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An Update Review on Novel Drug Delivery System

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Abstract: *The term "novel drug delivery system NDDS refers to procedures, preparations, tools, and systems for effectively introducing medicinal substances into the body. Since the beginning of time, humans have used plants for sustenance and medicine because they are nature's cure-alls. There are currently global efforts underway to locate herbal remedies in plants and introduce them to the market using an effective medicine delivery technology for people.*

Keywords: Herbal excipients, targeted medication delivery, unique herbal drug delivery system, novel drug delivery systems

I. INTRODUCTION

1.1 New Drugs Delivery System Presented

The disadvantages of the conventional drug delivery methods are addressed by the innovative drug delivery system, which is a novel method of drug delivery. Our nation possesses a wealth of Ayurvedic knowledge, but only recently has its full potential been recognised. Novel drug delivery systems (NDDS) have a number of benefits, such as improved therapy by increasing the efficacy and duration of drug activity, increased patient compliance due to reduced dosing frequency and practical administration routes, and improved targeting for a specific site to reduce negative side effects. It is difficult for both pharmaceutical and drug delivery companies to distribute both new and existing therapeutic technologies in a way that maximises the benefits to patients. (1,. Previously, scientists were unable to become interested in herbal medications becauseDue to challenges with processing, standardizing, extracting, and identifying, innovative medication delivery methods have undergone adjustments. The creation of herbal revolutionary drug delivery systems is now possible thanks to technological advancements such as novel drug delivery systems (NDDS). Advanced approaches can be used to guard against toxicity, improve stability, increase the bioavailability of herbal formulations, and prevent physical and chemical deterioration. In order to obtain customized administration of herbal medications and increase their therapeutic effectiveness, novel drug delivery systems have become increasingly important. The primary goals of creating such delivery methods are to reduce drug degradation and loss, avoid negative side effects, and maximize bioavailability(2, With their distinct physical and chemical propertiesNDDSs, or nanoparticle-based drug delivery systems, are currently undergoing substantial development for use in the treatment of disorders like cardiovascular disease, infectious disease, diabetes, and other conditions. The way a medicine is administered can significantly affect how effective it is. Some medications have an ideal concentration range where the greatest benefit is obtained; dosages outside or inside of this range can be hazardous or have no therapeutic effect at all. As opposed to thatmultidisciplinary approach to the delivery of therapies to targets in tissues is becoming increasingly necessary, as evidenced by the relatively modest improvement in the efficacy of treating severe diseases.(3)

1.2 Benefit of NDDS

1. Small dose needed for the desired therapeutic effect.
2. Reduces the overall dosage of the drug used during the course of the drug treatment.
3. Steer clear of initial metabolism.
4. Improved drug effectiveness and site-specific delivery.
5. Reduces toxicity and adverse effects.
6. Demonstrate patient adherence (4).

1.3 Currently Facing difficulties in Modernising and Improving Herbal Formulations

Only 5% of the global Ayurveda market is now occupied by India, and there is enormous room for growth from its current share of Rs. 4000 crore. But it is a sobering indictment that India missed out on chances in the global market

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while having the knowledge, talent, and resources.Research and documentation are necessary to meet international standards in order to improve manufacturing and product quality. This could be addressed by referring to worldwide pharmacopoeia and global standards suchHerbal B.P., Chinese, Japanese, Indian Ayurvedic Formulary, and WHO Herbal Medicine Guidelines.. The government should think about aiding the sector in establishing a well-established unit that will work toward excellence in quality control in order for the domestic and international markets for the Indian herbal sector to remain viable. Drug standardisation must achieve global standards in the upcoming years

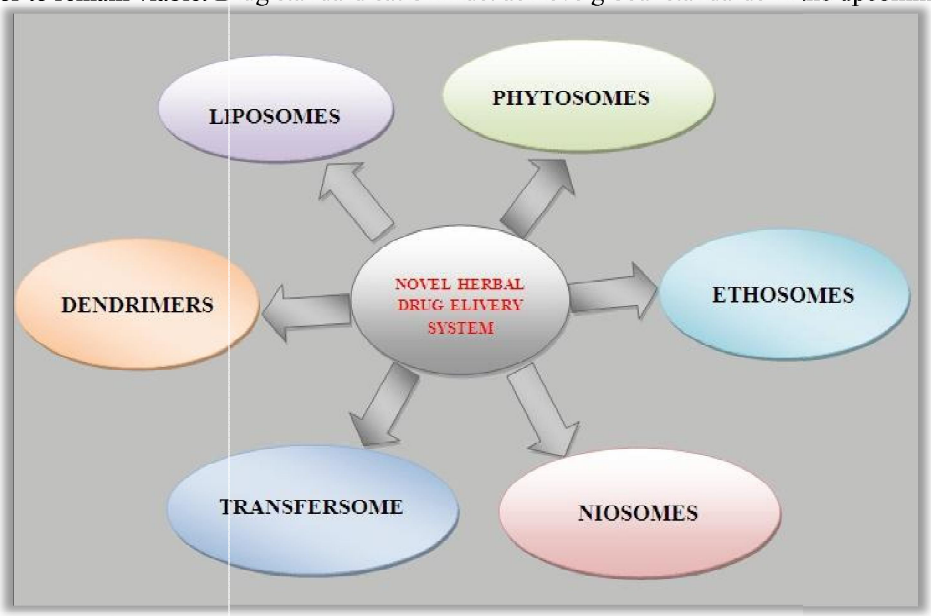

Figure: Numerous innovative herbal compositions of various types

1.4 Advantages and Disadvantages of Physical and Chemical Properties

A. Liposome

Introduction

Liposomes are vesicular, spherical colloidal particles with a lipid bilayer encasing an aqueous core. The natural and phospholipids make up the majority of the lipid bilayer. The size is between -2onm. Cholesterol and phospholipids are the main ingredients.

Liposome Preparation Technique:

General Preparation Techniques

There are four fundamental steps in all liposome preparation techniques Dehydration of lipids using an organic solvent.Purifying the resulting liposome; dispersing the lipid in aqueous environments. examining the resultant work. (5)

B. Phytosome

Introduction

Flavonoids make up the majority of phytomedicines' bioactive components, although they have a low oral bioavailability. compounds from plants that are soluble in water .Phytonutrients (mostly polyphenoles) can be transformed into phytosomes, lipid-compatible molecular assemblies. Due to their improved ability to pass lipid-rich biomembranes and eventually reach the blood, phytosomes are more accessible than basic herbal extracts. The lipid phase components used to create phytoco.

The Benefits of Phytosome

1. The active component(sdose)'s requirement decreases as their rate of absorption rises.
2. In addition to serving as a carrier, the phosphatidylcholine used in the preparation of phytosomes also has hepatoprotective properties.

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Negative Aspects of Phytosome

Phytosomes' phytoconstituents are quickly removed. (7)

Phytosome Preparation Process

Making of a phytosome In order to create phytosomes, a precise amount of phospholipid, such as soy lecithin, is usually added to plant extracts in an aprotic solvent. Phosphatidylcholine, the primary component of soy lecithin, serves a dual purpose. The phosphoryl group is choline portion is hydrophilic in nature and lipophilic in nature. In contrast to the phosphatidyl component, which is a lipid-soluble substance, the choline component is coupled with hydrophilic chef active components. It causes lipid complexes to form that are more stable and bioavailable. A synthetic or natural phospholipid is combined with the standardised plant extract at a ratio ranging from 0.52.0 to create phytosomes in a different manner. However, a 1:1 ratio is typically preferred.By precipitating with a non-solvent, often an aliphatic hydrocarbon, by lyophilization, or by spraying, the new complex can be separated from the process. An aprotic solvent, such as dioxane, methylene chloride, or acetone drying, is used to carry out the reaction either alone or in the natural mixture. Sometimes the solubilization or complex formation is achieved by refluxing the stoichiometric ratio mixture in the aprotic solvent for a predetermined period of time. By using a thin layer rotary evaporator under vacuum, phytosome vesicles were produced. Phytosomal complex was incorporated250 ml round bottom flask with anhydrous ethanol in it. A rotary evaporator has the flask attached to it. At a temperature of roughly 60 °C, the solvent will evaporate, forming a thin layer coating around the flask.

The lipid layer will tear off the film in 7.4 pH phosphate buffer hydrates the filmphosphate buffer creating a suspension of vesicles. The phytosomal suspension was exposed to 60% amplitude probe sonication. Before being characterised, phytosomal suspension will be kept in the fridge for 24 hours. The reflux approach can be used to make phytosomes. In a 100 mL round bottom flask, phospholipid and polyphenolic extract were combined, and the mixture was refluxed in DCM for one hour at a temperature below 40°C. A precipitate was produced after adding 15 mL of n-hexane while evaporating the clear solution. A desiccator was used to store the precipitate. [10] Weight the phospholipid and cholesterol accurately, dissolve it in 10 mL of chloroform, and then sonicate the mixture using a bath sonicator for 10 minutes. Removal of organic solvents is possibledone by putting it through a rotary evaporator at 40°C while under reduced pressure. In a rotary evaporator, a thin layer is created after the solvent has been completely removed and is hydrated with the drug's polyphenolic extract. For heat dissipation, a phospholipids mixture was sonicated in an ice bath.An amber-colored bottle was used to keep the prepared phytosome.(8)

C. Niosome

Introduction

By hydrating a mixture of nonionic surfactants and cholesterol, niosomes, which are non-ionic surfactant vesicles, are produced. It can be utilised to transport drugs that are both amphiphilic and lipophilic. The drug is enclosed in a vesicle when it is delivered by niosomes. Niosomes are biocompatible and degradable they are flexible in their structural characterisation and immunogenic (9).

Benefits of Niosomes

1. Depending on the need, the vesicle's attributes, such as size and lamellarity, can be altered.
2. The vesicles may serve as a depot, allowing for a controlled release of the drug over time.
3. The noisome can be used for a variety of drugs because its structure allows room for hydrophilic, lipophilic, and amphiphilic drug moieties.
4. They are stable and osmotically active.

Negative Aspects of Niosome

1. Fusion
2. Aggregation
3. Entrapped drug leakage
4. Physical unrest

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Niosome Preparation Process

Method for Injecting Ether

The surfactant solution, dissolved in diethyl ether, is gradually added to warm water held at 60°C as the basis of the ether injection method. The surfactant mixture in ether is injected into the material's aqueous solution using a 14 gauge needle. Inhalation of ether causes the production of vesicles with only one layer. The diameter of the vesicle ranges from 50 to 1000 nm, and the particle size of the noisome generated depends on the parameters utilised.

Hand Shaking Method

In this procedure, a round-bottomed flask is used to dissolve cholesterol and surfactant in a volatile organic solvent (such as diethyl either, chloroform, or methanol). The solid mixture is left on the flask wall after the organic solvent is evaporated using a rotary evaporator at room temperature (20°C).Rehydrating the dried surfactant film with aqueous phase at a temperature of 060 °C while gently stirring will result in multilamellar noisome. (10)

D. Ethosome

Introduction

Recent developments in patch technology have resulted in the creation of ethosomal patches, which contain drugs inside of ethosomes. They have a great capacity for entrapping molecules of different lipophilicities and are capable of forming multilamellar vesicles. For a variety of small compounds, peptides, proteins, and vaccines, the elastic vesicles and transferosomes have also been employed as drug carriers. [2] Athomal areAlcoholic liposomes Ethosomal delivery systems allow medications to penetrate deeply into the epidermal layers and/or the bloodstream without causing any harm. These flexible, squishy vesicles are designed for improved active agent distribution. (11)

Benefit of Ethosome

1. The dose size of phytosome is necessary because it increases the absorption of active ingredients.
2. In Phytosome, phosphatidylcholine molecules form chemical bonds, making itshows a stable foundation.
3. Phytosome enhances the herbal phytoconstituents' percutaneous absorption.

Problems with Ethosome

1. The drug's molecular size should be appropriate for percutaneous absorption.
2. Not all types of skin will adhere to adhesive well.
3. Could be expensive.
4. A bad yield.
5. Skin rashes or dermatitis brought on by the enhancers and excipients in drug delivery systems.

The Preparatory Process

There are two extremely easy and practical ways to manufacture ethosomal:

1. Cold Technique

The most popular technique for creating ethosomal formulations is this one. This approach involves vigorously swirling with the use of a mixer to dissolve phospholipid, drug, and other lipid components in ethanol in a covered vessel at room temperature. Among the polyols is propylene glycolwhile being stirred in. In a water bath, this combination is heated to 300C. The mixture is then agitated for 5 minutes in a covered vessel while the water heated to 300C in a another pot is added to it. Using the sonication or extrusion process, the ethosomal formulation's vesicle size can be reduced to the desired extent. In the end, the formulation is kept chilled.

2. Hot Technique

By heating phospholipid in a water bath at 400C until a colloidal solution is formed, phospholipid is dispersed in water using this approach. Ethanol and propylene glycol are combined and heated to 400C in a different tank. The organic phase is introduced to the aqueous phase once both solutions have reached 400C. The medication dissolves depending

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on its hydrophilic/hydrophobic characteristics, in either water or ethanol. Using the probe sonication or extrusion approach, the vesicle size of the ethosomal formulation can be reduced to the desired extent. (12)

Announcing the use of Herbal Excipients

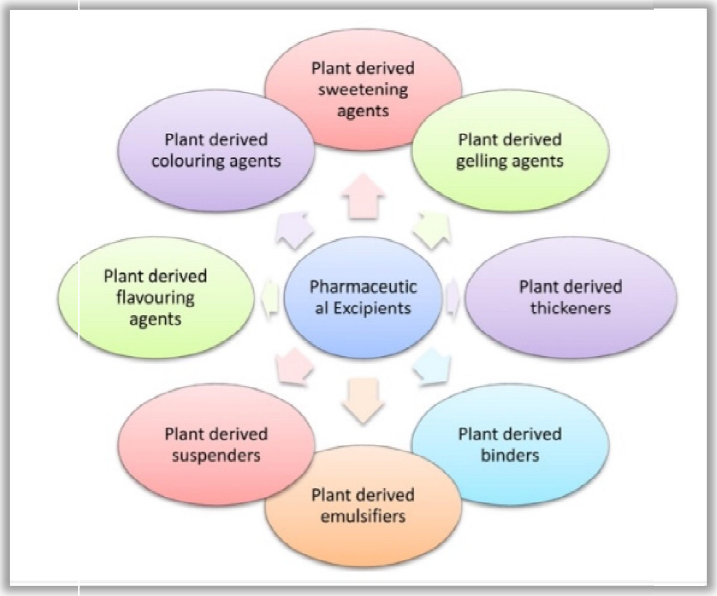
The term "excipients" refers to a material that is utilised to deliver an antibiotic. Natural polysaccharide polymers are specifically used in pharmaceutical formulations to assist in product identification, improve bioavailability or patient acceptability, protect, maintain, or enhance stability, or enhance any other aspect of the drug's overall safety, efficacy, or delivery during storage or use. A few examples of the plant-based pharmaceutical excipients used in the pharmaceutical industry as binding agents, disintegrants, sustaining agents, protective, colloids, thickening agents, gelling agents, bases in suppositories, stabilisers, and coating are starch, agar, alginates, carrageenan, guar gum, xanthan gum, gelatin, pectin, acacia, tragacanth, and cellulose. Plant resources can offer a consistent supply of raw materials because they are renewable and can be grown or harvested in a sustainable manner.Herbal extracts can be produced using waste from the food sector as the basic sourceexcipients. These are additional factors contributing to the rise in demand for herbal materials as excipients. Plant-based drugs do, however, also come with a number of potential drawbacks, such as the need to synthesis them in small amounts from structurally complicated mixes that can vary depending on the location of the plants as well as other factors like the time of year. As a result, the separation and purification process could be time-consuming and costly. The importance of intellectual property rights is another issue that has grown. Pharmaceutical formulations specifically utilise plant-derived polymers to create solid monolithic matrix systems, implants, films, beads, microparticles, nanoparticles, inhalable and injectable systems, as well as viscous liquidsthe formulas. Natural polymers became a focal point in the majority of pharmacological research studies because of their versatility in producing a variety of materials based on their characteristics and molecular weight. Excipients are typically utilised in conventional dosage forms like tablets and capsules as diluents, binders, disintegrates, adhesives, glidants, and sweeteners.

Pharmacological Ingredient

Nonactive components that are combined with therapeutically active compound(s) to create medications are known as pharmaceutical excipients. Ingredients that aren't active substances are referred to as excipients. Excipients impact how a medicine acts and how effective it is product with increasing capability and importance. Active ingredient, excipient, and process variability are clear contributors to product variability.

Assessment of Excipients

Herbs have been grouped into a number of categories based on their various functions as pharmacological aids, as seen in Fig.



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1. Plant Derived Thickeners

There are many different thickeners in nature or derivatives of natural thickeners. These components are polymers that expand and become viscous as they absorb water. Derivatives of polyose are frequently used in shampoos and body cleansers. Another example of a natural ally is gumproduced thickener Others choose gelatin, xanthan gum, and algarroba bean gum. In practical applications, plants and other gums are generally used to thicken or gel binary chemical systems and to control water. They will also serve as foam stabilisers, adhesives, and have other distinct features.

2. Plant-Derived Binders

Binders are the substances used to give the granules cohesion or adherenceIn addition to the flow characteristics by doing so, this guarantees that the tablet stays intact when crushedthe process of creating granules with specific hardness and size. It possesses compressional qualities since the genus Dioscorearotundata is used as a binder and disintegration in pill manufacture [12].

3. Plant-Derived Emulsifiers

Powdered henna leaves. Additionally used in baking to help the integration of fat into the dough and maintain the softness of the mixture. Gum Arabic, also known as gum acacia, is a dried, gluey fluid that can be extracted from a tree's stem and branchesconnected acacia species (Family Leguminous).

4. Plant-Derived Suspenders

High endurance condensed film that can withstand a droplet coalition. They keep water and oil stableemulsion by creating a stable, multimolecular, spherical film. Therefore, the liquefying barrier between the oil and water sections in every oil globe étards the coalition. Gum is the dried, glue-like exudate that Astragalus gummier and other Astragalus species produce. The gum accumulates in the pith and medullary rays when the stem sustains damage. Generally speaking, water absorption causes many gums to swell and leak through the wound. The majority of gums contain Ca, metal, and bassoric acid salts, sometimes known as bassoric. According to reports, the majority of them serve as suspending agents for insoluble powder.

5. Plant-Derived Gelling Agents

Numerous square measure gelling agents are available. The most popular ones include xanthan gum, tree, gum, and tragacanth. Certain gelling agents are more soluble in cold water than in warm water. In comparison to clay, methylcellulose and poloxamers are more soluble in cold water Gelatin and Na cellulose have higher solubilities in distress.

6. Plant-Derived Flavourer Agents

The majority of flavouring ingredients come from plants, usually in the form of flowers, leaves, stems, or bark. The components are often removed from the raw material to create an isolate that is only the flavour, which is then used in food products. Consequently, they are also referred as asBitter blockers or masking agents.

7. Plant-Derived Colouring Agents

There are more than 450 plants that can produce dye in India. Some of these plants not only have the ability to produce dye but also have medical benefit. Natural products have been used for medicinal purposes since the dawn of human civilization. For instance, mineral, The primary sources of medications were from plants and animals.

8. Plant-Derived Sweetening Agents

Stevia leaves contain a variety of very pleasant diterpene glycosides called steviol glycosides. Mogrosides are a collection of cucurbitane-type triterpenoid glycosides that are isolated from monk fruit. The chemical compound glycyrrhizin is an anoleanane-type triterpenoid produced from thecomponents of the Glycyrrhizin plant underground (15)

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Benefits of using Herbal Excipients

1. Biodegradable
2. Non-toxic and biocompatible
3. Economic
4. Risk-free and without side effects
5. Simple accessibility

Contradictions with Herbal Excipient

1. Microbiological contaminant
2. Variability
3. Slow Process
4. The presence of heavy metals (16)

The use of Herbal Excipients

1. Natural excipients are employed in a number of industries to express biologically active substances that have been constrained by synthetic components.
2. Natural excipients benefit from not being poisonous, being more affordable, and being widely accessible.
3. The functions of the excipients have a direct impact on the produced product's quality.
4. Chemicals known as excipients, which are internal in nature and aid active but do not have medical activity.

Use of a Cutting-Edge Drug Delivery Technology

1. Diabetes

Researchers are becoming more interested in Nano carriers in the treatment and management of diabetes mellitus due to the difficulties with pharmacological treatments and the advantages of nanoparticles (NPs) in drug administration and imaging (Rai et al., 2016). largely the makeup of medication delivery systeminclude liposome, NPs made of polymers, and inorganic NPs. Various polymer-based NPs, such as Nano spheres, Nano capsules, micelles, and dendrites, are among them and have been developed as appropriate drug carriers.Table 1 lists the documented in vivo effects of the many types of Nano carriers that are used to load insulin and other antidiabetic medications. These nano carriers have been found to have numerous potential benefits, including preventing medications from being degraded by enzymes, increasing their stability, breaking down various cellular barriers in vivo, A non-linear response to an external signal and the ability to simulate endogenous insulin delivery make them potential intelligent automated systems that could lower the risk of hypoglycemia and improve patient compliance. Additionally, they function well in administering medications more accurately over a lengthy period of time, which could reduce unfavourable side effects and increase therapeutic efficacy (Wang J. Q. et al., 2019).Otherwise, due to their distinct photo luminescent features, quantum dots and metal-oxide NPs are commonly used in imaging in medication administration, pH monitoring, and chemical analyzer analysis. The administration of antidiabetic medications also depends on the characteristics of polymer materials, mean particle size and polydispersity, surface electrical charge, and hydrophobicity of nanoparticles. Therefore, the development of adequate NP delivery systems is crucial for the successful management of diabetes.

2. Cardiovascular

Early, swift, and accurate action is essential for effective CVD prevention and treatment. In recent years, increasing focus has been made to the use of molecular imaging in the diagnosis of CVDs. New contrast agents are constantly being developed in addition to the various imaging modalitiesare essential for quick, sensitive, high-resolution, real-time diagnostics. The following benefits of nano-contrast agents over traditional contrast agents: As well as in vivo stabilisation, regulable distribution, and prolonging the half-life of contrast agents or pharmaceuticals, as well as controlled physical and chemical features (such as chemical composition, size), imaging performance, and benefits in personalized diagnosis and therapy are envisaged, and the ability to identify specific biomolecules (Attia etal., 2016). For use in magnetic resonance imaging (MRI), X-ray imaging, and other imaging techniques, By creating particular nano-probes with the peculiar chemical signal molecules of diseased tissues identified by pathological research, the

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contrast agent can be directed to the lesion region in the first stages of the disease. contrast-enhanced ultrasonography (US) imaging and fluorescence imaging (17,18)

II. CONCLUSION

A novel drug delivery system combines cutting-edge methodology with fresh dosage forms, making it superior to traditional dosage forms. Benefits of a novel drug delivery system include delivering the desired dose at the appropriate time and place, effectively using pricey pharmaceuticals, excipients, and lowering production costsbetter therapy, increased comfort, and higher living standards are all advantageous to patients.Targeted medication delivery and controlled drug delivery are two common types of new drug delivery systems. A new technology employed in the pharmaceutical industry is the novel Drug delivery systemsuch drug delivery targeting, gene therapy, vaccination therapy, and the commercialization of novel carriersDelivering a medication molecule to its intended target is a challenging endeavour given the intricate biological processes at play in an organism. Finally, targeted drug delivery is emerging as a superb sophisticated medical strategy for the identification and management of a few lethel 23 diseases. It is currently at its maximum point after crossing the infant stagesubstantial expansion in clinical and pharmaceutical research and development. Today, patient compliance is emphasised, and NDDS development is underway to help with this aim. Because herbal excipients are promising biodegradable, biocompatible chemicals, they can be chemically compatible with excipients in drug delivery systems. Herbal excipients also play a key role in the pharmaceutical industry and are less expensive, more widely accessible, and non-toxic than their synthetic counterparts. The natural excipients will therefore continue to garner interest in the future.

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