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PREPARATION AND EVALUATION OF POLYMERIC NANOPARTICLES LOADED FROM LEAVES EXTRACT OF *CYMBOPOGON CITRATUS*

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Abstract : This work studies the development and evaluation of *Cymbopogon citratus* extract loaded sustained release polymeric nanoparticles (PNPs) for enhanced bioavailability and reduced nephrotoxicity. The current therapy is associated with the drawbacks of addiction and repeated administration. In the last few decades, several natural bioactive agents have been widely utilized in the treatment and prevention of many diseases owing to their unique and versatile therapeutic effects, including Parkinson's disease of neuroprotective action. Plant-based Nano formulation is one of the novel approaches for therapeutic benefits This research synthesized a polymeric nanoparticle from the polyherbal combination of plant material. The polyherbal extract (PH) was extracted by the Soxhlet-maceration extraction method and the resulting crude extract was undergone for polymeric nanoparticle synthesis. The sustained release PNPs were developed and evaluated for toxicity. PNPs of Cymbopogon citratus were prepared by nanoprecipitation technique utilising Taguchi model and evaluated for physicochemical properties.

***Keywords*- Nanotechnology, *Cymbopogon citratus*, Maceration Extraction, Synthesise PNPs., Evaluations for PNPs,**

I. INTRODUCTION:

Nanoparticles have been studied since early 1990s and used as drug nanocarriers and are be able to be encapsulated inside nanocarriers or onto the surface of small nanocarrier molecules, genes, biopharmaceuticals and diagnostic and imaging agents. The nanocarriers commonly present different matrix systems (nanostructured materials) and an architecture composed of polymers (polymeric nanoparticles), liposomes (solid lipid nanoparticles, cubosomes, niosomes, spherulites etc.), metal nanoparticles (silicon nanoparticles, gold nanoparticles, silver nanoparticles, magnetic nanoparticles), carbon nanotubes and quantum dots (diagnostic image agents).[1]

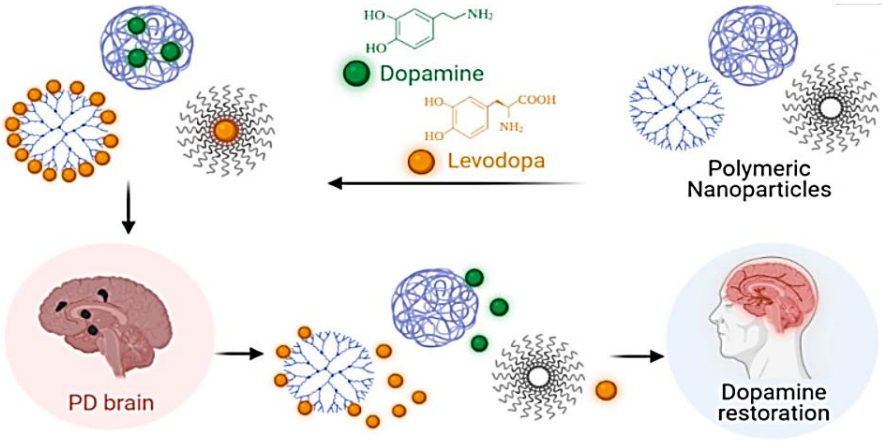
Among the nanostructured systems, polymeric nanoparticles are one of the most promising nanocarriers being developed. Manufactured with a mean diameter in the range of 10–1000 nm, polymeric nanoparticles are mainly composed of synthetic biodegradable polymers such as the HPMC K4.[2]

Nanodosage forms can provide a number of advantages for herbal drugs, including enhancement of solubility and bioavailability, reduction of toxicity, increase of therapeutic index, improvement of stability, controlled delivery and protection from physical and chemical degradation. At the same time, the toxicity of nanoparticles is a very important point in scientific research due to the nanometer size of these structures that can provide facilitated diffusion between tissues and promote their accumulation.[3]

Herbal drugs have gained popularity both in developing and developed countries because of their natural origin and lesser side effects. The loading of natural products into nanostructured systems have been widely studied since nanoparticles can optimize beneficial properties that improve the activity of natural compounds and extracts. A major advantage is passive targeting, which allows nanoparticles to tissue-targeted, effective, and safe nanodelivery systems that can be further administered for brain delivery. [4]

1. *Cymbopogon citratus* following Parkinson's disease (PD):

Parkinson's disease (PD) is a worldwide major public health concern defined as one of the most common neurodegenerative disorders, the second to Alzheimer's disease. [5,6] Neurodegenerative disorders are classified as a group of neurological ailments that form specific brain lesions which develop over time. Such brain lesions combined with the gradual loss of the neurocentral regulation of the affected individuals are responsible for the deteriorating symptoms among patients. This focuses on the recent polymeric nanoparticulate drug delivery systems that have been exploited for dopamine and levodopa replacement in Parkinson's disease.[7,8]



2. Nanosystems for drug delivery into the CNS:

The chemical and physical properties of drugs can be modified to enhance their BAV and biocompatibility *via* different techniques offered by the nanotechnology field. Such modifications could be performed by incorporating the drug of interest into certain delivery systems designed to reach its site of action. The BBB in the CNS could prevent several medications from achieving their optimal therapeutic efficacy. [9,10]

Several organic (polymers, lipids, *etc.*), inorganic (metals, zeolites, carbon nanotubes, *etc.*), and hybrid (metal organic frameworks) matrices have been utilized to construct different nanocarriers which then can be used to deliver drugs to specific biological targets. The biodegradable characteristics of organic nanocarriers and polymeric and lipid matrices, make them more preferred to design nanodrug delivery systems. [11,12]

) Because of their biocompatibility, polymers have been reported to be used as implants, substrates, and insulating materials for neurological interfaces, where they do not trigger detrimental biological interruptions. Furthermore, different clinical applications have been documented to introduce and benefit from several devices that are formed of polymers, such as biofilms, microspheres, gels, *etc.* [13,14]

II. MATERIALS AND METHODS:

- **Collection of Plant Material**:

Choose a location where *Cymbopogon citratus* is growing in abundance. Ensure you have permission to collect if it is not on your property.

- **Extraction by Cold Maceration:**

The leves of *Cymbopogon citratus* was first cut into small pieces, seed removed and dried completely without any amount of moisture present in it. This dried fruit was then pulverised and made into fine powder. About 100g of the powder was taken in a beaker and a required amount of chloroform was poured to the content and allowed to macerate overnight. The next day the content of primary extract filtrate was discarded and the residue was air dried for 30 min. This dry sample was again treated with 150mL of methanol and kept overnight for extraction. The next day the filtrate was collected and evaporated in a water bath for 24 hours at 70°C. The dry extract was obtained after the evaporation process was complete. [15]

- **Synthesis of Polymeric Nanoparticles:**

Take 150 mg of drug extract. 50 mg of polymer are added into the 25 ml of acetone it gives 60 ml of phase 1. 100 mg of extract added to the 2 ml of dimethyl sulphide it gives phase 2. Then then phase 1 and phase 2 added in water of 50 ml then this solution are sonicated for 15 minutes. Then this solution is stirred for 30 minutes. Evaporated acetone under reduced pressure after 10 ml solution Then centrifuge it.[16]

- **Calibration of the *Cymbopogon citratus* extract by UV-Visible Spectrophotometer:**

  Stock I

  Accurately weighed 10 mg of Drug was dissolved the insufficient amount of Ethanol and volume was made to 10 ml with it. (conc 1000µg/ml)

  Stock II

  From stock-I 1 ml sample is withdrawn by pippete and diluted to 10 ml of by using Ethanol (100µg/ml)

  Stock III

  From stock II Working standard solution of strengths 5, 10, 15, 20, 25(µg/ml) were made from the stock solution by appropriate dilution.

- **Solubility:**

The solubility of extract was analysed for the further evaluation. The solubility of extract in various solvents viz. ethanol, water, DMF, Methanol and distilled water was determined.

III. RESULT AND DISCUSSION:

- **Solubility:**

The extract was analysed for solubility in different solvents (Table 2 Figure 2)

Figure no. 2 Solubility of extract in different solvent

Table no. 2. Solubility of Cymbopogon citratus. in Different Solvent

Solvent	Solubility
Methanol	+
Acetone	+
Butanol	+
Ethanol	+
Toluene	+
Ethyl acetate	+
Distilled water	-
Acetic acid	+

Whereas, (+) indicate sign soluble and (-) indicate sign insoluble.

- **Calibration curve of Extract of *Cymbopogon citratus*.:**

Investigated the extract in the solution using UV-vis spectrophotometry. The calibration curve for extract in Methanol was plotted by using following results of absorbance at various concentrations was analysed at 204.8 nm for the leaf extract. For the extract, the peaks were in the range of 250–400 nm. The calibration curve was followed the Beer's-lambert law. The value of coefficient of correlation was observed to be 0.9613. The different concentration absorbance and the calibration curve shows in Figure 3 Respectively.

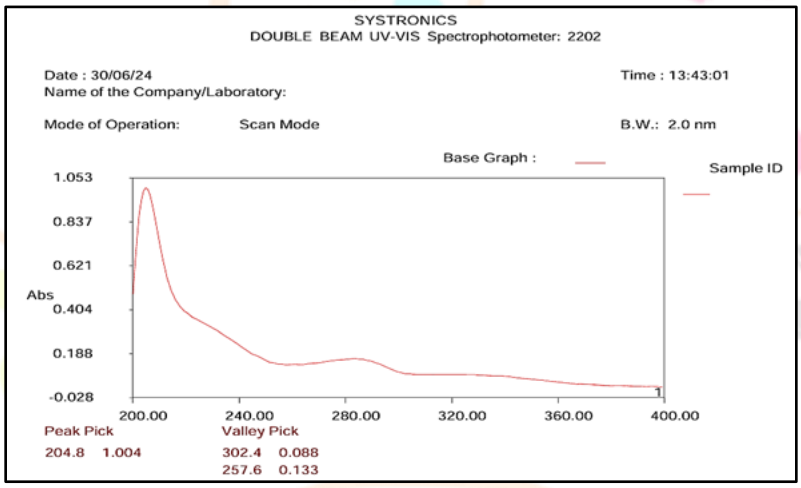


Figure No 3. UV λmax Graph of Extract

IV. PERSPECTIVE AND CONCLUSION:

The development of herbal nanoparticles using polymeric substance was found to be very successful in providing linear release of the encapsulated extract containing active ingredients in it. Nanoparticles loaded with drug extract were prepared and characterized both as suspensions and in solid state form, based on HPMC K4 matrix system. So, the future of such new polymeric nanoparticles will enable scientists to provide safe and smart delivery of natural bioactive agents. Overall, the use of natural bioactive agent-loaded polymeric nanoparticles is a promising strategy, provided that the platform used fulfils the therapeutic and safety aspects.

V. AUTHOUR CONTRIBUTIONS:

S. B. F, G. M. W, P. A. V.; UV-Spectroscopy. All authors have read and agreed to the published version of the manuscript.

VI. ABBREVIATIONS:

PNPs; Polymeric Nanoparticles, G; Gram, mg; Milligram, nm; Nanometre, HPMC K4; Hydroxypropyl Methylcellulose, DMSO; Dimethyl Sulphoxide,

VII. COMPETING INTERESTS

The authors declare that they have no competing interests.

VIII. ACKNOWLEDMENTS:

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IX. REFERENCES:

1. Ticiano Gomes-do Nascimento., "Polymeric Nanoparticles of Brazilian Red Propolis Extract: Preparation, Characterization, Antioxidant and Leishmanicidal Activity" *Nanoscale Research Letters;* 2016; 11(301); 2-16. DOI 10.1186/s11671-016-1517-3
2. Rao, J.P., Geckeler, K.E., "Polymer nanoparticles: preparation techniques and size-control parameters." *Prog. Polym. Sci.* 2011; 36, 887–913.
3. Bitencourt, P.E.R., "A new biodegradable polymeric nanoparticle formulation containing *Syzygium cumini*: Phytochemical profile, antioxidant and antifungal activity and *in vivo* toxicity" Ind. Crops Prod; 2016; 83; 400-407. http://dx.doi.org/10.1016/j.indcrop.2016.01.007
4. Obaydah A. A. Alabrahim., "Polymeric nanoparticles for dopamine and levodopa replacement in Parkinson's disease" *Nanoscale Adv.* 2022; 4(24); 5233–5244.
5. Duty S. Jenner P. "Animal models of Parkinson's disease: a source of novel treatments and clues to the cause of the disease." *Br. J. Pharmacol.* 2011;164(4):1357–1391. doi: 10.1111/j.1476-5381.2011.01426.x.
6. Jagmag S. A. Tripathi N. Shukla S. D. Maiti S. Khurana S. "Evaluation of models of Parkinson's disease." *Front. Neurosci.* 2016;9;503. doi: 10.3389/fnins.2015.00503.
7. De Virgilio A. Greco A. Fabbrini G. Inghilleri M. Rizzo M. I. Gallo A. Conte M. Rosato C. Appiani M. C. De Vincentiis M. "Parkinson's disease: autoimmunity and neuroinflammation." *Autoimmun. Rev.* 2016;15(10):1005–1011. doi: 10.1016/j.autrev.2016.07.022