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A REVIEW ON BIOPOLYMERS AS A NOVEL BIO-EXCIPIENTS IN DRUG DELIVERY SYSTEM

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In present time biopolymer has attracted and concentrated on its use for novel drug delivery and utilization of drug. A number of biopolymers have been isolated by Satheesh Madhav for drug delivery system and most of them are used frequently in various drug delivery systems. In current practices the vast number of plant-based excipients is used in the Pharmaceutical field. Because biopolymer have number of advantages over the synthetic polymer like biocompatible, biodegradable in nature, nontoxic, less side effect and low cost etc. Bio polymers have been successfully investigated and employed in the different types of formulation like solid, liquid, and semisolid dosage forms and are specifically useful in the design of novel drug delivery systems. At present era a number of plant based pharmaceutical excipients are available. Many researchers have explored the usefulness of plant-based materials and meet the requirements of drug delivery systems, thus compete with the synthetic excipients available in the market. A number of biopolymers like Biopolymer from extract of Ocimum basilicum, Sesamum indicum seeds, Psidium gaujava Sodium salt of Musa paradisiaca biopolymer, Cocos nucifera, Bombax malabaricum, kernels of Helianthus annus, fruit pulp of Cordia dichotoma, Mangifera indica, Lotus corniculatus, Cajanus indicus, Logelaria siceraria, Arahcis hypogea seeds ,Lallimantia royalena seeds, Annona squamosa fruit pulp, Gravia oppositifolia, Cucurbita maxima fruit pulp, Psidium guajava, Artocarpus heterophyllus are under identification and isolation. The use of these biopolymers has proved a promising and tremendous use in drug delivery due to its novelistic characteristics and minimised side effectes. These may be used in ear to brain drug targeting for treatment of different brain diseases. **Madhav et.al., (2013) reported** the novelistic method for formulating resealed erythrocytes loaded with Repaglinide bionanoparticles. The biopolymer was separated from Citrus sinensis and it was characterized for its physicochemical properties. This invention was also discloses a method for preparing nanoparticles along with resealing of it into goat blood. The formulation showed promising prolongability for 56 hrs apart from this it also showed promising emulsifying ability, retardability and film forming ability which was confirmed by suitable formulations. Conclusion was drawn that this is a novelistic approach significantly delivering the drug for prolonged period and the biopolymer was served as a promising excipient for delivering dosage forms.[9] **Madhav & Priyanka et.al.,(2013) reported** the novelistic method for isolating the bio-polymer from vigna unguiculata by simplified economical process using anti solvent addition method and it is subjected for various physico chemical properties , spectral analysis like NMR, IR ,MASS and morphological studies like SEM and XRD in order to determined its polymeric nature and chemical nature. The novel bio polymer also possesses in built properties like emulsifiability, filmability and retardability which was confirmed by suitably formulating different dosage forms using nimuslide, Zidovudine as a model drug. The conclusion was drawn that this novelistic approach can be adapted for formulating various drug loaded SNEDDS and where as the bio polymer can be used as bio excipient for formulating various drug delivery system.[10]

Madhav et.al., (2013) reported a novel biopolymer from fried seeds of Amaranthus Spinosus. The biopolymer was isolated by simplified economical process using dimethyl ketone as a non solvent. The biopolymer contains a alkane group, alcohlic group and alkenes as a functional group. It also discloses a novel method for preparing biofilm loaded with This biopolymer also possess enhanced property like bioretardent, emulsifying and filmability which confirmed by suitable formulated drug delivery system. So biopolymer can be served as a bioexipient for formulating various drug loaded dosage forms.[11] **Madhav et.al., (2013) reported** This invention explores a novelistic composition for formulating Montelukast bio-microcapsules using a novel biomaterial which was isolated from fruit pulp of Opuntia aciculata. Biopolymer comprises of prominent mucoadhesive groups (Alcohols, Ethers, Ketones, Alkanes) which was confirmed by IR

spectra. Microcapsules were formulated by using biomaterial as a wall material cum retardant and the co-processing agent by solvent evaporation method. The formulated microcapsules showed promising in-vitro and in-vivo drug release for a prolonged time of 24hrs with good mucoadhesivity. The bio-polymer was screened for other in-built properties like emusifiability, filmability and bio-retardability which were confirmed by suitably formulating drug loaded formulations emulsion, films, microcapulse, nanoparticles and sustained release tablets. The conclusion was drawn that the novel microcapsules showed prolonged drug release and isolated biopolymer displayed in-built properties.[12] **Madhav et.al., (2013) reported** This current invention explores a novalistic method for isolating biopolymer from the dry fruit of Pistachio vera. This biomaterial comprises alkane, alkene, ester and aromatic functional groups which were confirmed by IR spectra. It is devoid of toxicity which was confirmed by acute toxicity study. This invention also explores a method of preparing a novel bio nanosuspension loaded with Moxifloxacin and biomaterial as a retardant cum stabilizer. This study revealed that biomaterial showed its inbuilt retardability and stability propreties apart from that it also possess novel in-built properties like emulsifiability, suspendibility, filmability and retardability which was confirmed by suitably formulating drug loaded dosage forms. The conclusion was drawn that bio-material; possess potent inbuilt properties and it can serve as a bio-excipient for formulating various dosage forms.[13] **Madhav et.al., (2013) reported** the method for isolating the biopolymer from fruit pulp of Ficus carica by non-solvent addition method. The biopolymeric material comprises of alkane, alcohol and ether functional groups. It displayed inbuilt properties like emulsifiability, suspensibility, filmability and retardability which were confirmed by suitably formulating drug loaded delivery system. This invention also discloses formulating the bio-microemulsion for ocular drug delivery loaded with Acetazolamide. So biopolymer possesses an inbuilt novelistic properties and it can serve as bio-excipient for delivering various dosage form.[14] **Madhav et.al., (2013) reported** In recent years, biodegradable polymer materials (known as biocomposites) have gained particular interest specially in Pharma field. Bio-polymers are continually being employed in an expanding range of areas. As a result, many researchers are keen to modify natural materials to make them more user-friendly, and into designing novel polymer composites out of naturally occurring materials. It is suggested that biodegradable polymer materials will reduce the need for synthetic polymer production at a low cost, thereby producing a positive effect both environmentally and economically. We current expose a method for formulating bioniosomes using a biosurfactant which was isolated from santalum album wood. The biopolymer revealed its inbuilt functional groups containing NH2, CH2-, CH3-, CN- and CH2-CH=0 as a functional groups. The niosomes were formulated by modified thin film hydration andsonication method. Conclusion was drawn that bioniosomes can be used for effectively targeting the drug to the hair follicles and niosomes can be prepared by a novel bio-excipient from santalum album and the biopolymer can also serve as a bio-excipient for formulating various drug delivery dosage forms. This present paper is intended to provide a novel method for extraction of the biomaterial from natural source & employ it for various pharmaceutical purpose.[15] **Madhav et.al.,(2013) reported** This invention discloses the method for formulating Emtricitabine Solid lipid Nanoparticles by using bio retardant which was isolated from Mangifera Indica seeds. The isolated bio retardant is devoid of toxicity. Emtricitabine Solid Lipid nanoparticles were formulated by using bio retardant, PVA, Chloroform and other co processing agents by hot melt solvent evaporation method. The formulation showed nanosizing in the range of 442 to 500 nm with a promising stability and prolonged ability for a period of 24 hrs. The isolated bio retardant also possess a novelistic inbuilt retardability, Emulsifiability and Filmability which was confirmed by formulating suitable doses forms using the bio retardant and other co processing agents. Conclusion was drawn that the bio retardant can serve as a promising excipient for formulating controlled or prolonged drug delivery system.[16]

Deepika Raina et.al. 2016 told about nanoparticles (NPs) and that could be an exciting prospect for transnasal drug delivery as they have higher surface area to cover highly vascularised nasal absorptive area providing a greater concentration gradient. NPs are used as a sustained drug delivery system. NPs , interacts with mucus to prolong the residence time of drug carrier at the drug absorption sites and protected the entrapped drug from enzymatic degradation until they are absorbed. Therefore, the bioavailability of drug is improved. Our research work aimed to formulate bio-nano particles loaded with chlorpromazine using a novel bio-retardant from Prunus amygdalus. The bio- polymer was isolated by novel method by addition of non aqueous solvent. Five formulations were prepared using Chlorpromazine, and Prunus amygdalus as bio-polymer, and five from the synthetic polymer Pullulan gum varying concentration of bio-polymer and synthetic polymer. The nano-particles were prepared by solvent evaporation method and were evaluated for drug content entrapment efficacy in-vitro drug release in-vivo studies and stability studies. On the basis of in-vitro drug release in-vivo, pharmacokinetic data and muco adhesivity FA8(1:15) displayed the best results whose R^2 value was 0.9179 and Fickian Diffusion as mechanism of release hence selected as the best formulation depicted by bits software. Delivery of API molecule to the brain for the management of depressive disorder is significant, minimizes the ADR and side effects of therapeutic molecule and offer good patient compliance through this novelistic approach.

Nanogels may be defined as Nano-sized hydrogel systems which are highly cross linked systems in nature involving polymer systems which are either co-polymerized or monomers.[2] Sudden outbreak in the field of nanotechnology have introduced the need for developing nanogel systems which proven their potential to deliver drugs in controlled, sustained and targetable manner. With the emerging field of polymer sciences it has now become inevitable to prepare smart Nano-systems which can prove effective for treatment as well as clinical trials progress.[3] Traditionally in the name of gels we have heard of semisolid formulations with three dimensional network of organic systems encompassing fluids and drugs. Prospects of targeted drug delivery perhaps could not been established with these preparations.[4] The significance of Nano-sized micro gel and hydrogel has arisen due to specific delivery system anticipation. Wide variety of polymer systems and the easy alteration of their physico-chemical characteristics has given advantage for versatile form of nanogel formulations. Nanogels have revolutionized the field of gene therapy, since delivery of gene has now become possible within cellular organelles for gene silencing therapy systems.[6] Nanogels are typical formulations mainly of the size range of 100 nm, by varying solvent quality and branching the volume fraction can be altered variably to maintain a three dimensional structure.[7] Finally a smart conclusion was drawn out the isolated biopolymers showed its in-built ability to enhance the pharmalogical action, reducing the side effects and reduction of the dosing frequency of Aripiprazole. They can serve as a novel bio-retardant for the formulation of drug loaded sustained release nanoparticles for trans-cranial delivery through the layers of skin, meninges, trigeminal nerves, emissary veins, cranial bones and sutures. The isolated biopolymers were found to be safe, biodegradable, have good spreadibility and retardability. The researcher those working in this trans-cranial drug delivery can exploit further this route by formulating bio-nanogels, emulsions, multiple emulsions, Emulgel.[8]

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