International Journal of Enhanced Research in Medicines & Dental Care (IJERMDC),
ISSN: 2349-1590, Vol. 11 Issue 5, May 2024, Impact Factor: 8.325

A Review: Herbal Drug Nanosuspension

Utkarsha B. Khade[1], Mr. J.V. Shinde[2], Mrs. Pooja Khatate[3], Vidya Gadkari[4], Harshda Shirsode[5], Prafull Avhad[6]

[1]Research student of PDEA Seth Govind Raghunath Sable College of Pharmacy
[2]HOD of Pharmaceutics Department
[3]Assistant Professor In Seth Govind Raghunath Sable College Of Pharmacy Saswad
[4]Research Student Of PDEA Seth Govind Raghunath Sable College Of Pharmacy Saswad
[5]Research Student Of PDEA Seth Govind Raghunath Sable College Of Pharmacy Saswad
[6]PDEA Seth Govind Raghunath Sable College Of Pharmacy Saswad

ABSTRACT

Important carriers for creating a unique therapeutic formulation are nanosuspensions. Many recently developed medications are water insoluble and so poorly bioavailable, which leads to abandoned research projects. One common formulation technique to improve the therapeutic efficacy of these medications in any mode of administration is the use of drug nanosuspension. Drugs with low water solubility and low bioavailability can be made more soluble using nanosuspension technology. Many times, people believe that medicinal plants or their phyto-compunds are less harmful and have less negative effects than synthetic medications. However, because of their low water solubility, medicinal plants or their phytocompunds have restricted formulation possibilities. This paper primarily examined the biological activity of natural plant compounds in nanosuspension.

Key words: natural goods, nanosuspension

INTRODUCTION

Due to their potential health advantages and safety, medicinal plant use has recently expanded globally.The study of secondary metabolites obtained from natural products for the treatment of diseases due to broad spectrum management is given top priority by the World Health Organization (WHO) . About 80% of people in poor nations rely on natural goods for their basic health requirements. It is clear that the majority of the bioactive components in herbal extracts have large molecular diameters and little water solubility, which further contributes to their poor systemic absorption and low bioavailability.

Recently, nanotechnology has become a cutting-edge method for dealing with the problems that poorly water-soluble medications have with solubility and bioavailability. The water solubility and bioavailability of plant extracts processed using nanotechnology may increase the effectiveness. Because it promotes saturation solubility and reduces negative effects even with high drug loading, pharmaceutical nanosuspension of natural medicines is a perplexing and exciting method. Furthermore, nanosuspensions can be administered via a number of ways, including oral, parenteral, intravenous, and pulmonary.

To solve the solubility issue of poorly soluble medications, a number of formulation strategies, including micronization, solid dispersion, inclusion complexes, lipid carriers and liposomes, emulsions and micro-emulsions, are widely used. However, the fundamental issue with these treatments is that not all types of medications can be treated with them. Due to its ease of usage and advantages over other solutions, nanosuspension technology has demonstrated higher promise to solve the issue. Exceptionally tiny, evenly scattered solid medication particles in pharmaceutical nanosuspensions.

Herbal drugs play a major role in the treatment of hepatic disorders. In the absence of reliable liver protective drugs in modern medicine, in India, a number of medicinal plants and their formulations are used to cure hepatic disorders in traditional systems of medicine. Several studies were conducted in the field of drug discovery and development but due to the side effects of modern medicine, natural remedies are considered to be effective and safe alternate treatments for hepatotoxicity.

The majority of novel chemical entities produced by drug discovery initiatives—more than 40%—have low water solubility. One of the hardest issues facing pharmaceutical chemists has always been the creation of medications that are poorly soluble in water. Numerous traditional techniques, including micronization, co-solvent solubilization, surfactant dispersions, and precipitation technique, have been developed to increase the solubility of pharmaceuticals that are poorly soluble in water.

However, these methods revealed that some medications have limitations since they are insoluble in both organic and aqueous solvents. Using nanosuspension technology, the issues with the previously mentioned methods can be resolved.

NANOSUSPENSION

Nanosuspension is defined as colloidal dispersion of nano-sized drug particles stabilized by surfactants. They can also be defined as a biphasic system consisting of pure drug particles dispersed in an aqueous vehicle in which the diameter of the suspended particle is less than 1 µm in size. Nanosuspension can be used to enhance solubility of drugs that are poorly soluble in aqueous as well as lipid media. As a result, rate of flooding of the active compound increases and the maximum plasma level is reached faster (eg, oral or intravenous administration of nanosuspension). This is one of the unique advantages that it has over other approaches for enhancing solubility.

It is useful for molecule with poor solubility, poor permeability or both, which poses a significant challenge for the formulators. The reduced particle size renders the possibility of intravenous administration of poorly soluble drugs without blockade of the blood capillaries. The nanosuspension can also be lyophilized or spray dried and the nanoparticles of a nanosuspension can also be incorporated in a solid matrix. Nanosuspension formulation approach is most suitable for the compunds with high log P value, high melting point and high dose.

Advantages of Nanosuspension

It offering improves in the dissolution velocity and saturation solubility of the drug.

- They are having augmented biological performance
- Ease of manufacture and scale-up.
- They possess long-term physical stability.
- They are capable of focusing a drug to the specific site in body.
- Enhancement of biological performance as a result of the medications' high saturation solubility and dissolution rate
- Make manufacturing simple and scale up for mass production
- The potential to modify the nanosuspension's surface for site-specific delivery.
- A better proportionality of dose.

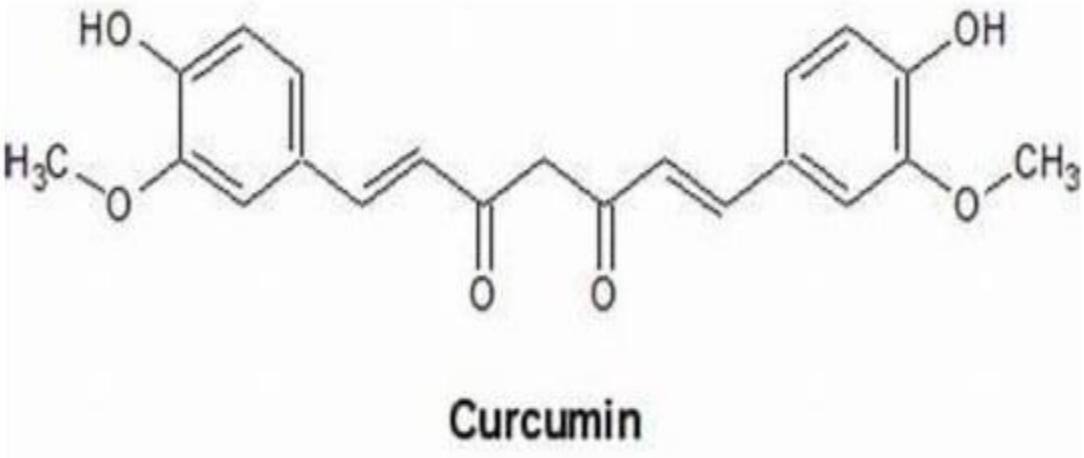
Disadvantages of Nanosuspension

- They are capable of intending a drug to the specific site in body.
- Require stabilizers.
- High energy input.
- Lack of controlled release.

Plants that are medicinal or their phyto-compunds

Compared to manufactured medications, medicinal plants or their phyto-compunds may be less toxic and have fewer adverse effects. However, because of their low water solubility, medicinal plants' or their phyto-compunds' formulation options are restricted. It may be possible to improve the poor water solubility of medicinal plants or their phyto-compunds by taking into account nanosuspension formulation, which may also be utilized to investigate biological activity.

Nanosuspension of Organic Matter
Curcumin-



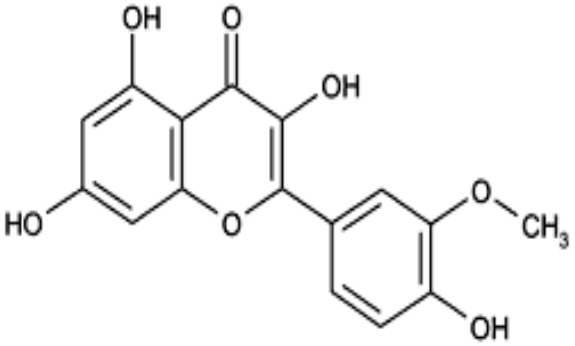
It is a naturally occurring product that is separated from the rhizomes of curcuma longa Linn. (Zingiberaceae) and used as a nutritional supplement and spice. It has the potential to treat a number of malignant diseases, diabetes, allergies, arthritis, Alzheimer's disease, and other conditions. It also demonstrates antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal, and anticancer properties.

Cadmium and lead are two examples of heavy metals that curcumin binds to and lessens in toxicity. This characteristic of curcumin explains why it protects the brain.

Curcuminoids are the collective name for the constituents of turmeric, which mostly consist of curcumin, demethoxycurcumin, and bisdemethoxycurcumin. These substances aren't very soluble in water. Curcumin's primary disadvantages, which include instability, low solubility, poor absorption, and quick metabolism, significantly restrict its therapeutic applicability. It has been attempted to distribute curcumin by nanosuspension, making it fully dispersible in an aqueous medium.

The anticancer activity of curcumin nano-formulations is higher than that of native curcumin. Curcumin nanoparticles with a size range of about 100–200 nm can be produced using polymer nanoparticles based on PLGA, a biodegradable and biocompatible polymer. This spectrum of particle sizes permits escape from macrophage absorption while permitting intracapillary passage with the help of an appropriate surface coating.

Quercetin



It is a naturally occurring polyphenol that is a member of the flavanoids group of plant pigments that give fruits, vegetables, and flowers their color. The chemical structure of quercetin, a flavonol, is derived from flavone. The chemical name for quercetin is 3,3,4,5,7-pentahydroxyflavone.Onions, apples, and tea are particularly high-quercetin foods. It has numerous biological actions that are thought to be advantageous tod rate of disintegration. As a result, the quercetin nanosuspension was created to increase the drug's solubility and rate of dissolution.

Coriander sativum

Since coriander (Coriandrum sativum L.) is an annual herb, an extract was extracted from the entire plant. Despite having different flavors and purposes, the plant's seeds, leaves, and roots can all be eaten. Due to the perishable nature of its leaves, coriander can be used whole or processed to make ripe fruits more palatable before being employed as a flavoring in various culinary recipes.In [14] The coriander plant is a significant source of dietary components and minerals. In addition to its well-known antimicrobial, anti-diabetic, anti-mutagenic, anti-anxiety, and antioxidant properties, coriander also has an analgesic and hormone-balancing effect. These properties encourage the use of coriander in food because of its many health advantages as well as its ability to protect food for extended periods of time. coriander sativum extract-containing nanosuspension against the hepatotoxic effect.The results indicate that the nanosuspension significantly affects the male Wistar albino mice's hepatotoxic liver, which is caused by carbon tetra chloride.

Phyllanthus amarus

There are over 800 species of Phyllanthus amarus, a plant belonging to the Euphorbiaceae family, which are distributed throughout tropical and subtropical regions of the globe. It is frequently used in conventional Indian medicine and as dietary supplements to treat a wide range of physiological conditions, including problems of the liver. Phyllanthus amarus is an annual glabrous herb that branches out and grows as a weed in both cultivated and waste areas.

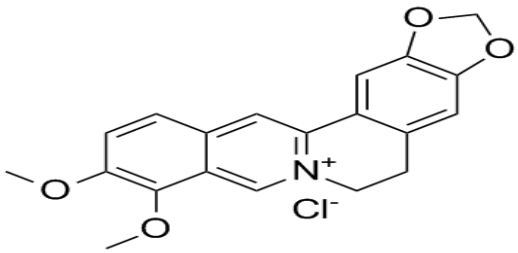
Its absorption after oral administration may be restricted since its main ingredients, lignans and flavanoids, are poorly soluble in water. Thus, phyllanthus amarus nanosuspension was created to increase the drug's solubility. Examining the hepatoprotective benefits of Phyllanthus amarus extract (PAE) and its nanoparticles (PAN) on acute liver injury caused by paracetamol.

Cuscuta chinensis

A popular traditional Chinese medicine used to nourish the kidney and liver is cuscuta chinensis. It is a plant parasite that is in the convoluceae family. It is frequently used as an aphrodisiac, pain reliever, anti-inflammatory, and anti-aging agent. Its absorption after oral administration may be restricted since its main ingredients, flavonoids and lignans, are poorly soluble in water. Therefore, the drug's solubility was increased by using the nanosuspension approach.Rats exposed to acetaminophen-induced hepatotoxicity were used to study the ethanolic extract (CE) of Cuscuta chinensi's hepatoprotective and anti-oxidant properties.

Similar hepatoprotective effects were observed at an oral dosage of Cucuta chinensis nanosuspension, which is five times lower than the oral dose of Cucuta chinensis extract. Furthermore, there was a considerable rise in superoxide dismutase, catalase, glutathione peroxidase, and a decrease in malondialdehyde due to the anti-oxidant actions of CE and CN. Results also indicated that Cuscuta chinensis nanosuspension had superior hepatoprotective and anti-oxidant benefits over Cuscuta chinensis extract.

Berberine



The active component of copies, bebeerine, is an alkaloid derived from isoquinolines with a broad range of pharmacological effects. Both Ayurvedic and traditional Chinese medicine have used it. Berberine and its derivatives have potential in a number of therapeutic areas, including cancer, inflammation, diabetes, depression, hypertension, and other infectious regions.

They can also be used in combination with other pharmaceutically active substances or in formulations. But because of its low oral bioavailability, berberine's therapeutic use is restricted. In diabetic mouse models, the antidiabetic effects of bebeerine nanosuspension were assessed in comparison to the effectiveness of bulk bebeerine. Furthermore, when compared to an equivalent dose of bulk bebeerine and metformin, bebeerine nanosuspension demonstrated greater hypoglycemic, total cholesterol, and body weight reduction effects. As a result, using bebeerine as a nanosuspension to treat type 2 diabetes is a potential strategy.

Hepatocarcinoma, a malignant cancer, threaten human life badly. Both in vitro and in vivo anti-hepatocarcinoma effects of bebeerine nanosuspension relative to efficacy of bulk Berberine were evaluated. Berberine nanosuspension exhibited significant inhibitory effects against human HepG2 and Huh7 cells where as in vivo studies also showed higher antitumor efficacy. Therefore the delivery of bebeerine as a nanosuspension is a promising approach for treating hepatocarcinoma.

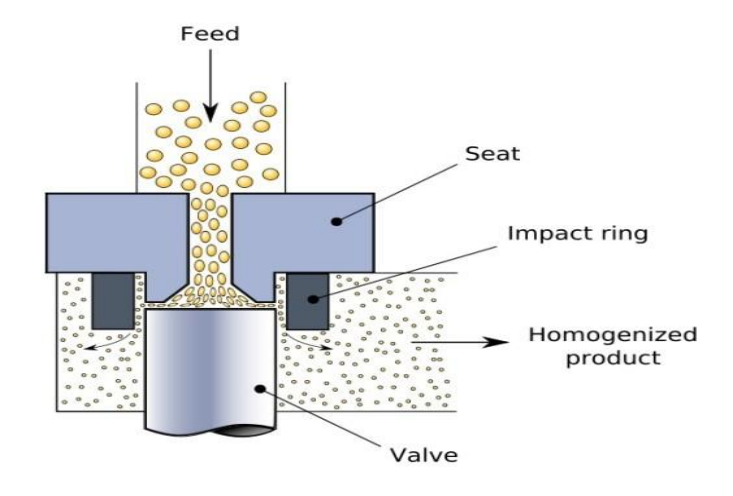
PREPARATION METHOD FOR NANOSUSPENSION

The nanosuspension of drug molecules is mainly developed by two different methods such as bottom up technology and top down technologies.

1.**Bottom up Technology** -Conventional methods of precipitation are known as bottom-up technology. In bottom up technology the drug is dissolved in a solvent, which is the included to nonsolvent to precipitate the crystals. The basic precedence of precipitation technique is to use simple and low cost equipments. The basic challenge of this technique is that during precipitation method the growing of drug crystals needs to be controlled by addition of surfactant to formation of micro particles. The restriction of this precipitation technique is that the drug needs to be soluble in at least one solvent and this solvent needs to be miscible with the non-solvent. Moreover precipitation technique is not applicable to drugs, which are simultaneously poorly soluble in aqueous and non-aqueous media .

Top down technology -The top-down technologies are the disintegration methods and choose over the precipitation methods11-12 . The Top down Technologies comprise

1. **High-pressure homogenization method-**In this process firstly the drug powders are dispersed in a stabilizer solution to form pre-suspension was homogenized by the high pressure homogenizer at a low pressure for several times as a kind of premilling, and finally it was homogenized at a high pressure for 10 - 25 cycles until the nanosuspension with the desired size were prepared.



2.**Ultracritical fluid techniques-**Nanoparticles are produced using a variety of techniques, including the precipitation with compressed antisolvent (PCA) process, the supercritical antisolvent process, and the rapid expansion of supercritical solution (RESS) process. The RESS process involves expanding a drug solution through a nozzle into a supercritical fluid, which causes the supercritical fluid's solvent power to evaporate and precipitate the drug as small particles. Young et al. synthesized 400–700 nm diameter cyclosporine nanoparticles by employing the RESS technique. The drug solution is atomized into the CO2 compressed chamber in the PCA procedure. The solution becomes supersaturated as the solvent is removed, leading to precipitation in the end. The drug solution is introduced into the supercritical fluid during the supercritical antisolvent procedure, and both the solvent and the medication are removed.

CONCLUSION

Pharmaceutical experts have long faced a difficult issue with poorly water soluble medicines. In this instance, formulations utilizing nanosuspension may be a potential option. The primary uses of medicinal plants in traditional Indian medicine are as nutritional supplements for the management of a wide range of physiological conditions, such as hepatic conditions. Its absorption may be restricted because its main ingredients are poorly soluble in water. As a result, nanosuspension technology has the potential to transform Ayurvedic research while also offering a host of immediate benefits. The emphasis on this technology will also have economical benefits for our society.

REFERANCES

[1]. Dubey R. Pure drug nanosuspensions impact of nanosuspensions technology on discovery and development. Drug Del.Tech. 2006; 6: 65-71.
[2]. Patel BP. A Review on Techniques which are useful for solubility Enhancement of poorly water soluble drugs. International Journal for Research in Management and Pharmacy. 2012; 1: 56-70.
[3]. Chingunpituk J. Nanosuspension Technology for Drug Delivery. Walailak J Sci & Tech. 2007; 4(2): 139-153.
[4]. Patravale B, Abhijit AD, Kulkarni RM. Nanosuspension: a promising drug delivery strategy. Journal of Pharmacy and Pharmacology. 2004; 56: 827-840.
[5]. Prasanna L. Nanosuspension Technology: A Review, International Journal of Pharmacy and Pharmaceutical Sciences. 2010; 2(4): 35-40.
[6]. Yadav G, Singh S. Nanosuspension: a promising drug delivery system. Pharmacophore. 2012; 3(5): 217-243.
[7]. Mishra SB, Pandey H, Pandey AC. Nanosuspension of Phyllanthus amarus extract for improving oral bioavailability and prevention of paracetamol induced hepatotoxicity in Sprague–Dawley rats. Adv. Nat. Sci: Nanosci. Nanotechnol. 2013; 1: 1-6.
[8]. Aggarwal BB, Li YW, Gupta, SC. Curcumin-free turmeric exhibits anti-inflammatory and anticancer activities: Identification of novel components of turmeric. Mol. Nutr. Food Res. 2013; 57(9): 1529-1542.
[9]. Steffi PF, Srinivasan M. Preparation, characterization and stabilization of curcumin Nanosuspension. International Journal of Pharm Tech Research. 2014; 1: 842-849.
[10]. Aggarwal BB., Kumar A, Bharti AC. Anticancer potential of Curcumin: Preclinical and clinical studies. Anticancer Research. 2003; 23(IA): 2003: 363-398.
[11]. Karadag A, Ozcelik B, Huang Q, Pure Quercetin nanosuspension produced by high pressure homogenization, J Agric Food Chem. 2014; 62(8): 1852-1859.
[12]. Sun M, Gao Y, Pei Y, Guo C, Li H, Cao F. Development of Nanosuspension formulation for oral delivery of Quercetin. J Biomed Nanotechnol. 2010; 6(4): 325-332.
[13]. www.wjpps.com Vol 4, Issue 07, 2015. 546 Kumar et al. World Journal of Pharmacy and Pharmaceutical Sciences
[14]. Kavitha V.B, Neethu C.S, Krishnakumar K, Anish John, Dineshkumar B. Quercetin Nanosuspension: In-vitro Antitumor Activity against Dalton Lymphoma Cells. American Journal of Pharm Tech Research. 2015; 5(1): 2249-3387.
[15]. Amudha P, Komala M. Formulation of Nanosuspension drug delivery system containing Corriander sativum extracts. International Journal of Biopharmaceutics. 2014; 5(3): 241-244.
[16]. Singdha C, Monika T. Coriander Sativum : A promising functional and medicinal food. Int. J Phyomed Related Industr. 2013; 5: 59 – 65
[17]. P.Amudha, M, Komala; Evaluation of Hepatoprotective Activity of Nanosuspension containing coriander sativum extracts; International Journal of Phytopharmacology. 2014; 5(6): 463-465.
[18]. Mishra SB, Pandey H, Pandey AC. Nanosuspension of Phyllanthus amarus extract for improving oral bioavailability and prevention of paracetamol induced hepatotoxicity in Sprague-dawley rats. Advances in natural sciences and Nanotechnology. 2013; 1: 1-6.
[19]. Dong H, Wang N, Zhao L, Lu F. Berberine in the treatment of type 2 diabetes mellitus: a systemic review and meta-analysis. Evidence-Based Complementary And Alternative Medicine. 2012; 1: 1-12.
[20]. Wang Z, Wu J, Zhou Q, Wang Y, Chen T. Berberine Nanosuspension Enhances Hypoglycemic Efficacy on Streptozotocin Induced Diabetic C57BL/6 Mice. Evidencebased complementary and alternative medicine. 2015; Article ID239749,5 Pages.
[21]. Quigming Luo, Wang LV; Valery V. Twelfth International Conference on Photonics and Imaging in Biology and Medicine. Volume 9230; 2014 ID923003.
[22]. Yen FL, Wu TH, Lin LT, Cham TM, Lin CC. Nanoparticles formulation Cuscuta Chinensis prevents acetaminophen-induced hepatotoxicity in rats. Food Chem Toxicol.2008; 46(5): 1771-1777.
[23]. Yen FL, Wu TH, Lin LT, Lin CC. Hepatoprotective and antioxidant effects of Cuscuta Chinensis against acetaminophen-induced hepatotoxicity in rats. Journal of Ethnopharmacol. 2007; 111(1): 123-128.
[24]. Ulukan H, Swaan PW. Camptothecin, A review of their chemotherapeutical Potential. Drugs. 2002; 62(2): 2039-2057.
[25]. Yao L, Zhao X, Li Q, Zu Y, Fu Y, Zu B, Meng X, Liu C. In vitro and in vivo evaluation of camptothecin nanosuspension: a novel formulation with high antitumor efficacy and low toxicity. International Journal of Pharmacy and Pharmaceutical Sciences. 2012;423(2): 586-588