International Journal of Nanomedicine

Dovepress

ORIGINAL RESEARCH

Niosomal carriers enhance oral bioavailability of carvedilol: effects of bile salt-enriched vesicles and carrier surface charge

This article was published in the following Dove Press journal:
International Journal of Nanomedicine
29 July 2015
Number of times this article has been viewed

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Abstract: Carvedilol (CRV) is an antihypertensive drug with both alpha and beta receptor blocking activity used to preclude angina and cardiac arrhythmias. To overcome the low, variable oral bioavailability of CRV, niosomal formulations were prepared and characterized: plain niosomes (without bile salts), bile salt-enriched niosomes (bilosomes containing various percentages of sodium cholate or sodium taurocholate), and charged niosomes (negative, containing dicetyl phosphate and positive, containing hexadecyl trimethyl ammonium bromide). All formulations were characterized in terms of encapsulation efficiency, size, zeta potential, release profile, stability, and morphology. Various formulations were administered orally to ten groups of Wistar rats (n=6 per group). The plasma levels of CRV were measured by a validated high-performance liquid chromatography (HPLC) method and pharmacokinetic properties of different formulations were characterized. Contribution of lymphatic transport to the oral bioavailability of niosomes was also investigated using a chylomicron flow-blocking approach. Of the bile salt-enriched vesicles examined, bilosomes containing 20% sodium cholate (F2) and 30% sodium taurocholate (F5) appeared to give the greatest enhancement of intestinal absorption. The relative bioavailability of F2 and F5 formulations to the suspension was estimated to be 1.84 and 1.64, respectively. With regard to charged niosomes, the peak plasma concentrations (C_{max}) of CRV for positively (F7) and negatively charged formulations (F10) were approximately 2.3- and 1.7-fold higher than after a suspension. Bioavailability studies also revealed a significant increase in extent of drug absorption from charged vesicles. Tissue histology revealed no signs of inflammation or damage. The study proved that the type and concentration of bile salts as well as carrier surface charge had great influences on oral bioavailability of niosomes. Blocking the lymphatic absorption pathway significantly reduced oral bioavailability of CRV niosomes. Overall twofold enhancement in bioavailability in comparison with drug suspension confers the potential of niosomes as suitable carriers for improved oral delivery of CRV.

Keywords: niosomes, bile salts, surface charge, bioavailability, oral delivery, lymphatic transport

Introduction

Oral delivery is the most convenient route of drug administration, especially for chronic illness, with high patient compliance, ease of administration, cost-effectiveness, and other benefits.[1] Although high oral bioavailability is highly desirable, many important drugs in the clinic suffer from poor oral bioavailability and highly variable exposure. This can be due to various factors, including low solubility, limited permeability, first-pass metabolism and drug efflux.[2]

To reach the bloodstream, a drug should first dissolve in the gastrointestinal (GI) fluid. Thus, dissolution may be the rate-limiting step in oral administration of poorly

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Niosomal Carriers Enhance Oral Bioavailability Of

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Niosomal Carriers Enhance Oral Bioavailability Of:

Biomaterial-Inspired Nanomedicines for Targeted Therapies Madhulika Pradhan,Krishna Yadav,Nagendra Singh Chauhan,2024-09-16 This book delves into the burgeoning field of nano biomaterials and their application in targeted drug delivery across various therapeutic domains Through its comprehensive exploration it offers insights into the innovative approaches and potential of biomaterial inspired nanomedicines in revolutionizing healthcare Chapter 1 introduces readers to the fundamental concepts of biomaterial inspired nanomedicines laying the groundwork for subsequent discussions Chapter 2 delves into the utilization of nano biomaterials in tissue engineering highlighting their role in regenerative medicine The book further examines the targeting of specific physiological barriers such as the blood brain barrier Chapter 3 and explores the opportunities and challenges in biomaterial based vaccine delivery Chapter 4 Additionally it discusses the use of nano biomaterials in addressing pulmonary obstruction Chapter 5 and targeting the tumor microenvironment for chemotherapy Chapter 6 Chapters 7 to 16 explore various therapeutic applications of nano biomaterials across different medical conditions including autoimmune skin disorders diabetes wound healing central nervous system disorders ocular diseases infectious diseases musculoskeletal disorders and gastrointestinal diseases Furthermore the book sheds light on advances in nano biomaterials for effective antimicrobial therapy and offers insights into the clinical and regulatory considerations associated with their use Chapter 17 By encompassing a wide range of topics and providing in depth analyses Biomaterial Inspired Nanomedicines for Targeted Therapies serves as a valuable resource for researchers practitioners and policymakers aiming to leverage the potential of nano biomaterials in improving healthcare outcomes *Design and Development of New Nanocarriers* Alexandru Mihai Grumezescu,2017-11-30 Design and Development of New Nanocarriers focuses on the design and development of new nanocarriers used in pharmaceutical applications that have emerged in recent years In particular the pharmaceutical uses of microfluidic techniques supramolecular design of nanocapsules smart hydrogels polymeric micelles exosomes and metal nanoparticles are discussed in detail Written by a diverse group of international researchers this book is a valuable reference resource for those working in both biomaterials science and the pharmaceutical industry Shows how nanomanufacturing techniques can help to create more effective cheaper pharmaceutical products Explores how nanofabrication techniques developed in the lab have been translated to commercial applications in recent years Explains safety and regulatory aspects of the use of nanomanufacturing processes in the pharmaceutical industry **Pharmaceutical Sciences: Breakthroughs in Research and Practice** Management Association, Information Resources,2016-12-28 The delivery of optimal pharmaceutical services to patients is a pivotal concern in the healthcare field By examining current trends and techniques in the industry processes can be maintained and improved Pharmaceutical Sciences Breakthroughs in Research and Practice provides comprehensive coverage of the latest innovations and advancements for pharmaceutical applications Focusing on emerging drug development techniques and drug

delivery for improved health outcomes this book is ideally designed for medical professionals pharmacists researchers academics and upper level students within the growing pharmaceutical industry Medicinal Chemistry with Pharmaceutical Product Development Debarshi Kar Mahapatra,Sanjay Kumar Bharti,2019-02-04 This volume focuses on novel therapeutics and strategies for the development of pharmaceutical products keeping the drug molecule as the central component It discusses current theoretical and practical aspects of pharmaceuticals for the discovery and development of novel therapeutics for health problems Explaining the necessary features essential for pharmacological activity it takes an interdisciplinary approach by including a unique combination of pharmacy chemistry and medicine along with clinical aspects It takes into consideration the therapeutic regulations of the USP along with all the latest therapeutic guidelines put forward by WHO and the US Food and Drug Administration **Antiviral and Antimicrobial Coatings Based on Functionalized Nanomaterials** Shahid Ul Islam,Sudheesh K. Shukla,Chaudhery Mustansar Hussain,2023-06-15 Antiviral and Antimicrobial Coatings Based on Functionalized Nanomaterials Design Applications and Devices is the first book on functionalized nanoparticles based coatings that encompasses the majority of aspects of antimicrobial and antiviral coatings The use of functionalized nanoparticles has revolutionized all fields of science and engineering and this book provides the reader with a fundamental interdisciplinary look at this emerging field It focuses on the most advanced coating systems being utilized by various industries including a discussion of the current challenges to be considered during manufacturing This book provides both academics and those working in industry with a broad based introduction to the area of modern antimicrobial coatings practices Describes functionalized nanoparticles based antimicrobial and antiviral coatings utilized in modern industrial platforms Evaluates functionalized nanoparticles based antimicrobial and antiviral coatings as prime options for sustainable and transformational opportunities Serves as a reference for scientists and engineers who are searching for modern design techniques for antimicrobial and antiviral coatings systems **Fundamentals of Nanoparticles** Abdel Salam Hamdy Makhlouf,Ahmed Barhoum,2018-08-09 Fundamentals of Nanoparticles Classifications Synthesis Methods Properties and Characterization explores the nanoparticles and architecture of nanostructured materials being used today in a comprehensive detailed manner This book focuses primarily on the characterization properties and synthesis of nanoscale materials and is divided into three major parts This is a valuable reference for materials scientists and chemical and mechanical engineers working in R D and academia who want to learn more about how nanoparticles and nanomaterials are characterized and engineered Part one covers nanoparticles formation self assembly in the architecture nanostructures types and classifications of nanoparticles and signature physical and chemical properties toxicity and regulations Part two presents different ways to form nanometer particles including bottom up and top down approaches the classical and non classical theories of nanoparticles formation and self assembly surface functionalization and other surface treatments to allow practical use Part three covers characterization of nanoparticles and nanostructured materials including

the determination of size and shape in addition to atomic and electronic structures and other important properties Includes new physical and chemical techniques for the synthesis of nanoparticles and architecture nanostructures Features an in depth treatment of nanoparticles and nanostructures including their characterization and chemical and physical properties Explores the unusual properties of materials that are developed by modifying their shape and composition and by manipulating the arrangement of atoms and molecules Explains important techniques for the synthesis fabrication and the characterization of complex nano architectures Nanostructures for Drug Delivery Ecaterina Andronescu,Alexandru Mihai Grumezescu,2017-03-24 Nanostructures for Drug Delivery extensively covers the various nanostructured products that have been tested as carriers in target drug delivery systems In addition the book analyses the advantages of and issues related to using nanostructured materials in drug delivery systems also detailing various nanocarrier preparation techniques As delivering the drug to the target site is a major problem in providing effective treatment for many diseases this book covers the latest advancements in numerous nanotechnological products that are being used in disease detection controlled drug delivery as biosensors and in tissue engineering that have been developed for more efficient patient healthcare Due to the versatility of nanostructured materials it is now possible to deliver a drug at its target site in a more accurate and efficient way This volume is an up to date state of the art work that highlights the principal mechanistic aspects related to the delivery of active nanoscale therapeutic agents natural or synthetic and their release profile in different environmental media It highlights nanoscale encapsulation strategies and discusses both organic and inorganic nanomaterials as carriers and delivery platforms Demonstrates how nanostructures are successfully employed in drug delivery stems and as drug delivery agents allowing biomaterials scientists and biochemists to create more effective drug delivery systems Offers an overview of recent research into the use of nanostructures in drug delivery techniques in a cogent synthesized way allowing readers to quickly familiarize themselves with this area Includes examples of how the application of nanostructures have improved the efficiency of drug delivery systems showing medical scientists how they are beneficial **Systems of Nanovesicular Drug Delivery** Amit Kumar Nayak,Md Saquib Hasnain,Tejraj M. Aminabhavi,Vladimir P. Torchilin,2022-07-16 Systems of Nanovesicular Drug Delivery provides a thorough insight into the complete and up to date discussions about the preparation properties and drug delivery applications of various nanovesicles This volume discusses cubosomes proniosomes and niosomes dendrimerosomes and other new and effective approaches for drug delivery It will be a valuable title and resource for academics and pharmaceutical scientists including industrial pharmacists analytical scientists health care professionals and regulatory scientists actively involved in pharmaceutical products and process development of tailor made polysaccharides in drug delivery applications Recently there have been a number of outstanding nanosystems in nanovesicular carrier forms such as nanoemulsions self nanoemulsifying systems nanoliposomes nanotransferosomes etc that have been researched and developed for efficient drug delivery by many formulators researchers and scientists However no

previously published books have covered all these drug delivery nanovesicles collectively in a single resource Provides thorough insights and up to date discussions about the various systems of nanovesicular drug delivery Covers advanced trigger assisted systems such as iontophoresis ultra sound triggering etc and how they have been used for improved drug delivery by nanovesicles Presents recent advances in drug delivery fields by global leaders and experts from academia research industry and regulatory agencies Includes an updated literature review of relevant key topics good quality illustrations chemical structures attractive flow charts and well organized tables *Theranostics Nanomaterials in Drug Delivery* Prashant Kesharwani,N.K Jain,2024-10-10 Theranostics Nanomaterials in Drug Delivery presents the most recent advances in the development of theranostic nanomaterials for drug delivery This book compiles reports and studies on the latest changes and improvements of theranostic nanocarriers such as nanoemulsions liposomes exosomes polymeric micelles PLGA nanoparticles chitosan nanoparticles dendrimer quantum dots silica nanoparticles gold nanoparticles silver nanoparticles magnetic nanoparticles and many more all of which can help in the sensitive diagnosis precise targeting and efficient and controlled delivery of nanomaterials to control various diseases at different clinical stages Theranostics nanomaterials in drug delivery will serve as a solid foundation and reference for pharmaceutical scientists undergraduate and postgraduate students researchers and experts in the medical field involved in the development of advanced drug delivery systems Presents a compilation of thoroughly analyzed data and results regarding the usage of theranostics nanocarriers as a platform for diagnosis and treatment of various diseases Gathers novel drug delivery applications of theranostics nanocarriers in biological milieu and discusses the principles behind the formation characterization applications and future perspectives of theranostics for targeted therapy development Discusses the most recent technologies in theranostics nanometrials to help readers define major gaps in knowledge that can lead new scientific breakthroughs and discoveries **Encyclopedia of Medical Devices and Instrumentation, Capacitive Microsensors for Biomedical Applications - Drug Infusion Systems** John G. Webster,2006-04-07 The articles in The Encyclopedia of Medical Devices and Instrumentation focus on what is currently useful or is likely to be useful in future medicine They answer the question What are the branches of medicine and how does technology assist each of them Articles focus on the practice of medicine that is assisted by devices rather than including for example the use of drugs to treat disease The title is the only resource on the market dealing with the subject in encyclopedic detail Accessible to practitioners with a broad range of backgrounds from students to researchers and physicians Articles cover the latest developments such as nanotechnology fiber optics and signal processing **Index to Theses with Abstracts Accepted for Higher Degrees by the Universities of Great Britain and Ireland and the Council for National Academic Awards** ,1995 Theses on any subject submitted by the academic libraries in the UK and Ireland **The Design and Synthesis of Drug Carrier Molecules to Improve Oral Bioavailability Via HPepT1** Gayle Wilson,2016 Felodipine Loaded Nanoemulsion for Oral Delivery Kunal Jain,R. Suresh

Kumar,Sumeet Sood,2013-01 Among the approaches for exploiting nanotechnology in medicine the use of lipid nanocarriers to enhance oral bioavailability is well established Nanocarriers play a major role in diagnosis and therapy This book provides the formulation development of felodipine loaded nanoemulsion with an objective to improve its oral bioavailability This work may be useful for researchers working in the area of improving oral bioavailability of poorly water soluble drugs via nanotechnology mediated drug delivery Hydrophilically Modified Self-assembling A-tocopherol Derivative as Niosomal Nanocarrier for Improving Clarithromycin Oral Bioavailability ,2018 Nanocarriers for Oral Bioavailability Enhancement Marc Muchow,2009 **Recent trends in solubility and bioavailability enhancement for poorly water-soluble drugs** □□□,2019-12-17 1 Silymarin loaded solid nanoparticles with excellent hepatic protection physicochemical characterization and in vivo evaluation 2 The Influence of Bile Salt on the Chemotherapeutic Response of Docetaxel loaded Thermosensitive Nanomicelles 3 Enhanced oral bioavailability of fenofibrate using polymeric nanoparticulated systems Physicochemical characterization and in vivo investigation 4 Tumor targeting pH sensitive nanoparticles for docetaxel delivery to drug resistant cancer cells 5 Comparative study on solid self nanoemulsifying drug delivery and solid dispersion system for enhanced solubility and bioavailability of ezetimibe 6 Novel electrosprayed nanospherules for enhanced aqueous solubility and oral bioavailability of poorly water soluble fenofibrate 7 Receptor targeted drug loaded functionalized graphene oxides for chemotherapy and photothermal therapy 8 Progressive slowdown prevention of cellular senescence by CD9 targeted delivery of rapamycin using lactose wrapped calcium carbonate nanoparticles 9 Optimization and physicochemical characterization of a cationic lipid phosphatidylcholine mixed emulsion formulated as a highly efficient vehicle that facilitates adenoviral gene transfer 10 Combination of NIR therapy and regulatory T cell modulation using layer by layer hybrid nanoparticles for effective cancer photoimmunotherapy 11 Cyclic RGD conjugated Pluronic blending system for active targeted drug delivery 12 Transferrin Conjugated Polymeric Nanoparticle for Receptor Mediated Delivery of Doxorubicin in Doxorubicin Resistant Breast Cancer Cells 13 Self microemulsifying drug delivery system SMEDDS for improved oral delivery and photostability of methotrexate 14 Comparison of 1 palmitoyl 2 linoleoyl 3 acetyl rac glycerol loaded self emulsifying granule and solid self nanoemulsifying drug delivery system powder property dissolution and oral bioavailability 15 Liposomal Formulations for Nose to Brain Delivery Recent Advances and Future Perspectives 16 Development of folate functionalized zein nanoparticles for ligand directed delivery of paclitaxel Nanoparticulates as Drug Carriers V. P. Torchilin,2006 Written by key experts in the field of nanomedicine this book provides a broad introduction to the important field of nanomedicine and application of nanotechnology for drug delivery It covers up to date information regarding various nanoparticulate drug delivery systems describes the various opportunities for the application of nanoparticular drug carriers in different areas of clinical medicine and analyzes already available information on their clinical applications This book can be used as an advanced textbook by graduate students and young scientists and clinicians at the early stages of their career

It is also suitable for non experts from related areas of chemistry biochemistry molecular biology biomedical engineering physiology experimental and clinical medicine and pharmaceutical sciences who are interested in general problems of drug delivery and drug targeting as well as in more specialized topics of using nanoparticulate mediated drug delivery approaches in the individual areas of clinical medicine Prof Torchilin is an expert in Nanomedicine and a recipient of numerous awards including the Lenin Prize in Science Polymer Micelles as Drug Carriers E V Batrakova et al Lipoproteins as Pharmaceutical Carriers S Liu et al Dendrimers as Nanoparticular Drug Carriers S Svenson Cells and Cell Ghosts as Drug Carriers J M Lanao Magnetic Nanoparticles as Drug Carriers U O Hnfeli Liposomal Drug Carriers in Cancer Therapy A A Gabizon Delivery of Nanoparticles to the Cardiovascular System B A Khaw Nanoparticles for Targeting Lymphatics W Phillips Nanoparticular Carriers for Ocular Drug Delivery A Sanchez and other papers Readership Graduate students academics in nanomedicine clinicians pharmacologists pharmacists bioengineers researchers in biotechnology and diagnostic imaging **Nanocarriers for the Delivery of Combination Drugs** Sanjula Baboota,Javed Ali,2021-05-21 Nanocarriers for the Delivery of Combination Drugs focuses on the role of nanocarriers in the delivery of combination drugs for the management and treatment of various diseases Nanocarriers belonging to the category of polymeric nanoparticles dendrimers lipidic nanocarriers like nanoemulsions liposomes solid lipid nanoparticles nanostructured lipid carriers are now being used in the drug delivery of combination drugs This book helps readers assimilate all the information available surrounding the application of various nanocarrier technologies for the delivery of combination drugs of synthetic and natural origin including small and large molecules This is an important reference source for pharmaceutical scientists and biomaterials scientists who are looking to gain an increased understanding on how nanotechnology is improving the efficiency of combination drug delivery Outlines how nanocarriers are used to enhance combination drug delivery systems Assesses the major challenges of delivering combination drugs successfully and explains how nanocarriers can help meet these challenges Explores the characteristics of a variety of nanocarrier material types **Improving nanoparticulate carriers for oral drug delivery using archaeal lipids** , **Development of a Novel Drug Delivery System to Enhance the Oral Bioavailability of Lactoferrin** Xudong Yao,2015

Decoding **Niosomal Carriers Enhance Oral Bioavailability Of**: Revealing the Captivating Potential of Verbal Expression

In a time characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its capability to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Niosomal Carriers Enhance Oral Bioavailability Of**," a mesmerizing literary creation penned by way of a celebrated wordsmith, readers embark on an enlightening odyssey, unraveling the intricate significance of language and its enduring impact on our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

Table of Contents Niosomal Carriers Enhance Oral Bioavailability Of

1. Understanding the eBook Niosomal Carriers Enhance Oral Bioavailability Of
    - The Rise of Digital Reading Niosomal Carriers Enhance Oral Bioavailability Of
    - Advantages of eBooks Over Traditional Books
2. Identifying Niosomal Carriers Enhance Oral Bioavailability Of
    - Exploring Different Genres
    - Considering Fiction vs. Non-Fiction
    - Determining Your Reading Goals
3. Choosing the Right eBook Platform
    - Popular eBook Platforms
    - Features to Look for in an Niosomal Carriers Enhance Oral Bioavailability Of
    - User-Friendly Interface
4. Exploring eBook Recommendations from Niosomal Carriers Enhance Oral Bioavailability Of
    - Personalized Recommendations
    - Niosomal Carriers Enhance Oral Bioavailability Of User Reviews and Ratings

- Niosomal Carriers Enhance Oral Bioavailability Of and Bestseller Lists

5. Accessing Niosomal Carriers Enhance Oral Bioavailability Of Free and Paid eBooks
    - Niosomal Carriers Enhance Oral Bioavailability Of Public Domain eBooks
    - Niosomal Carriers Enhance Oral Bioavailability Of eBook Subscription Services
    - Niosomal Carriers Enhance Oral Bioavailability Of Budget-Friendly Options
6. Navigating Niosomal Carriers Enhance Oral Bioavailability Of eBook Formats
    - ePub, PDF, MOBI, and More
    - Niosomal Carriers Enhance Oral Bioavailability Of Compatibility with Devices
    - Niosomal Carriers Enhance Oral Bioavailability Of Enhanced eBook Features
7. Enhancing Your Reading Experience
    - Adjustable Fonts and Text Sizes of Niosomal Carriers Enhance Oral Bioavailability Of
    - Highlighting and Note-Taking Niosomal Carriers Enhance Oral Bioavailability Of
    - Interactive Elements Niosomal Carriers Enhance Oral Bioavailability Of
8. Staying Engaged with Niosomal Carriers Enhance Oral Bioavailability Of
    - Joining Online Reading Communities
    - Participating in Virtual Book Clubs
    - Following Authors and Publishers Niosomal Carriers Enhance Oral Bioavailability Of
9. Balancing eBooks and Physical Books Niosomal Carriers Enhance Oral Bioavailability Of
    - Benefits of a Digital Library
    - Creating a Diverse Reading Collection Niosomal Carriers Enhance Oral Bioavailability Of
10. Overcoming Reading Challenges
    - Dealing with Digital Eye Strain
    - Minimizing Distractions
    - Managing Screen Time
11. Cultivating a Reading Routine Niosomal Carriers Enhance Oral Bioavailability Of
    - Setting Reading Goals Niosomal Carriers Enhance Oral Bioavailability Of
    - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Niosomal Carriers Enhance Oral Bioavailability Of
    - Fact-Checking eBook Content of Niosomal Carriers Enhance Oral Bioavailability Of
    - Distinguishing Credible Sources

13. Promoting Lifelong Learning
    - Utilizing eBooks for Skill Development
    - Exploring Educational eBooks
14. Embracing eBook Trends
    - Integration of Multimedia Elements
    - Interactive and Gamified eBooks

Niosomal Carriers Enhance Oral Bioavailability Of Introduction

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