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A Review on Nanotechnology in Diagnosis and Treatment of Alzheimer's Disease

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ABSTRACT

Alzheimer's disease is a progressive mental deterioration that can occur in middle or old age, due to generalized degeneration of the brain. It is the commonest cause of dementia. The currently available therapeutics for Alzheimer's disease only act to lower its symptoms. Therefore, the nanotechnology is advancing molecular detection, drug discovery, delivery and monitoring for a number of ever challenging human diseases, including cancer and neurodegenerative disorders. In this paper, we present the role of nanotechnology in the development and improvement of techniques for early diagnosis and effective treatment of Alzheimer's disease (AD). The nano diagnostic methods reported and compared in this paper include both of *in vitro* and *in vivo* approaches. The nano treatment methods for AD are numerous. They are categorized in this report under neuroprotective methods and nanocarriers for targeted drug delivery. Considering that the AD is a multi-factorial disease with several pathogenetic mechanisms and pathways, a multifunctional nanotechnology approach will be needed to target its main molecular culprits.

Keywords: Alzheimer's disease, Nanotechnology, *In vitro* and *In vivo* approaches.

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NANOSUSPENSION: A NANOCARRIER DRUG DELIVERY SYSTEM

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ABSTRACT

Nanosuspensions are fine dispersion of uniform-sized solid particles in an aqueous vehicle. Many of the drug candidates are exhibiting poor aqueous solubility. The use of drug nanosuspension is a universal formulation approach to increase the therapeutic performance of these drugs in any route of administration. Nanosuspension consists of the pure poorly water-soluble drug without any matrix material suspended in dispersion. Preparation of nanosuspension is simple and applicable to all drugs which are water insoluble. A nanosuspension not only solves the problems of poor solubility and bioavailability, but also alters the pharmacokinetics of drug and thus improves drug safety and efficacy. This review article describes the preparation methods, characterization, and applications of the nanosuspension.

KEYWORDS: Nanosuspension, Bioavailability and Pharmacokinetics.

INTRODUCTION

A pharmaceutical nanosuspension is defined as a very finely colloid, biphasic, dispersed, solid drug particles in aqueous vehicle, size below 1µm, without any matrix material, stabilised by surfactants & polymers, prepared by suitable methods for drug delivery applications, through various routes of administration like oral, topical, parenteral, ocular & pulmonary routes. A nanosuspension not only solves the problem of poor solubility & bioavailability but also alters the pharmacokinetics of drug & that improves safety & efficacy. Nanosuspension formulation approach is most suitable for the compounds with high log P value, high melting point & dose. Nanosuspension has been reported to enhance adsorption & bioavailability it may help to reduce the dose of the convectional oral dosage forms. Drug particle size reduction leads to an increase in surface area & consequently in the rate of dissolution as described by Nernst-Brunner & Levich modification of the Noyes- Whitney equation. In addition, an increase in saturation solubility is postulated by particle size reduction due to an increase dissolution pressure explained by the Ostwald Freundlich equation. Depending on the production technique applied changes in crystalline structure of the drug particles may also occur. An increasing amount of amorphous drug fraction could induce higher saturation solubility (Nayak S & Panda D. *et al.*, 2010). Nanosuspensions differ from nanoparticles, Nanoparticles are commonly polymeric colloidal carrier of drugs whereas solid lipid nanoparticles are lipidic carriers of drugs. In nanosuspension technology, the drug is maintained in the crystalline state with reduced particle size, leading to increase dissolution rate & therefore improved bioavailability. Drugs encapsulated within nanosuspensions exist in pharmaceutically accepted crystalline or amorphous state. Nanaosuspensions can successfully formulate the brick dust molecules for improved dissolution & good absorption (Prabhakar C & Krishna K. *et al.*, 2011).

Advantages

1. Its general applicability to most drugs & simplicity
2. It can apply for poorly water soluble drugs
3. It can given by any route
4. Reduced tissue irritation in case of subcutaneous/intramuscular administration
5. Rapid dissolution & tissue targeting can be achieved by IV route of administration
6. Oral administration of nanosuspension provide rapid onset & improved bioavailability
7. The absorption form absorption window can be increased, due to reduction in the particle size
8. Drug with higher log P value can be formulated as nanosuspensions to increase the bioavailability
9. Long term physical stability
10. Possibility of large scale production

Disadvantages

1. Physical stability, sedimentation & compaction can cause problems
2. It is bulky sufficient care must be taken during handling & transport
3. Improper dose
4. Uniform & accurate dose cannot be achieved

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MOUTH DISSOLVING FILMS: AN EFFECTIVE ORAL DISINTEGRATING DRUG DELIVERY SYSTEM

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ABSTRACT

The drug discovery and development of new chemical entity is not only an expensive but also time consuming affair. Hence the pharmaceutical industries are focusing on designing and development of innovative drug delivery systems for the existing drugs. One of such delivery systems is mouth dissolving film, which has gained the popularity among the pediatric and geriatric patients. This mouth dissolving film with many potential benefits of a fast disintegrating tablet but devoid of friability and risk of choking is more acceptable to pediatric and geriatric patients. In view of the advantages of the mouth dissolving films over the fast disintegrating tablets and other dosage forms, it has the potential for commercial exploitation. Formulation of mouth dissolving film can be achieved by various techniques, but the common methods of preparation include spraying and casting. These techniques use hydrophilic film former in combination with suitable excipients, which allow the film to disintegrate or dissolve quickly in the mouth within a few seconds without the administration of water. The oral disintegrating films not only have certain advantages of other fast disintegrating systems but also satisfy the unmet needs of the market. The present review focuses on benefits, formulation development, characterization and applications of orally fast disintegrating films.

KEYWORDS: Oral disintegrating films, Casting method and Hydrophilic film former.

INTRODUCTION

Oral drug delivery systems still need some advancement to be made because of their some drawbacks related to particular class of patients which includes geriatric, pediatric and dysphasic patients associated with many medical conditions as they have difficulty in swallowing or chewing solid dosage forms. Many pediatric and geriatric patients are unwilling to take solid preparations due to fear of choking. Even with fast dissolving tablets there is a fear of choking due to its tablet type appearance. One study showed that 26% of 1576 patients experienced difficulty in swallowing tablets.[1] The most common complaint was tablet size, followed by surface form and taste. The problem of swallowing tablets was more evident in geriatric and pediatric patients, as well as travelling patients who may not have ready access to water.[2] So, fast-dissolving drug-delivery systems came into existence in the late 1970's as an alternative to tablets, capsules and syrups for pediatric and geriatric patients who experience difficulties in swallowing traditional oral solid-dosage forms. These systems consist of the solid dosage forms that disintegrate and dissolve quickly in the oral cavity without the administration of water.[3] Research and development in the oral drug delivery segment has led to transition of dosage forms from simple conventional tablets or capsules to modified release tablets or capsules to oral disintegrating tablet (ODT) to wafer to the recent development of oral fast dissolving films (OFDFs). Amongst the plethora of avenues explored for the rapid drug releasing products, oral strip technology is gaining much attention.[4]

Orally fast-dissolving film is new drug delivery system for the oral delivery of the drugs. It was developed on the basis of technology of the transdermal patch. The delivery system consists of a very thin oral strip, which is simply placed on the patient's tongue or any oral mucosal tissue, instantly wet by saliva the film rapidly hydrates and adheres onto the site of application. It then rapidly disintegrates and dissolves to release the medication for oromucosal and intragastric absorption.[5] Technology Catalysts forecasts the market for drug products in oral thin film formulations was valued of $500 million in 2007 and could reach $2 billion in 2012. Based on upward global growth trends of the past decade, the fast dissolving dosage market could produce revenues of $13 billion by 2015.[6]

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LIQUISOLID TECHNOLOGY: A REVIEW

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ABSTRACT

The liquisolid (LS) technique is a novel approach for delivery of drugs through the oral route. This technique is suitable for poorly soluble or water insoluble drugs, highly permeable drugs (BCS Class II drugs) and also for immediate or sustained release formulations. The design of liquisolid systems are mainly intended for enhancement of solubility, dissolution rate and bioavailability of poorly water-soluble and highly lipophilic drugs. Improvement in bioavailability may be due to increased surface area, increased aqueous solubility and increased the wettability of the drug. Liquisolid technique also has the potential to be optimized for the reduction of drug dissolution rate and thereby production of sustained release systems. Overall, liquisolid technique is a most promising and novel technique for enhancing the dissolution and bioavailability of poorly water soluble drugs and sustaining drug release from tablet matrices. The current review mainly focuses on different carriers, solvents and coating materials employed in liquisolid technique. Literature reports on the applicability of liquisolid compact techniques over a wide range of pharmaceutical formulations are also explicated.

KEYWORDS: Bioavailability, Wettability, Carrier and Sustained Release.

INTRODUCTION

Solubility is one of the important parameters to achieve desired concentration of drug in systemic circulation for pharmacological response to be shown. Poorly water soluble drugs will be inherently released at a slow rate owing to their limited dissolution rate within the gastrointestinal tract (GIT) contents. One challenge for poorly water soluble drugs is to enhance the rate of dissolution. Various techniques have been employed to formulate oral drug delivery system that would enhance the dissolution profile.[1] Solid dispersions, micronization, use of mesoporous silica carriers, ball milling technique, use of complexing agents, crystal engineering, solubilization by surfactants and liquisolid (LS) technique developed. These techniques take advantage of the increased dissolution rate resulting from the addition of a solubilizing agent, particle size reduction or the drug being in an already dissolved or amorphous state.

LS technique has been identified as a promising technique to improve the dissolution rate of poorly water soluble drugs.[2] When properly formulated, LS powder blends possess acceptable flowability and compressibility properties. They are prepared by simple blending with selected powder excipients referred to as the carriers and the coating materials. This technique was successfully applied for low dose poorly water soluble drugs. Drug can be present in a completely or partially dissolved state in the LS formulation. The LS formulation can then facilitate the release of this drug by two mechanisms: (1) Already dissolved drug only need to diffuse out of the formulation and (2) the liquid component of the formulation act as a solubilizing aid to facilitate the wetting and dissolution of undissolved particles. Since dissolution of a non polar drug is often the rate limiting step in gastrointestinal absorption, better bioavailability of an orally administered poorly water soluble drug is achieved when the drug is formulated using a LS system.

Advantages

1. Poor water soluble or water insoluble drugs can be formulated into LS systems.
2. Better availability of an orally administered poorly water soluble drugs.
3. LS tablets or capsules of poorly water soluble drugs exhibit enhanced *in vitro* and *in vivo* drug release.
4. Can be applied to formulate liquid medications such as oily liquid drugs.
5. Enhanced bioavailability can be obtained as compared to conventional tablets.

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Review Article

A Scientific review on Crateva religiosa

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ABSTRACT

Sacred garlic pear is the common name for Crateva Religiosa belongs to crateva genus and Capparaceae family. Traditionally it is used to treat many disorders but very few abstracts are proving its scientific evidence. Hence an attempt has been made to collect the information regarding its cultivation requirements, folklore usages pharmacological action with its phytochemical isolates. With this review it was found that even though many folklore usage are present for this divine fruit but very little research was conducted on this species of Capparaceae family, hence this review will be helpful for plant researchers to work on this species.

Keywords : Crateva religiosa , Capparaceae , phytochemical and pharmacological activity.

Introduction

Herbal medicine has been around since the beginning of recorded history. Currently, there is an increasing interest in the use of plant for treatment of illness. The easy accessibility and cheapness of medicinal plants encourage their use but most of the uses are not validated. According to WHO more than 80% of world's population, are thought to depend chiefly on traditional medicine, which is largely of plant origin, for their primary health care needs. In recent years, there is a growing interest in herbal therapy.[14]

The capparaceae or capparidaceae, commonly known as the caper family, are a family of plants in the order brassicales. This family contains 33 genera and about 700 species. The largest genera are *capparis* (about 150 species), *maerua* (about 100 species), *boscia* (37 species) and *cadaba* (30 species). Crateva religiosa is a flowering tree which belongs to capers family. It is also called as the sacred garlic pear and temple plant. The name crataeva is given in the honor of crataevus, a greek botanist, who was living in the time of hippocrates and the name religiosa indicates its growth near the places of worship. It is native to japan, australia, much of southeast asia and several south pacific islands. It is grown elsewhere for fruit, especially in parts of the african continent. In this present review article, we are providing brief information of crateva religiosa species which belongs to the capparaceae family. Out of all the species of crateva religiosa was found to have very few scientific evidence in its treatment towards alleviating diseases/ disorders. Hence this review will be helpful for the researchers to carry out further work on this plant.

Folklore uses:[12]

Crataeva religiosa is sweet, pungent, bitter, and astringent in nature. They use the leaves and the bark of the tree for medicinal purposes. Crataeva religiosa proves to the best medicinal herb for various kinds of urinary disorders. This litholytic herb is used to cure people of benign prostate hyperplasia. The various traditional uses of crataeva religiosa are Immunity , Restless leg syndrome , Weight Loss , astringent , cholagogue , Strengthens Bones , Urination and Excretion. Lower Risk of Heart Problems , Proper Growth , Antiemetic , antidote in snakebite , improves digestion , increases apetite and biliary secretion , laxative , convulsions , swelling and burning sensation in the soles of feet , vesicant and neurologic pains.

Taxonomical classification[12]:

Kingdom	Plantae (plants)
Subkingdom	Tracheobionta (vascular plants)
Superdivision	Spermatophyta (seed plants)