY SYSTEMA

The innovative medicine delivery system offers a groundbreaking system for distributing drug, successfully addressing the limitations of traditional medicine administration ways. The vast knowledge of Ayurveda in our country has only lately begun to be honored. still, the effectiveness of herbal drugs is frequently compromised when administered through outdated delivery styles. By integrating ultramodern medicine delivery technologies into herbal treatments, we can ameliorate their efficacity and reduce the side goods associated with colorful herbal constituents and shops. This conception underlines the significance of incorporating advanced drug delivery systems into natural curatives.

It's essential to combine Indian Ayurvedic practices with contemporary medicine delivery approaches to address further critical health issues. Historically, herbal drugs were overlooked for the development of new phrasings due to their lack of scientific backing and difficulties in processing, similar as standardization, birth, and relating specific remedial factors within complex polyherbal systems. nonetheless, contemporary phytopharmaceutical exploration can fulfill the scientific criteria for integrating herbal products into innovative medicine delivery systems like liposomes, solid dissipations, nanoparticles, microemulsions, and solid lipid nanoparticles. These criteria involve probing pharmacokinetics, understanding mechanisms of action, determining remedial spots, and establishing precise lozenge conditions. colorful medicine delivery and targeting systems are presently in development to minimize medicine loss and declination, avoid adverse goods, and enhance medicine bioavailability and retention in the targeted area.[2]

III. POTENTIAL OF NOVEL DRUG DELIVERY FOR HERBAL DRUGS

Specifically, phytopharmaceuticals use conventional composites that are purchased from stores instead of artificial compounds. Natural compounds are more quickly and effectively re-used by the body. As a result, they often have fewer, if any, side effects and improve bloodstream absorption, resulting in more thorough and efficient therapies. The usage of chemicals in medications may result in unfavorable side effects. The human body frequently rejects artificial compounds that don't exist in nature. From minor headaches to serious, life-threatening diseases, comparable rejections can cause negative reactions. Numerous investigations into lipid-based medicine delivery systems have demonstrated their potential for precise and regulated drug delivery.Amphiphilic phospholipids that form bonds with other phospholipids and contain active hydrogen are known as pharmacosomes. They increase the drug's bioavailability by providing it with improved biopharmaceutical packages. Phytosomes are novel compounds composed of complexes derived from phospholipid-containing extracts such as ginseng and ginkgo biloba, as well as lipophilic components derived from plants like Silybum Marianum. They are also known as the delivery method for phytolipids. Their strong lipophilicity completes their pharmacological packages and improved absorption. These are sophisticated herbal extracts that maintain improved pharmacokinetic and pharmacological properties, which makes them beneficial for the management of acute liver disorders brought on by metabolic or infectious causes. By means of an individual procedure, every component of the herbalTo create phytosomes, a polar end of a herbal extract—which includes terpenoids and flavonolignans—molecularly clicks to phospholipids, which are comparable to phosphatidylcholine. Phytosomes are used in medicine and cosmetics for a variety of purposes. Still, there are many unresolved problems regarding phytosomes' covert restorative functions. [8]

IV. IDEAL FEATURES- [9]

Targeted medication delivery system:

1) It must maintain its stability both chemically and physically in in vitro and in vivo settings, and it must be biochemically stable and non-immunogenic (harmless).
2) The medicine should be distributed consistently, restricted to the targeted cell or organ, and delivered at a steady and predictable rate.
3) It is not appropriate for the release of the medications to affect their effect.
4) Drugs should release a therapeutic dosage that is adequate.
5) During transit, there should be very little medication leakage.

Because the carriers are biodegradable or readily removed from the organism, they should facilitate rapid (or comparatively simple) reproduction and not result in problems or unfavorable immunological reactions.

V. IDEAL FEATURES- [6]

1) Framework for delivering medication in a targeted manner.
2) Biochemically neutral and does not provoke an immune response (safe for use).
3) Chemically and physically stable in both laboratory conditions and living organisms.
4) Medications should be consistently delivered specifically to the intended cells or organs, at a controlled and predictable rate
5) The efficacy of medications remains unchanged by their method of release.
6) Medications are released in therapeutic quantities.
7) Minimal drug leakage occurs during transport.
8) The carriers used do not cause issues or lead to illness modification when they are biodegradable or can be readily removed from the body.

9) A rapid (or relatively simple) method for producing and economically distributing the system is established.

VI. RECENT DEVELOPMENTS IN NOVEL DRUG DELIVERY SYSTEM OF HERBALS

1) Phytosome
2) Liposome
3) Nanoparticles
4) Emulsions
5) Microsphere
6) Ethosome
7) Solid lipid nanopartical
8) Niosomes
9) Proniosomes
10) Transdermal Drug Delivery System
11) Dendrimers
12) Liquid Crystals [4]

VII. NOVEL DRUG DELIVERY SYSTEMS

Since its introduction, NDDS has experienced numerous transformations, such as the incorporation of extracellular matrices, nanoparticles, microencapsulation, epithelial and transdermal delivery methods, as well as liposomal vesicles and nanoparticles. The continuously advancing delivery techniques not only alleviate the burden on patients and are easier to manage, but they also enhance safety by reducing the risks associated with drug administration into the body. The practice of drug delivery utilizing innovative methodologies primarily features two key approaches: Carrier Based DDS and Transdermal Drug Delivery System, which are further divided into classifications.[5]

Drug Delivery Systems Utilizing Carriers

- Nanoparticle carriers,
- Microspheric carriers,
- Liposomal carriers,
- Niosomal carriers,
- Monoclonal antibody carriers,
- Resealed erythrocytes utilized as drug carriers.[5]

1) *Nanoparticles :*

The study of matter and materials with an emphasis on tiny particles is known as nanotechnology. The Latin term "nano" signifies dwarf (1nm = 10^-9m). Solid particles or dispersions with sizes between 10 and 1000 nm are called nanoparticles. It is possible to dissolve, entrap, encapsulate, or attach drugs to a matrix of nanoparticles. Nanoparticles have several advantages, including improving the stability of proteins and medications and providing advantageous controlled release characteristics. They have very high drug loading capabilities, may be customized for both active and passive targeting, and can be delivered orally, parenterally, nasally, or intraocularly. Benefits of the delivery technique for herbal nanoparticles [3]

- The nanoparticulate system targets the herbal expression directly to the asked point of action.
- Enhanced effectiveness and remedial range.
- Enhanced stability through encapsulation.
- further pharmacokinetic performance.
- Can be produced in various sizes and with different face conflation characteristics.[6]

2) *Microsphere*

The tiny spherical particles that make up microspheres range in size from 1 µm to 1000 µm (1 mm). These microspheres are often called micro-particles. They can be created from a variety of natural and synthetic substances. Microspheres made of glass, ceramic, or polymers are all commercially available.Microspheres can be categorized as either biodegradable or non-biodegradable.

Albumin microspheres, modified starch microspheres, gelatin microspheres, polypropylene dextran microspheres, and polylactic acid microspheres are examples of biodegradable forms.

Current literature indicates that polylactic acid is the sole polymer classified as non-biodegradable that is approved for human use and is utilized as a controlled-release agent. Solid and hollow microspheres exhibit a wide range of densities, making them suitable for various applications.[3]

Benefits of microsphere formulation

- The use of a micro-particulate system for medication administration is beneficial because microspheres can be taken orally or administered through injection, and they can be customized to achieve specific release profiles while facilitating site-specific drug delivery, and in certain instances, enabling targeted release to organs.
- The drug can be easily released from the formulation.
- It can safeguard the particular function of drugs and can release the drugs into an external phase over an extended duration.[3]

3) Liposomes .

Phospholipid bilayers can range in quantity within liposomes, from one to several layers. Polar medicinal substances can be encapsulated due to the liposomal core's polar properties. Depending on their affinity for the phospholipids, chemicals that are lipophilic or amphiphilic are dissolved within the phospholipid bilayer. When nonionic surfactants are substituted for phospholipids during bilayer formation, niosomes are created. Without compromising their functionality, channel proteins can be incorporated into the hydrophobic regions of vesicle membranes to serve as size-selective filters that promote the passive diffusion of tiny solutes like as ions, nutrients, and antibiotics.Drugs that are encased in channel protein-equipped nanocages are therefore successfully shielded from proteolytic enzymes' early destruction. Nevertheless, the concentration difference between the inside and outside of the nanocage can still force the drug molecule through the channel.[3].

4) Niosomes

Cholesterol and a tiny amount of an anionic surfactant, such as dicetyl phosphate, are commonly added to stabilize the non-ionic surfactant Span-60, which forms vesicles in niosomes. Liposomes and niosomes both have the ability to transport medications, and they do so more effectively than free pharmaceuticals. Because of its higher cost-effectiveness and improved chemical stability, niosomes are preferred over liposomes. Surfactant-producing niosomes are biocompatible, non-immunogenic, and degradable. Niosome encapsulation increases the effectiveness of medications like nimesulide, flurbiprofen, piroxicam, ketoconazole, and bleomycin that have better bioavailability than their free counterparts. [7]

5) Monoclonal Antibodies

Monoclonal antibodies (MAb(s)) consist of a uniform set of antibody molecules that bind specifically to a given antigen, typically generated by fusing a B-cell with a clone of cells containing a unique antibody gene. When combined with cytotoxic drugs, monoclonal antibodies targeting specific antigens can transport medications to cancer cells while protecting normal cells from damage (usually administered through infusion). Beyond these monoclonal antibodies, their complexes are currently being investigated as highly sensitive probes that can be directed towards specific cells or organs. They have been utilized for delivering enzymes or cytotoxic drugs to particular cell types. Antibodies targeting various T lymphocyte subsets, particularly suppressor cells, are anticipated to remain valuable in diagnosing and treating individuals with multiple sclerosis, various heart diseases, several types of leukemia, and malaria.

6) Released Erythrocytes as Drug Carriers [5]

Red blood cells (RBCs), also referred to as erythrocytes, have garnered a lot of interest and have been studied for their possible applications as drug delivery systems and as medicine-containing microspheres. The reason these erythrocytes are called "resealed erythrocytes" is because the process involves transferring blood samples from the target species, removing the erythrocytes from the tube, resealing the cellular carriers that surround them, and recapitulating the drug inside the erythrocyte. But generally speaking, the motes should be non-polar, hydrophobic, polar, and hydrophilic, with sizes ranging from 5,000 to 600,000 Daltons. Medication-containing erythrocytes direct the drug to the reticuloendothelial system (RES), act as slow-release depots after reinjection,, prevent unwanted drug reactions, maintain the medication's attention in a stable condition, and lessen the decline of the loaded medication brought on by endogenous chemical inactivation.

APPLICATIONS OF NDDS

Innovative drug delivery techniques have numerous potential uses in the medical and pharmaceutical sectors. The goals of these systems are to improve therapy efficacy, decrease adverse effects, and increase patient adherence. Listed below are a few significant uses for sophisticated drug delivery systems:

- Targeted Drug Delivery: Focused drug delivery is a major application for novel drug delivery technologies. These devices deliver medications straight to organs or tumors, among other targeted body parts. This makes it easier to treat patients locally, lowering systemic exposure and limiting adverse consequences.
- Controlled Release: New drug delivery technologies enable the gradual, controlled release of pharmaceuticals. The drug's efficacy is increased since this ensures a steady and ideal concentration of the medication at the intended location. In addition to improving patient adherence, controlled release can reduce the frequency of drug delivery.
- Personalized medicine: Drug delivery methods can be tailored to each patient's particular requirements and health. This gives rise to personalized medicine, in which drugs are given in a way that optimizes their therapeutic efficacy while reducing side effects.
- Chronic Disease Management: The management of chronic diseases is the focus of several cutting-edge medication delivery systems. By providing long-lasting formulations that release the medication over a longer period of time, these systems can reduce the need for frequent dosage. For chronic illnesses, this expedites the course of treatment and increases patient adherence.
- Combination Therapies: Multiple medications can be delivered sequentially or simultaneously thanks to sophisticated drug delivery devices. This encourages the use of combination medicines, which mix several drugs with complimentary modes of action to enhance therapeutic outcomes. Combination treatments work especially well for treating infections that are resistant to medications or complicated illnesses.
- Gene and Cell treatments: In the field of gene and cell treatments, drug delivery systems are essential. They can transport therapeutic cells or genetic material to specific bodily parts, enabling targeted and efficient treatment. These systems can prevent genetic materials or cells from degrading and enhance target cells' ability to absorb them. [5]

VIII. TRANSDERMAL DRUG DELIVERY SYSTEMS

1) Sonophoresis :

This technique uses ultrasonic radiation to significantly increase the absorption of topical medications (transdermal administration) into the dermis, epidermis, and skin appendages. The delivery of macromolecules and low molecular weight drugs to the skin can be accomplished quickly, easily, non-invasively, and precisely via sonophoresis. Sonophoresis is believed to improve drug delivery by altering the temperature, mechanical properties, and chemical composition of skin tissue. Ultrasound frequencies ranging from 20 kHz to 16 MHz with intensities up to 3W/cm are used in the sonophoresis technique. The most important ultrasonography factors influencing the efficacy of percutaneous absorption are treatment frequency, intensity, and length.. When ultrasonic waves induce microvibrations beneath the skin's epidermis, they increase the total kinetic energy of the molecules in topical medications, which is how sonophoresis occurs. It's likely that ultrasound enhances drug dispersion by microstreaming, cavitation, and heating. In therapeutic settings, sonophoresis is frequently used to transdermally administer medicines.Pharmacy professionals manufacture the medications by combining them with a coupling agent (gel, cream, or ointment) that facilitates the skin's absorption of ultrasonic energy from the ultrasound transducer. [10]

2) Osmotic Pump

An bibulous agent that draws water from the girding terrain across a semipermeable membrane which lets water through while blocking specifics is part of the force- suchlike structure of the bibulous pump system. rather of the physiological parameters of the gastrointestinal tract, similar as pH situations or hydrodynamic variables, an bibulous system regulates the release of drug grounded on bibulous pressure. Generally, bibulous pumps or delivery systems have a core that contains a medicine and an osmogene. A semipermeable membrane covering this core has one or further medicine delivery holes, which enable the drug to be released gradationally as a suspense or result" A ray or mechanical drill is used to compress the tablet core and cover it with a semipermeable membrane in order to produce delivery orifices.Examples of this include mannitol and sucrose, dextrose and fructose, sucrose and fructose, dextrose and sucrose, mannitol and fructose, lactose and fructose, mannitol and dextrose, to name a few. combinations of osmogenes or bibulous agents that can be employed.[5]

3) Microencapsulation :

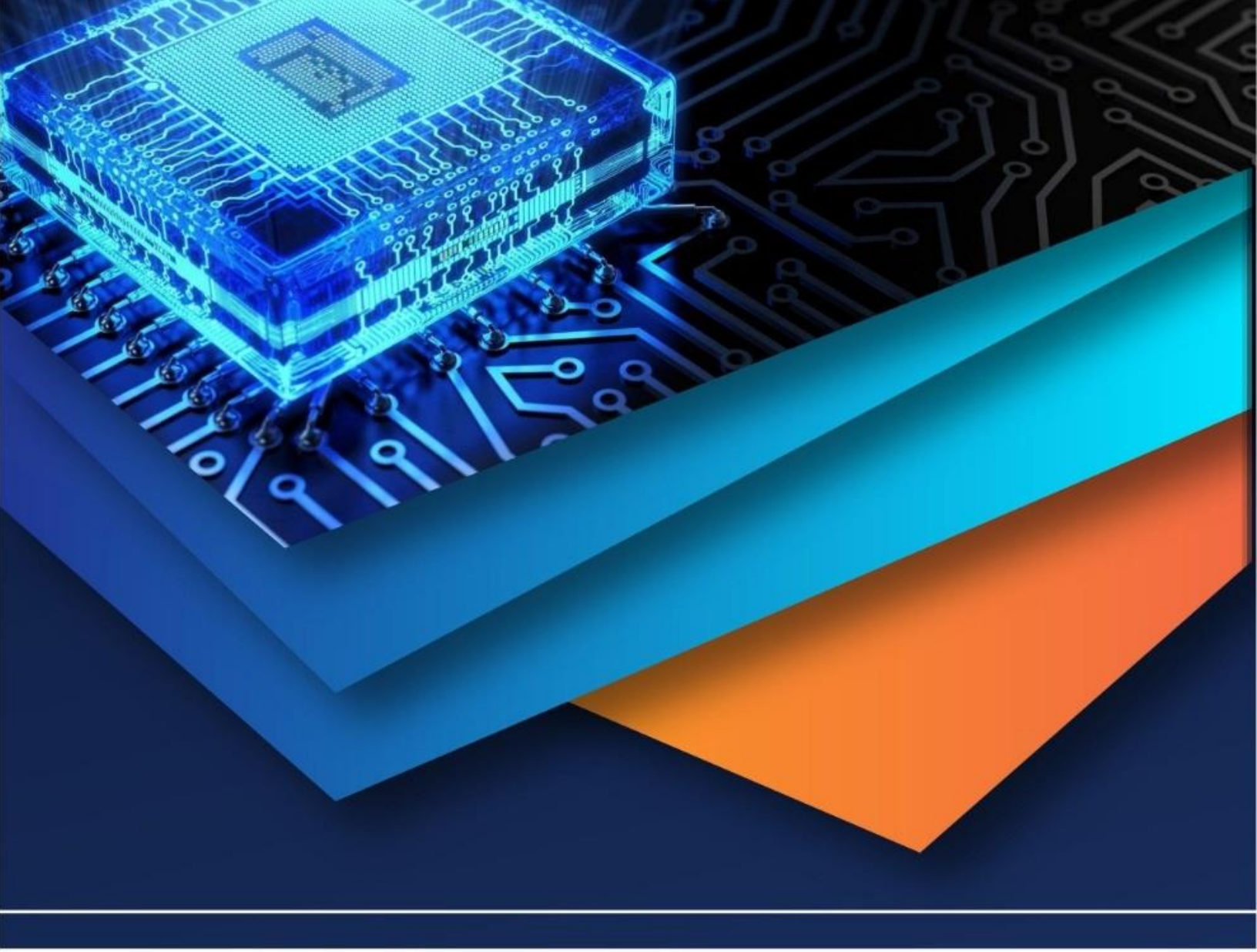
Microencapsulation involves encasing solids, liquids, or gases within tiny particles to form thin wall coverings around them. This technology provides several benefits, such as protecting and hiding the active ingredient, slowing down the dissolution rate, facilitating easier handling, and enabling targeted delivery of the active substance. By using this approach, it is possible to accurately distribute small doses of potent medications while reducing drug concentrations in areas other than the intended organ or tissue.[5]

IX. CONCLUSION

A Novel Drug Delivery System (NDDS) combines cutting-edge methods with recently created dosage forms that work noticeably better than conventional ones. This innovative drug delivery system enhances therapeutic efficacy by decreasing toxicity, increasing bioavailability, and minimizing the necessity for frequent administration to address noncompliance. There is even greater potential for utilizing nanoparticulate drug delivery systems in the administration of vaccines, radiation therapy, antibiotics, anti-tumor therapies, proteins, gene therapy, AIDS treatment, and as vehicles to penetrate the blood-brain barrier.

REFERENCES

[1] Chouhan AS, Gupta A, Maurya G, Singh S. A review on novel drug delivery systems. Maharana Pratap College Of Pharmaceutical Sciences, Mandhana, Kanpur, Uttar Pradesh; 209217.
[2] Rangasamy M, Parthiban KG. Recent advances in novel drug delivery systems. JKK Munirajah Medical Research Foundation, College of Pharmacy, Komarapalayam, Tamilnadu, India. 2010 Oct 17 [revised 2010 Nov 28; accepted 2010 Nov 30].
[3] Patil S, Mhaiskar A, Mundhada D. A review on novel drug delivery system: a recent trend. Agnihotri College of Pharmacy, Department of Pharmacology, Wardha, Maharashtra, India.
[4] Jain NK. Controlled and novel drug delivery. 4th ed. New Delhi: CBS Publishers and Distributors; 2002. p. 236–7.
[5] Sharma S, Patidar A, Chopra R. A review on novel drug delivery system. Department of Pharmacy, Shri G S Institute of Technology and Science, Indore (M.P.).
[6] Kate P, Sawale V, Kakade R, Karale R, Dubey T. Review article: novel herbal drug delivery system. Siddhi's Institute of Pharmacy, Nandgaon.
[7] Jain S, Kirar M, Bindeliya M, Sen L, Soni M, Shan M, Purohit A, Jain PK. Novel drug delivery systems: an overview. Adina College of Pharmacy, Sagar, MP, 470001.
[8] Devi VK, Jain N, Valli KS. Importance of novel drug delivery systems in herbal medicines. 2010.
[9] Kumar R, Saha P, Sarkar S, Rawat N, Prakash A. A review on novel drug delivery system. Int J Res Anal Rev. 2021;8(1).
[10] Jasmine D. Novel drug delivery system: brief review. Department of Pharmaceutics, Global College of Pharmacy, Anandpur Sahib, India.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY