An analysis on the application of Herbal Nanotechnology in treating Cancer cell

[1]Dr Sumanta Bhattacharya Research Scholar at MAKAUT , Public–Foreign-Defence Policy Analyst , C.E , CH.E , CCIO ,M.Tech , MA in Development Studies, LLB , DIA&D , DG&GS ,PGCPP&A , MPI(oxford University) ORCID ID : 0000-0003-2563-2787

[2]Rituparna Mazumder B.Pharm, M.Pharma(pursuing), Bengal School of Technology

[3]Dr. Swarupananda Mukherjee, Assistant professor, department of pharmaceutics NSHM Knowledge campus , Kolkata , West Bengal

[4]Dr Sparsha Moni Chatterjee Ex Vice Chancellor of IIST shipbur , Member of Executive Council AICTE ,Former Director of Technical Education, Chairman of BOAA,IIHT , Ministry of Textile (Govt of India).Member of Development commission (Govt of India).

Abstract

With the application of nanomedicine for herbal medicines, it can be developed into nano herbal meditation with high bioavailability characteristics and provide a pathway of new research in herbal drug delivery mechanisms. But the major challenge was its low absorption because of the cell's lipid membrane, high molecular size resulting in loss of bioavailability and efficiency. Nanotechnology proactively is able to extract the ingredients of the herbal medicinal plants reducing their side effects and improving their activities. The motive of the research is to comprehensively explore the understanding regarding herbal nanotechnology and analyze the potential advantages of herbal nanotechnology in retardation of cancer cells. For this perspective the paper selects a secondary methodology which exclusively analyses the 33 studies and tries to determine the research objective and the paper also emphasises on the future perspective of herbal nanotechnology.

Keywords- nanotechnology, nanoparticles, nanocarriers for cancer treatment, herbal nanotechnology.

Introduction

Nanotechnology

Nano is a Greek terminology which means dwarf and application of dwarf size particles on engineering and constructing at micro or molecular level called nanotechnology.

Nanotechnology is the element of matter consisting of material less than 100 nanometer(nm) to construct the materials with elementary novel characteristics and functioning[1]. Nanotechnology consists of two processes.

a. Top-up approach
b. Bottom-up approach

In the top-up process the large sized components are subdue into nanoscale material, without affecting the original characteristic, that is miniaturizing of the electronics composed from large structure. While, in the Bottom-up process which is also termed as molecular nanotechnology or molecular manufacturing in which elements are composed from collaboration of multiple atoms[2]. However the most advanced technology is based on the top-down methodology, molecular nanotechnology encompasses immense potential and promising for breakthroughs in material and manufacturing, medical science and wellness, agriculture, biotechnology, information technology, safety and security[3].

Nanotechnology and medicine

Nanotechnology at a molecular level has a multidisciplinary scientific potential that demonstrates exclusive and dynamic promise capacity to introduce revolutionary advantages in the medical sector through means of medicine, packaging of medicine, genome and robotics. On the surface miniaturization provides cost-effective most frequent functioning mechanisms based on mechanical, chemical, and biological determinants[4].

Nanomedicine depends on several overlapping molecular technologies which are themselves subsumed with evolutionary, progressive and developing fields comprising[5]:

- For the manufacturing of nanosized structures for diagnostic, monitoring, detection, biosensing, drug sensing and drug delivery mechanisms.
- For expanding and boosting the revolution in genomics, gene delivery, proteomics and nano engineering microbes.
- For manufacturing of molecular mechanisms for medical robots that hold the capability to determine and eliminate host pathogens, replacing cell or cellular compounds in vivo.

Application of nanotechnology in Medical sector

1. Influence of nanotechnology on herbal drugs: A Review

Herbal components had the dynamic potential to cure and provide the remedy to abandon ingredients that concurrently strive against the illness or pathogen. The consolidation of the herbal extract into nanotechnology provides evolutionary improvements such as volume dosing. More concise consumption can create significant challenges being faced by the existing pharmaceutical corporation of the Medical industry. However, plenty of organic-forming drugs exhibit inexplicable characteristics, driving to low bioavailability and intensifying systemic withdrawal, claiming reformed management of large doses, delivering the drug a hope for curative service [6]. Nanoparticles like nanoemulsion, solid lipid nanoparticles have enormous benefits for herbal medicines encompassing advancement of solubility and bioavailability restriction from toxicity, enhance pharmacological responses, foster stability encouraging sustainable delivery and security provided from physical and chemical degradation. Therefore, nanosized medication offering practices of herbal remedies encourage the future to stimulate the action and resolve the challenges correlated with the medicinal herbs [7].

Utilization of nanotechnology for herbal Medicines

The use of nanotechnology for phytotherapy or curing numerous disorders by herbal drugs, which consist of herbal drug delivery based on advanced nanotechnology, can be enumerated as a noble technology of the therapeutic industry. The nanoparticles intensify the Pharmacokinetics Therapeutic Index of a plant origin drug and make it more reliable and convenient to use. Nanotechnology is implemented to inject and activate the gene delivery mechanism into plant cell walls[8]. Additional pharmaceutical science is enormously implementing nanoparticles in order to subdue toxicity and eliminate the side effects of drugs. The utility of nanotechnology for plant research is to be implemented in phytotherapy. The mesoporous nanoparticles formulate the gene and activate it in a precise and manageable manager without affecting and toxic and introducing any side effects[9]. The chemical manner in which a blend of nanoparticles produces better chemotherapeutic ingredients demonstrates the potential impact on microbial disorders. With the utilisation of advanced nanoparticle techniques, it is assumed to address the high demand for treating the most challenging concern of allopathy, for example, artemisinin for malaria and cancer chemotherapy[10]. Using the advanced technology herbal medicine compound was capable

of quickly injecting in Cancer cells without destroying or damaging the healthy cell of a human body. It also impacts drug delivery mechanisms such as camptothecin, an anticancer agent that has intensified the drug significantly because of progression in nanosized dosage form of camptothecin-derived medicine [11]. DNA topoisomerase is one of the drugs that have the capability to provide its medicinal treatment of cancer.

Nanotechnology and Cancer

Benefits of Nanotechnology for Cancer

The use of the nanoscale substance for the medication of melanoma confirms its functionality and dynamic activity[12], which is ready to perform effortlessly and conveniently as it is cautiously to address and serve as the curative symptomatic, acquired at the appropriate neoplasm segment, to target particular microorganisms of malignancy actively, abandon physiological limitations in the material like dense stromal membranes of the pancreas of the blood-brain fence, and central nervous system [13].

- An appropriate carcinoma medication transmission tool proves the potential and promising approach to accomplish high accommodation in neoplasm and forbear the encompassing healthy membranes. The scientist is utilising the EPR effect for passive tumour-targeting drug delivery for solid tumour treatment.
- Enhanced permeability and retention (EPR) have the aptitude to stimulate targeting of carcinoma cells by appropriating Nanomedicine accumulation which strengthens their proposed cell uptake during receptor-mediated endocytosis.
- Nano-Drug delivery mechanisms work on the principal impeded membrane wall before the medication arrives at the cancer position. Tissue barrier for active conveying of nanomedicine to carcinoma locality holding neoplasm stroma and neoplasm endothelium bars.

Carcinoma Nanotechnology: Implementation of nanotechnology in Carcinoma Treatment

Nanotechnology agents used in malignancy treatment, such as liposomes, consist of lipids fabrication implemented as a nanocarrier for melanoma medication. Nanocantilevers are array-like formations that support in identifying the terminal protein available in specific types of tumours[14]. Quantum dots are fluorescent nanocrystals prominently employed for malignancy medicine. Nanotechnology-based excellent carcinoma treatment consists of[15]

- Nanotechnology-related gene medication procedure
- Nanotechnology origented photodynamic treatment

- Nanotechnology-based radiotherapy and radiofrequency treatment
- Nanotechnology-based carcinoma theranostics

The challenges of nanotechnology in cancer therapy[16]

- Exhibiting a proposition for the Vivo disclosure and monitoring of cancer signs.
- Refining technology principles for immediate exposure of carcinoma biomarkers ex-vivo.
- Raising the targeting competence of curative or imaging factors to melanoma injuries and the microenvironment.
- Manufacturing of the nanoparticles to evade organic and biophysical determinants.

Review of Literatures

The paper comprehensively analyzes the correlation between the nanoparticle and organic methodology of cancer treatment as synthesization of new technology and bioactivity demonstrate the promising potential to resolve the existing challenges and transform the component into a more advanced form of organic element[16]. The elements separated from the herbal and polyaromatic plant are in enormous need, specifically in the medicinal industry[17]. Having some concerning and limitations features of phytomolecules that restrict the meditation to appropriate use, but with nanotechnology, this limitation can be effectively eliminated, such as low assimilation, high cytotoxicity, bioavailability and deficiency, and other related adverse impact[18]. The use of nanoparticles mechanism for the bioavailability improvement of herbal drugs was highlighted in this research. With the application of nanomedicine for herbal medicines, it can be developed into nano herbal meditation with high bioavailability characteristics and provide a pathway of new research in herbal drug delivery mechanisms. Herbal phytochemicals like nano curcumin, nanopipette, nanobernerine act as a breakthrough that can be analyzed from the examination of the minimization[19]. Nanotechnology implements several nanodesign to carry anti-carcinoma agents to the particular position where the cancer activity takes place. The stability of nano phytosomes is due to the emergence of chemical correlation among phospholipid elements and phytoactive factor [20]. The paper summarises the latest estimation relevant for the promising utility of phytosome complexes for tumour medication. Result demonstrated that phytosome perceives and cutting-edge technology to actively deliver phytomolecules actively to the target site of action and enhance the formulation technique and transportation mechanism through phytosome[21].

The progression of phytochemicals and phytopharmacological science has enabled elucidation of several medicinal plant products' composition and biological activities. The effectiveness of several subspecies of herbal herbs based on the provision of active components. But the major challenge was its low absorption because of the cell's lipid membrane, high molecular size consequencing in deficiency of bioavailability and efficiency[22]. Nanotechnology proactively is able to educe the ingredients of the herbal plants, reducing their side effects and improving their activities. The paper emphasizes polymeric nanoparticles, liquid crystalline structure, and solid lipid nanoparticles. The study[23] was explicitly focused on breast cancer and trying to analyze anti-carcinoma factors based on organic plant ingredients which have a promising potential to serve as anti-carcinoma factors. And the results demonstrate that garlic, turmeric, green tea, flax seeds, and black cumin shows chemosensitivity and treatment potential. These herbs display anti-cancer properties, and their outcome and the mechanism of activities encompasses suppression of cell profusion apoptosis as well as transition of critical extracellular tract. Another study highlights some nanoparticles that can extract herbal ingredients from the medicinal plant and provide anti aging properties. Chemotherapy nanocapsules like nanocapsules, quantum-dot, phytosomes, and nanoemulsion have been conjugated with anti-cancer herbal bioactives[24]. These nano chemotherapeutic agents enhance bioactivity, produce stability and pharmacological activity, which reduce toxicity and side effects of the herbal ingredients. Head and neck cancer is a complicated and most usual disorder correlated with death rate and morbidity. The most frequent surgical treatment for head and neck cancer is radiotherapy chemotherapy for combined methodology, which has prolonged severe side effects. The paper focuses on Nano space technology for the treatment of head and neck cancer on specific sites and subdue the adverse impact of surgical side effects. The outcome demonstrates that the development of targeted nanoparticles has immense potential to effectively cure and preserve head and neck cancer challenges and open up new endeavours for future beneficial aspects and opportunities. Pancreatic ductal adenocarcinoma (PDAC) imaging is one of the most life taken carcinoma, and usually, prognosis takes place too late for appropriate medication. In the traditional methodology, the treatment was not allowed to accomplish prolonged satisfactory outcomes in curative and remedial measures. With the imaging of Nanotechnology, that challenge is quickly and markedly resolved because of its characteristic potentiality. It assists in early detection and diagnosis followed by proper medication. The prominent and significant characteristic of nanoparticles is in carcinoma diagnosis that it has the capability to specifically concentrate on alternatives in human

proteome adverse impact of cancer. With the assistance of nanotechnology, blood tests reached up to a high level of sensitivity as approximately 85% and specificity about a hundred percent.

Research Questions

Examine the implementation of herbal nano technology in retardation of cancer cells?

Research Objective

1. To explore the understanding regarding herbal nanotechnology.
2. To analyze the potential advantages of nanotechnology in retardation of cancer cells.
3. To determine the applications of herbal nano technology in retardation of cancer cells.

Methodology

The study opts for a secondary approach that involves already existing resources to explore, understand and enhance effectiveness in the research. It utilizes online and offline resources like research papers, literature, public reports, and other internet website data relevant to the research. In this research, more than 100 research papers were initially selected to understand the objective of the research thoroughly. Subsequently, for research writing, the study finally selected 30 research papers and relevant internet resources for obtaining appropriate finding and conclusion.

Examine the implementation of herbal nanotechnology in the retardation of cancer cells?

Medicinal herbs and plants play pivotal roles in treating multiple disorders from other physical agonies. Medicinal herbs have always been a source of treatment from chronic age as Ayurveda, Unani, Siddha worldwide. Herbal medication is implemented in several distinct methods to provide better results. The root of herbal medication originated from Mesopotamia civilization, followed by the Indian ayurvedic system. The founding father of herbal medicine can be identified from Charaka Samhita, Sushruta Samhita, where 341 and 356 drugs are discussed in the Samhita. Other than that, Chinese treatment methodology also found relevance with herbal medications. The Greece-Roman also clearly manifested the information regarding chronicle herbal medication. As per the World Health Organisation,

they reported around 80% of the rural people from the World population, specifically e of developing countries highly dependent on herbal medication processes in their daily lives.
According to the various studies, it is determined that about sixty-one percent of anticancer elements and forty-nine percent of anti-infection ingredients are approved from the period of 40 years from 1981 to 2010, which are the component of natural or herbal ingredients.
Herbal retreat element which can be utilized in anticancer drug medication can be divided into four major classifications the vinca alkaloids, the epipodophyllotoxins and the taxanes and the camptothecin derivatives.

- Vinca alkaloids are an organic ingredient obtained from the Madagascar periwinkle herb. They have an immense potential to manage diabetes and malignancy. The plant disrupted the cellular division procedure of Cancer cells.
- Epipodophyllotoxins are disengaged from the origin of Indian podophyllum weeds. Etoposide and teniposide are the two prominent components that hinder the propagation of neoplasm microorganisms by repressing them, which prompts the disruption of DNA duplex strands.
- Taxanes such as paclitaxel, docetaxel, and other notable homology are deemed the most potent antitumor causes and efficient upon an extensive array of malignancies such as ovary, lung, thorax, and other metastatic melanoma.
- Camptothecin is a natural cytotoxic drug isolated from the Nyssaceae family that demonstrates a substantial habitat of nucleic acid in mammalian leukocytes and provokes strand separation in chromosomal DNA topoisomerase I.

Other than that, a comprehensive assortment of herbal medications have been examined for their anticancer characteristics; strands from medicinal plants and sorts reveal their anticancer attributes by immediately cytotoxic consequences for accentuating the immune practice. Actively phytochemicals and their derivatives observed in petal, stem, shoot and peduncle describe the promising potential as they perform several Pharma illogical activities in the human body.

Herbal drugs injected with nanoformulation can be composed using this distinct methodology: hypertension homogenization conglomerate coacervation, coprecipitation, peppering out nano impetuosity, enzyme emulsification, self-assembly procedure, and so on. Usual herbal Nano drug delivery systems implemented multiple herbal ingredients like liposome, emulsion, solid lipid nanoparticles, polymeric nanoparticles, and carbon nanotubes

in organic nanoparticles. Nanoparticle delivery drug mechanisms for the specific cancer site can be performed by two methods: active and passive targeting systems.

a. Active targeting

Inactive targeting, nanocarriers are channelized to the tumor side with the assistance of targeting ligands specifically against receptors overhead represented on neoplasm microorganisms or tumefaction vasculature, which are not revealed by healthy microorganisms. Chemotherapeutic factors encumbered nanocarriers are conjugated with activating locations like folic acid monoclonal immunoglobulin integrin and others in this manner.

This nanocarrier can be injected with the motive to target

- Receptor preferentially exposed on the endothelial cell of tumor hemoglobin capillaries.
- Receptor overexpressed on tumor cells.
- Lineage-specific objectives are manifested at a comparable level on both neoplasm and healthy cells.

1. Passive targeting

In the passive targeting approach, particles are managed into the tumor interstitium aur membrane through broken neoplasm vasculature with the assistance of element mobility within the fluid or passive diffusion. An appropriate carcinoma medication transmission tool proves the potential and promising approach to accomplish high accommodation in neoplasm and forbear the encompassing healthy membranes. The scientist is utilizing the EPR effect for passive tumor-targeting drug delivery for solid tumor treatment. Enhanced permeability and retention (EPR) have the aptitude to stimulate targeting of carcinoma cells by appropriating Nanomedicine accumulation which strengthens their proposed cell uptake during receptor-mediated endocytosis.

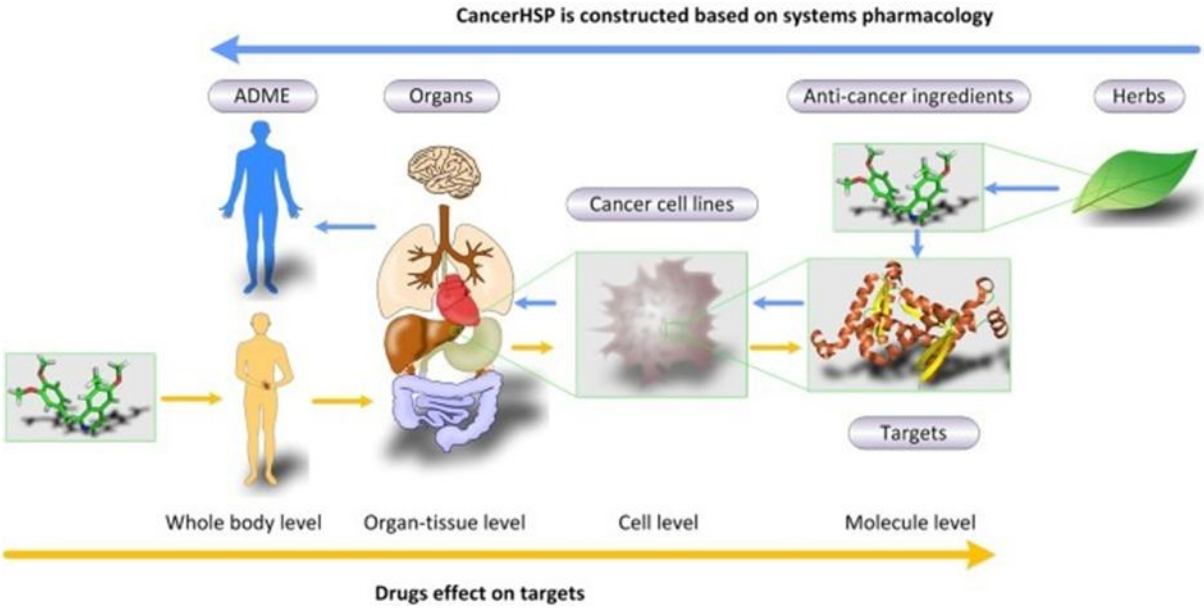

Fig 1: Herbal nanostructure for cancer treatment

Multiple varieties of nanocarrier with organic elements have been determined for the therapy of several varieties of melanoma. These nanocarriers target melanoma cells either by aggressive targeting or receptive targeting artifice. Nanotechnology agents used in malignancy treatment, such as liposomes, consist of lipids fabrication implemented as a nanocarrier for melanoma medication. Nanocantilevers are assemblage-like configurations that support in identifying the terminal protein available in specific types of tumors. Quantum dots are fluorescent nanocrystals prominently employed for malignancy medicine. Nanoemulsions are colloidal nanoparticles known for their balance and remarkable packing performance. Nanocapsules encompass solid-liquid or in which the medicine is deposited into a basin enclosed by a distinguishing polymer sheath manufactured up of ordinary or artificial polymers. Polymer nanoparticles are one of the most attractive procedures for melanoma medicine distribution due to their selective functionalities like endurance, the comfort of conjugating operative affiliations, and accessible surface modification.

Data Analysis

1. Nanotechnology: Breaking the Present Medication restrict of Lung Carcinoma

   Lung cancer is frequently growing carcinoma with respect to fraternity and morbidity. However since 50 years traditional medication is utilised for resolving the challenges of postoperative uncertainty and toxic issues. With the changing and developing

technology, medical science also enhances its approach with promise and dynamic potential in nanotechnology for resolving all the concerning issues with tumor medication. Nanoparticle enabled services have significant potential to cure the carcinoma appropriately. With the assistance of biocompatibility has higher specific surface area that can carry substantial quantities of lung cancer remedial medication while avoiding toxicity editable and modify characteristic give rise to multifunctionality of Nano medicine through effective photoelectric impact make lung cancer multimodal meditation. Through biomarker in vitro characteristics like controllable size shape and physicochemical property and the feature of modifiable service nanoparticles effectively overcoming the challenges came in the pathway of lung cancer treatment.

2. Nanotechnology for cancer drug design, delivery, and theranostics applications

   Nanotechnology has environment characteristics specifically for treating dreadful disease like cancer because of its nanosize, polydispersity, surface potential and stability that play a crucial role in resize delivery to the targeted position of carcinoma in a well organised and adequate manner. Most prominent characteristics life absorption distribution metabolism and excretion are the the key processes that represent the biomedical functionality and toxicity profile of nanoparticles. The significant characteristic of ADME has its significance Pharmacokinetic of various chemicals in vivo like nano medication, environmental contaminants and other impurities. Nanoparticles can we utilised for organic cancer diagnosis and treatment application.

3. Nanotechnology and pancreatic cancer management: State of the art and further perspectives

   Pancreatic ductal adenocarcinoma (PDAC) imaging is one of the most life taken carcinoma and usually prognosis takes place too late for appropriate medication. In the traditional methodology the treatment was not allowed to accomplish prolonged satisfactory outcomes in curative and remedial measures. With the imaging of Nanotechnology that challenge is easily and markedly resolved because of its characteristic potentiality. It assists in early detection and diagnosis followed by proper medication. The prominent and significant characteristic of nanoparticles is in carcinoma diagnosis that it has the capability to specifically concentrate on

alternatives in human proteome adverse impact of cancer. With the assistance of nanotechnology blood tests reached up to a high level of sensitivity as approximately 85% and specificity about hundred percent.

4. Herbal Nanocarriers for Cancer Therapy

Multiple varieties of nanocarrier with organic elements have been determined for the therapy of several varieties of melanoma. These nanocarriers target melanoma cells either by aggressive targeting or receptive targeting artifice. Nanotechnology agents used in malignancy treatment, such as liposomes, consist of lipids fabrication implemented as a nanocarrier for melanoma medication. Nanocantilevers are assemblage-like configurations that support in identifying the terminal protein available in specific types of tumors. Quantum dots are fluorescent nanocrystals prominently employed for malignancy medicine. Nanoemulsions are colloidal nanoparticles known for their balance and remarkable packing performance. Nanocapsules encompass solid-liquid or in which the medicine is deposited into a basin enclosed by a distinguishing polymer sheath manufactured up of ordinary or artificial polymers. Polymer nanoparticles are one of the most attractive procedures for melanoma medicine distribution due to their selective functionalities like endurance, the comfort of conjugating operative affiliations, and accessible surface modification.

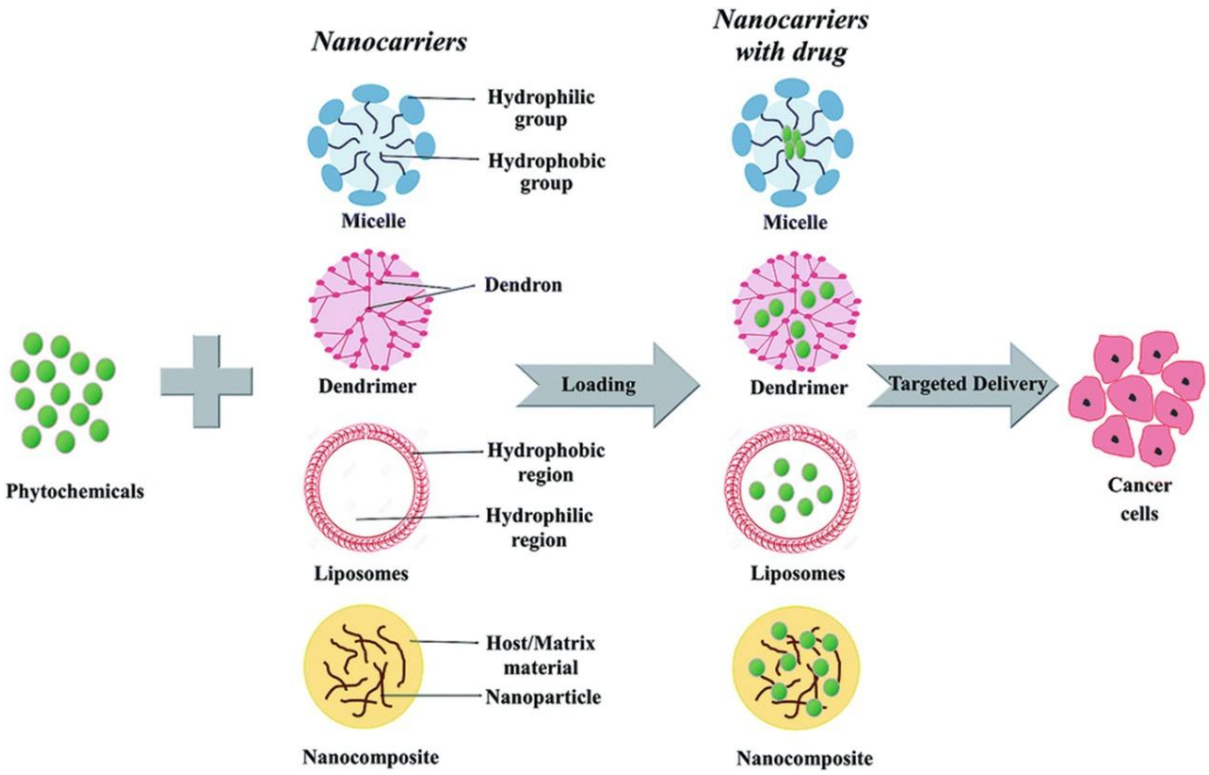

Fig. 2. Herbal Nanocarriers for Cancer Therapy

1. Latest progress in medicinal drug nanocarriers countering cervical carcinoma

Herbal drug or phytoconstituent ingredient derived from organic elements has curative properties or enhances existing chemotherapy with an intention to mitigate the challenges. Herbal components describe impressive characteristics like delivered in favorable denseness at a cellular target. When medicinal components blend with Nano carrier which resolve the locals of herbal component and highlight the phytoconstituent exhibiting promising impact on cervical cancer.

Results

The utility of nanotechnology for plant research is to be implemented in phytotherapy. The mesoporous nanoparticles formulate the gene and actuate it in a compiled and manageable manager without affecting and toxic and introducing any side effects. The chemical manner in which a blend of nanoparticles produces better chemotherapeutic ingredients demonstrates the potential impact on microbial disorders. With the utilisation of advanced nanoparticle techniques, it is assumed to address the high demand for treating the most challenging concern of allopathy, for example, artemisinin for malaria and cancer chemotherapy.

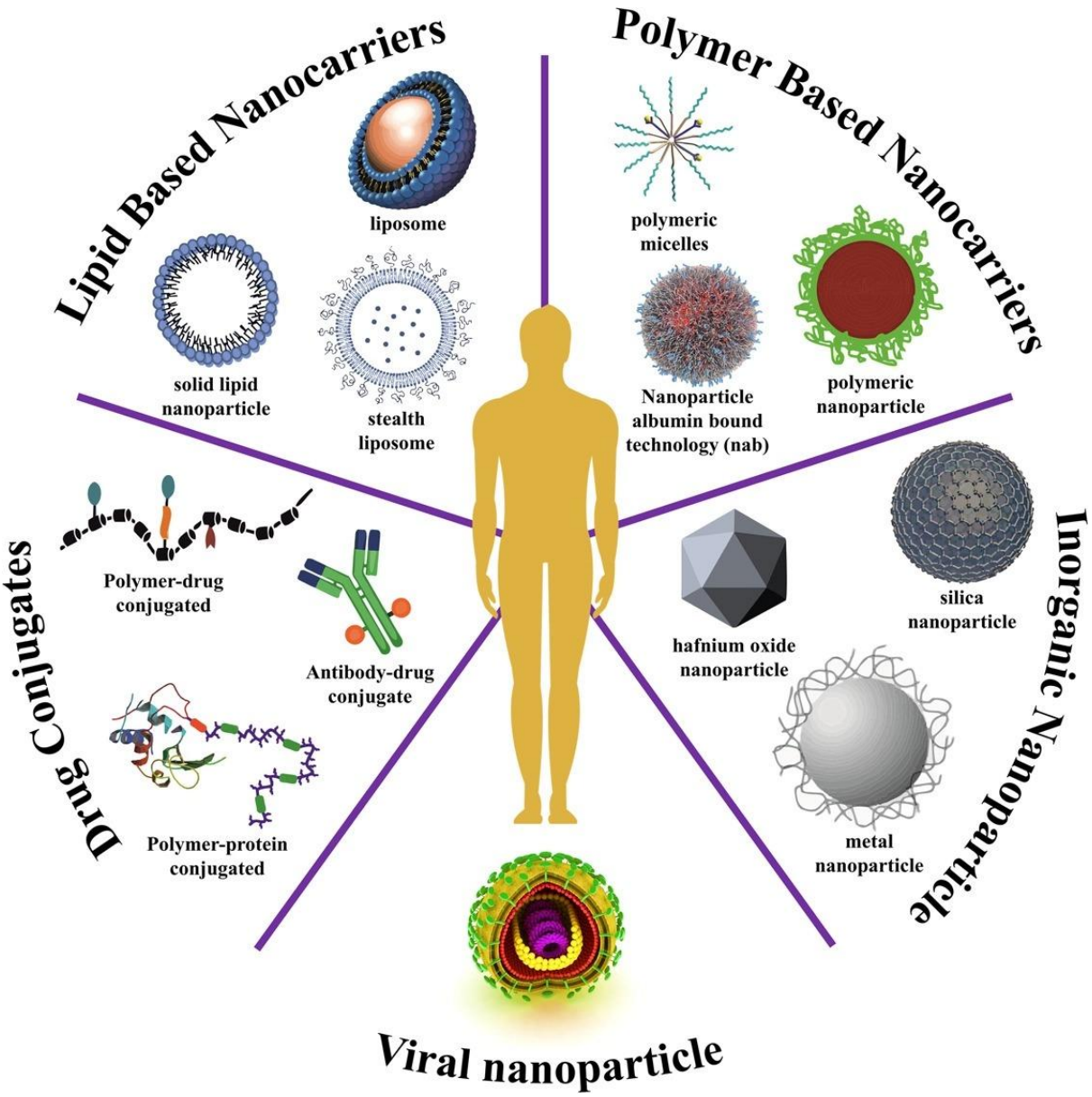

Fig. 3. Medicinal drug nanocarriers

With the application of nanomedicine for herbal medicines, it can be developed into nano herbal meditation with high bioavailability characteristics and provide a pathway of new research in herbal drug delivery mechanisms. Herbal phytochemicals like nano curcumin, nanopipette, nanobernerine act as a breakthrough that can be analyzed from the examination of the minimization. The progression of phytochemicals and phytopharmacological science has enabled elucidation of several medicinal plant products' composition and biological activities. The effectiveness of many species of medicinal herbs depends on the supply of active elements. But the major challenge was its low absorption because of the cell's lipid membrane, high molecular size resulting in loss of bioavailability and efficiency.

Nanotechnology proactively is able to extract the ingredients of the herbal medicinal plants reducing their side effects and improving their activities.

Challenges and Future Aspect-

To actively utilise the advanced nanotechnology with the motive to affordable and accessibility of herbal nanotechnology facility in a cost-effective manner as well as resolving the challenges for appropriate medication following points should be a focus on

- Should have a precise engraving perception of the heterogeneity of medicinal melanoma and the organic constituent controlling the performance of nanomedicines in sufferers.
- The transition from formulation approach in analysis to disorder drive-in growth and progress.
- Evolution of more applicable animal patterns and experiment etiquette
- Preselection of the victim most assuring to counter nanomedical procedure methodology.

Conclusion

The use of the nanoscale substance for the medication of melanoma confirms its functionality and dynamic activity, which is ready to perform effortlessly and conveniently as it is cautiously to address and serve as the curative symptomatic, acquired at the appropriate neoplasm segment, to target particular microorganisms of malignancy actively, abandon physiological limitations in the material like dense stromal membranes of the pancreas of the blood-brain fence, and central nervous system. An appropriate carcinoma medication transmission tool proves the potential and promising approach to accomplish high accommodation in neoplasm and forbear the encompassing healthy membranes. The scientist is utilising the EPR effect for passive tumour-targeting drug delivery for solid tumour treatment.

Nanoparticles like nanoemulsion, solid lipid nanoparticles have enormous benefits for herbal medicines encompassing advancement of solubility and bioavailability restriction from toxicity, enhance pharmacological responses, foster stability encouraging sustainable delivery and security provided from physical and chemical degradation. Therefore, nanosized medication offering practices of herbal remedies encourage the future to stimulate the action and resolve the challenges correlated with the medicinal herbs. some nanoparticles that can

extract herbal ingredients from the medicinal plant and provide anti aging properties. Chemotherapy nanocapsules like nanocapsules, quantum-dot, phytosomes, and nanoemulsion have been conjugated with anti-cancer herbal bioactives. These nano chemotherapeutic agents enhance bioactivity, produce stability and pharmacological activity, which reduce toxicity and side effects of the herbal ingredients.

Eventually, it may conclude that nanotechnology synthesis with herbal extraction ingredients has immense potential to cure the life taken diseases like cancer, as the study found that this herbal nanotechnology can effectively cure various types of cancer along with this the advanced technology has the capability to resolve the challenges facing by the world to deal with an herbal extracted component appropriately.

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