



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## REVIEW ON NOVEL DRUG DELIVERY SYSTEM

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### ➤ ABSTRACT

Plants area unit nature's remedies and are employed by masses on earth since precedent days for food and medication. These days there area unit international movements towards finding of seasoning medicaments in plants to bring them in market via an acceptable drug delivery system for grouping. The essential thought behind it's treatment of every unwellness is hidden in nature. However, delivery of seasoning medicine additionally needs modification with the aim to attain sustain unharness, to extend patient compliance etc. antecedently seasoning medicine couldn't attract scientists towards the modifications of novel drug delivery systems thanks to process, standardizing, extracting and identification difficulties. However currently days with the advancement within the technology, novel drug delivery systems (NDDS) open the door towards the event of seasoning novel drug delivery system. With use of advance techniques protection from toxicity, improvement in stability, improved bioavailability of seasoning formulations, protection from physical and chemical degradation is win. Novel drug delivery technologies have gained the importance to attain changed delivery of seasoning medicine their by increasing the therapeutic worth additionally as reducing toxicity. This reviews provides info relating to varied novel techniques used for rising safety and efficaciousness of phytomedicines and application of novel formulation.

- **Keywords:** New drug delivery system, Phytosome, Nanoparticles, Microsphere, transcutaneous Drug Delivery System.

## ➤ **INTRODUCTION [1,2,3,4]**

Herbal typeulation means that a indefinite quantity form consisting of 1 or additional herbs or processed herbs in such quantities to produce specific biological process, cosmetic advantages, and/or different advantages. Seasoning preparations area unit obtained by subjecting whole plant, fragmented or cut plants, plants elements to treatments like distillation, extraction, expression, fractionation, purification, concentration or fermentation. These embrace comminuted or pulverized seasoning substances, tinctures, extracts, essential oils, expressed juices and processed exudates [1]. Seasoning drug itself is complicated structure of the many active constituents; As all of them offer synergistic action and enhance the therapeutic worth [2]. Seasoning medicine have lesser aspect effects [3,4].

Herbal medicine have bound blessings over ancient medicines like lower risk of aspect effects,widespread handiness, low price and efficacious for: manner diseases for prolonged amount of your time [5]. Incorporating seasoning medicine into novel drug delivery systems not solely cut back the continual administration to beat rebelliousness, however additionally facilitate to extend the therapeutic worth by reducing toxicity and increasing the bioavailability. If the novel drug delivery technology is applied in seasoning medication, it should facilitate in increasing the efficaciousness and reducing the aspect effects of assorted seasoning compounds and herbs [6]. Novel drug delivery system could be a new approach to drug delivery. It helps the drug to act longer and additional effectively; management of the distribution of drug is achieved by incorporating the drug in carrier system or in dynamical the structure of the drug at molecular level.

### ➤ **Advantages of novel drug delivery system [7]**

1. Protection from physical and chemical degradation.
2. Sustained delivery.
3. Improved tissue macrophages distribution.
4. Enhancement of stability.
5. Enhancement of pharmacological activity.
6. Protection from toxicity.
6. Increased bioavailability
7. Enhancement of solubility [7].

### ➤ **Recent developments in novel drug delivery system of herbals [8]**

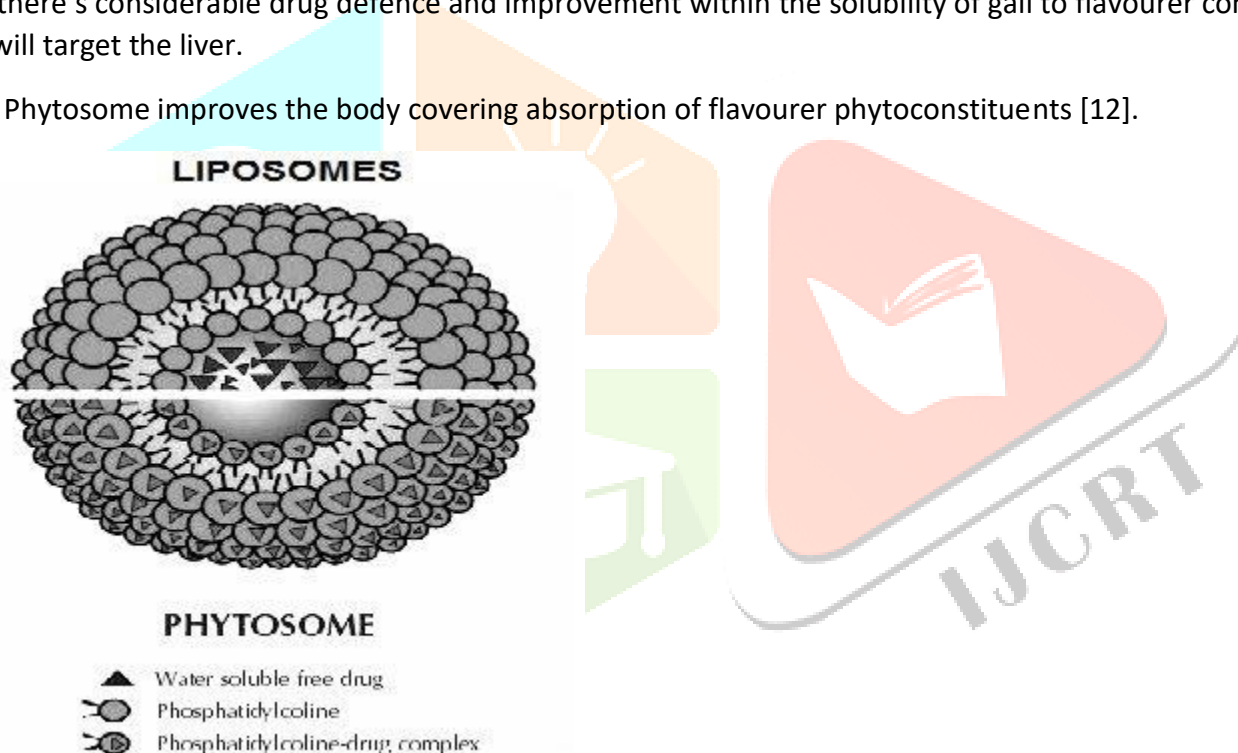
1. Phytosome
2. Liposome
3. Nanoparticles
4. Emulsions
5. Microsphere
6. Ethosome
7. Solid lipid nanopartical
8. Niosomes
9. Proniosomes
10. Transdermal Drug Delivery System
11. Dendrimers
12. . Liquid Crystals
13. Hydrogels [8]

## 1. Phytosome [9,10]

Phytosomes square measure macromolecule compatible molecular advanced that square measure composed of “phyto” which suggests plant and “some” which means cellular [9]. Complexing the polyphenolic phytoconstituents within the molar quantitative relation with phosphatidyl B complex leads to a brand new flavourer drug delivery system, referred to as “Phytosome”. Phytosomes square measure advanced sorts of flavourer product that square measure higher absorbed, used to provide higher results than those made by typical flavourer extracts. Phytosomes show higher pharmacokinetic and therapeutic profiles than typical flavourer extracts [10].

### ❖ Advantages of Phytosome [11,12]

1. Phytosome will increase the absorption of active constituents, thus its dose size needed is little.
2. In Phytosome, chemical bonds square measure shaped between phosphatidylcholine molecules, thus it shows smart stability [11].
3. there’s considerable drug defence and improvement within the solubility of gall to flavourer constituents, and it will target the liver.
4. Phytosome improves the body covering absorption of flavourer phytoconstituents [12].



## 2. Liposome [13]

Liposomes are coaxial bi-layered vesicles during which liquid volume is entirely fenced in by a membranous supermolecule bi-layer primarily composed of natural or artificial phospholipids. The liposomes are spherical particles that encapsulate the solvents that are freely floating within the interior [13].

### ❖ Advantages of Liposomes [14]

1. The high biocompatibility.
2. The easiness of preparation.
3. The chemical skillfulness that permits the loading of deliquescent, amphiphilic, and oleophilic compounds.

The easy modulation of their pharmacokinetic properties by ever-changing the chemical composition of the bilayer parts [14].

### **3.Nanoparticles [15,16]**

Nanotechnology is science of matter and material that traumatize the particle size in nanometers. The word "Nano" comes from Latin word, which suggests dwarf (1nm = 10<sup>-9</sup>m) Nanoparticles are outlined as particulate dispersions or solid particles with a size within the vary of 10- 1000nm. The drug is dissolved, entrapped, encapsulated or hooked up to a nanoparticle matrix [15]. Nanoparticles supply some specific blessings like they assist to extend the soundness of drugs/proteins and possess helpful controlled unleash properties. It are often changed to realize each active and passive targeting; drug loading is extremely high and may be administered by varied routes like epithelial duct, nasal, intra ocular and oral routes [16].

#### **❖ Advantages of flavorer nanoparticle delivery system [14]**

1. Nanoparticulate system delivers the flavorer formulation on to the positioning of action.
2. inflated effectuality and therapeutic index.
3. inflated stability via encapsulation.
4. Improved pharmacokinetic result.
5. Producibile with varied sizes, compound surface properties [14].

### **4. Emulsions [17,18]**

Emulsion could be a biphasic system within which one section is intimately disperse within the different innovate the shape of minute droplets in travel in diameter from zero.1µm to 100 µm. In emulsion, one section is usually water or liquid section, and therefore the different section is oily liquid, i.e. non liquid. Among them, the microemulsion is additionally known as nanoemulsion, and therefore the sub-micro-emulsion is termed liquid emulsion [17]. Microemulsion clear, thermodynamically stable, oft together with a co-surfactant [18].

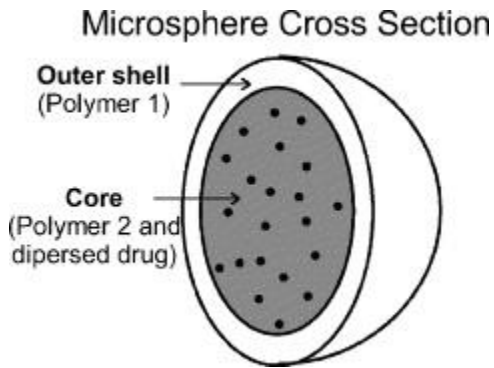
#### **❖ Advantages of emulsion-based formulations [19]**

1. It will unleash the drug for an extended time as a result of it's packed within the inner section and makes direct.
2. Contact with the body and different tissues.
3. As a results of the lipotropic medicine being created into o / w / o emulsion, the droplets of oil are phagocytosised by macrophages and increase its concentration in liver, spleen and urinary organ.
4. because the emulsion contains seasoner formulation, it'll increase the soundness of hydrolyzed developed material and improve the permeableness of drug into skin and mucose.
5. The new kind, viz., Elemenum emulsion, is employed as associate anti-cancer drug and causes no hurt to the center and liver [19].

### **5.Microsphere [20]**

Microsphere includes of little spherical particles, with diameters within the micrometer vary, generally 1 µm to 1000 µm (1 mm). Microspheres are typically remarked as micro-particles. Microspheres may be factory-made from varied natural and artificial materials. Glass microspheres, chemical compound microspheres and ceramic microspheres are commercially accessible. Microspheres are classified as perishable or non-biodegradable. Perishable microspheres embody albumen microspheres, changed starch microspheres, gelatin microspheres, polypropene dextran microspheres, polylactic acid microspheres, etc. in line with the present literature reports on non-biodegradable microspheres, polylactic acid is that the solely chemical compound approved to be

employed by individuals, and it's used as a controlled-release agent. Solid and hollow microspheres vary wide in density and thus are used for various applications [20].



### ❖ Advantage of microsphere formulation

1. It will defend the particular perform of medication, and might unharness the medication into Associate in Nursing outer part for an extended amount.
2. Drug may be simply discharged from the formulaperio
3. Administration of medication via micro-particulate system is advantageous as a result of microspheres may be eaten or injected, and that they may be tailored for desired unharness profiles and used for site-specific delivery of medication and in some cases will even give organtargeted unharness.

### 6. Ethosomes [21]

This are developed by mixture of phospholipids and high concentration of grain alcohol. This carrier will penetrate through the skin deeply result in improve drug delivery into deeper layer of skin and in blood circulation. These formulations are helpful for topical delivery of alkaloids in sort of gel and cream for patients comfort. They show increase in their porousness through the skin by fluidizing the lipide domain of the skin. Unstable nature and poor skin penetration are limits for Ethosomes tropical delivery. The Ethosomes was developed and examined for his or her ability the topical absorption of Tetrandrine through dermal delivery, additionally the} relation of formulations to the pharmacologic activity of Tetrandrine loaded within the formulation was also accessed. Results of the drug levels in rat plasma showed that once Tetrandrineloded Ethosomes were locally administered in rats the drug level was low to be detected in rat plasma. By providing fewer delivery of Tetrandrine into blood, topical administration would possibly supply favorable efficaciousness withreduced aspect effects, therefore resulting in improve patient's compliances. Finally, Ethosomes were incontestible to be promising carrier for rising topical delivery of Tentrandrine via skin [21]



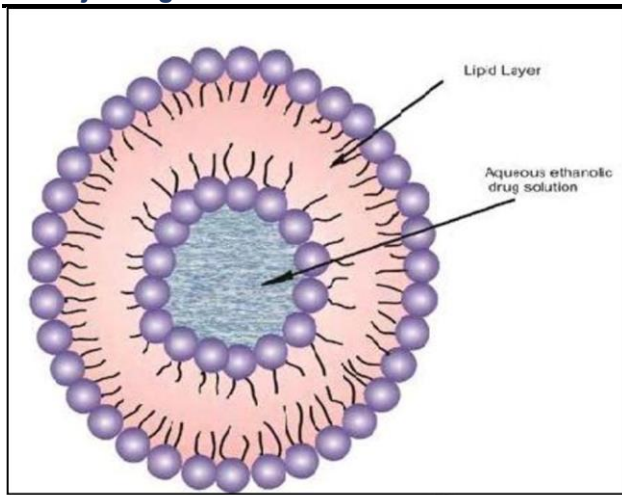


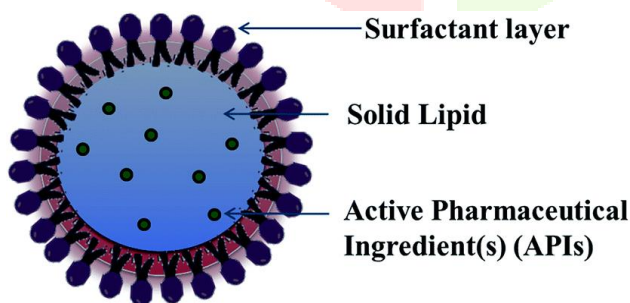
Figure 1: Structure of Ethosome

### ❖ Advantages of ethosomal drug delivery [22]

1. Ethosomes enhance transcutaneous permeation of drug through skin.
2. Ethosomes are a platform for the delivery of enormous amounts of various teams of medication.
3. Ethosomal drug is run in solid type leading to improvement in patients compliance [22].

### 7. Solid lipid Nanoparticles (SLN) [23,24]

It is a method developed within the 990s. it's a mixture carrier used particularly for the delivery of oleophilic compounds. The common mean size of solid lipid nanoparticles ranges from 50 nm to 1000 nm. Solid lipid nanoparticles are composed of lipid matrix, that becomes solid at temperature and conjointly at the blood heat [23]. The most options of solid lipid nanoparticles (SLNs) with relevancy epithelial duct application are the wonderful physical stability, protection of incorporated labile medicine from degradation. To cross bloodbrain barrier, it ought to be created for choice of lipids and surfactants. The SLNs are ready by totally different strategies like blending and therefore the heat micro-emulsion high-speed stirring ultrasonication and solvent-diffusion methodology. Lipids show compatibility with oleophilic medicine and increase the denial potency and drug-loading into the SLN [24].



SolidLipid Nanoparticles dig.

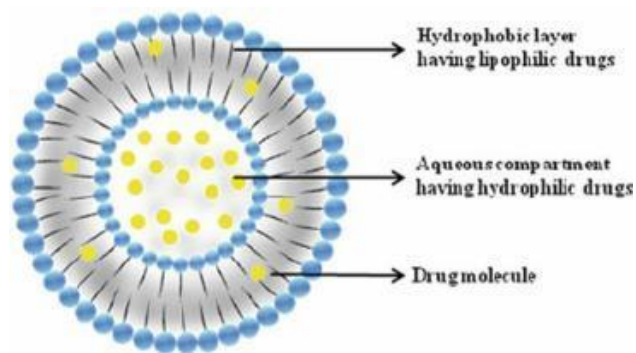
### ❖ Advantages of SLN flavorer formulation

1. It provides controlled unharms and site-specific drug targeting.
2. Large-scale production is done.
3. In this formulation, each oleophilic and deliquescent medicine is loaded.

4. Another advantage is that it's manufactured from lipid matrix (physiological lipids), that decreases danger of chronic and acute toxicity.

### **8. Niosomes [25]**

Niosomes are multilamellar vesicles fashioned from non-ionic surfactants of the alkyl radical or dialkyl polyglycerol ether category and sterol. Earlier studies, in association with L'Oreal have shown that, in general, niosomes have properties as potential drug carriers like liposomes. Niosomes are totally different from liposomes therein they provide sure benefits over liposomes [25].



**Niosomes dig.**

#### **❖ Advantages of Niosomes [26]**

1. Controlled and targeted drug delivery
2. Stable and osmotically active
3. Increased dermal penetration and oral bioavailability
4. Niosomes are nonimmunogenic, nontoxic, biocompatible, and perishable
5. Used for epithelial duct and oral furthermore as topical routes
6. No special conditions needed for handling and storage of surfactants
7. Improved drug performance of drug
8. Niosome ester base, therefore having nice patent compliance over oily dose forms [26].

### **9. Proniosomes [17]**

Proniosomes gel system is success to niosome, which may be utilised for numerous applications in delivery of actives at want web site. Proniosomal gels are the formulations, that on in place association with water from the skin are reborn into niosomes [17].

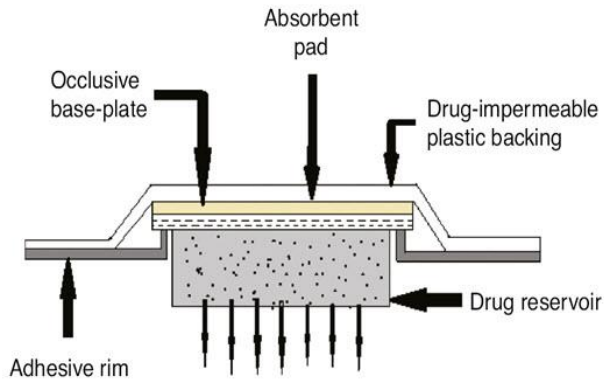
#### **❖ Advantages of Proniosomes**

1. additional stable throughout storage and sterilization.
2. straightforward to transfer and distribution

### **10. Transdermal Drug Delivery System [27]**

Transdermal drug delivery system has been Associate in Nursing accumulated interest within the drug administration via the skin for each native therapeutic effects on unhealthy skin (topical delivery) still as for general delivery of medication. However Brobdingnagian potential lies in transcutaneous drug as future sensible

drug delivery devices [27]. These square measure the devices during which drug gift within the formulation permeates into the circulation by diffusion to stratum and more to the established organ. These devices use chemical compound matrix, patch and permeation enhancers.



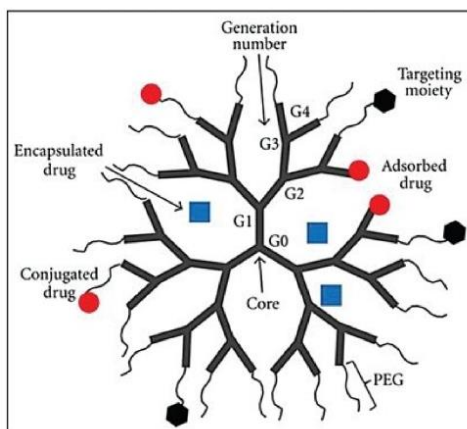
**Transdermal Drug Delivery System dig.**

### ❖ Advantages of transcutaneous Drug Delivery System [28]

1. Limitations of 1<sup>st</sup> pass metabolism, accumulated therapeutic result, and maintenance of steady state concentration within the liquid body substance [28].
2. Controlled drug delivery, increased bioavailability, reduction in side effects and simple application.
3. Transdermal delivery of medicinal drugs square measure to extend the penetration and sustained action. e.g. transdermal films containing boswellic acid (*Boswellia serrata*) and curcumin (*Curcuma longa*) were developed for the treatment of inflammation (synergistic effect).

### 11. Dendrimers [28]

Dendrimers square measure nanometer-sized, extremely branched and monodisperse macromolecules with symmetrical design whereas their stability and protection from the mononucleate scavenger cell system (MPS) is being achieved by functionalization of the dendrimers with synthetic resin glycol chains (PEG) [28].



**Dendrimer in Drug Delivery System dig .**

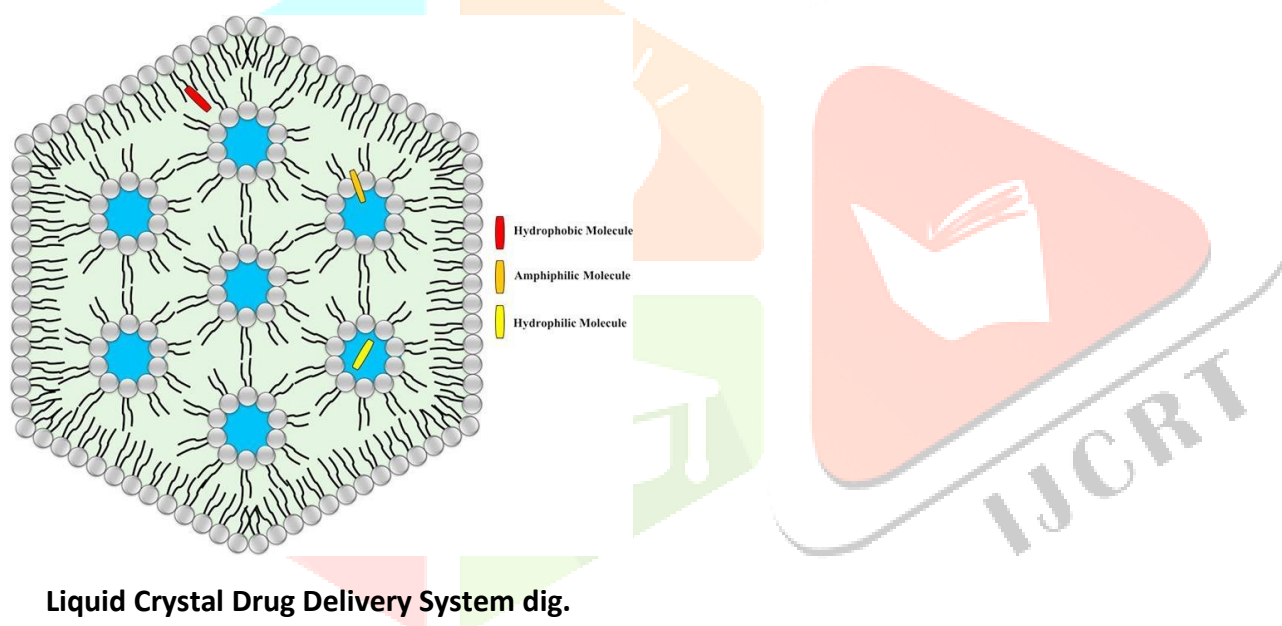


### ❖ Advantages of Dendrimer [32]

1. Divergent
2. Production of huge quantities
3. Achieve massive molecular dendrimers
4. Convergent
5. Easy to purify desired product
6. Occurrence of defects is decreased
7. Possible to introduce delicate engineering [32].

### 12. Liquid Crystals [30]

Liquid Crystals mix the properties of each liquid and solid states. They'll be created to form completely different geometries, with different polar and non-polar layers (ie., a lamellar phase) wherever binary compound drug solutions will be enclosed [30].

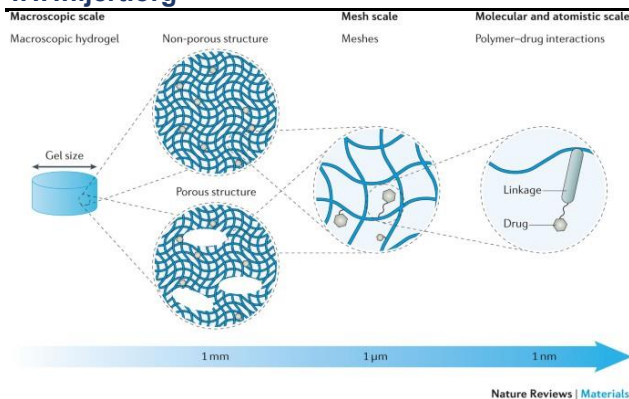


### ❖ Advantages of liquid Crystal [33]

1. Liquid crystals square measure thermodynamically stable and possess long period.
2. Liquid crystals show bio adhesive properties and sustained unharness effects[33].

### 13. Hydrogels [31]

Hydrogels square measure three-dimensional, deliquescent, compound networks capable of uptake massive amounts of water or biological fluids. They're accustomed regulate drug unharness in reservoir-based, controlled unharness systems or as carriers in swellable and swelling-controlled unharness devices [31].



## Hydrogel Drug Delivery System dig.

### ❖ Advantages of Hydrogels [34]

1. Hydrogels possess a degree of flexibility terribly like natural tissue, thanks to their vital water content
2. Entrapment of microbic cells inside colloidal gel beads has the advantage of low toxicity
3. Environmentally sensitive Hydrogels have the power to sense changes of pH. Temperature, or the concentration of matter and unharness their load as results of such a modification
4. Timed unharness of growth factors and alternative nutrients to make sure correct tissue growth
5. Hydrogels have smart transport properties
6. Hydrogels square measure Biocompatible
7. Hydrogels will be injected
8. Hydrogels square measure simple to modify[34].

### ➤ Applications of NDDS [35]

1. NDDSlude enhancement of solubility
2. Bioavailability
3. Protection against totoxicit
4. Enhancement of pharmacological activity and stability
5. Improve tissue macrophage distribution
6. Protection against chemical degradati

### ➤ CONCLUSION

Novel drug delivery system not only reduces the perennial administration to beat non compliance, however additionally helps to extend the therapeutic price by reducing toxicity and increasing the bioavailability, and so on. Intensive analysis goes on for flavouring medicine to include them in novel drug delivery systems. Application of those novel techniques to natural medicines can led to increased bioavailability, reduced toxicity, sustained unleash action, protection from GI degradation that can not be obtained through standard drug delivery system because of giant molecular size, poor solubility, degradation of herbal medicines in gastrointestinal media.

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