An astute mini-review on green approach of herbonanoceuticals

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Abstract
The preparation of safe and cost-effective herbal formulations have been reported for their advantages over various chemically designed/ synthesized crude drugs preparations like their respective improved solubility, bioavailability, non-toxicity, improved pharmacological activity, sustained delivery and improved resistance against physical and chemical degradation. Various herbal compounds based nanoparticles has been explored for their potent therapeutic efficiency against pathophysiological conditions as compared to crude drugs preparations. Green synthesis of herbal based nanoformulations has been reported very safe biomedical approach over several metallic nanoparticles and metal based nano-herb combination showed better efficacy against different pathophysioloical conditions. So, this mini-review is an effort to know the implicit role of medicinal herbs in synthesizing nanomaterials to explore their physiological compatibility and therapeutic efficacy to carry out safe and cost effective clinical and biomedical approaches.

Keywords: Herbonanoceuticals, Herbal therapeutics, Nano-herbal formulations.

Introduction
Herbal medicines have been used from very ancient times to treat various diseases with low side effects as very safe therapeutic approach as compared to chemically synthesized medicines.[1-3] So, these days, an improved novel phyto-pharmaceutical approach can solve the clinical and pharmaceutical needs of herbal medicines to develop various novel drug delivery systems includes microspheres, sub-micron particles, nanoparticles, liposomes, solid lipid nanoparticles and micelles.[3-5] In most conventional drug dosage administrations, only a limited amount of administered dose targets the specific site, while the majority of the drugs get dissipated throughout the body depending on their respective physicochemical and biochemical properties that resulted low therapeutic effect. Among all novel drug delivery systems, nano-formulations are considered to be an important drug delivery system which have most potent site-specific targeted delivery of administrated or loaded drugs. So, several medicinal plants or herbs and its bioactive molecules based formulation have been biomedically engineered and explored for studying their efficacy and valediction against various fatal diseases.[6-9] Hence, overall effect of administrated drugs must have sensitive reduction in toxicity or adverse effects and despite all remarkable recent methodologies, design and engineering of herbs based nanomaterials systems have more safe and cost effective established multiform interactions within the specific biological and physico-chemical as well as patho- physiological environment.[10-13]

Nanomaterials: Herbonanoceuticals
Nanomaterial have been reported as highly efficient transport module for loaded chemical and biological compounds includes micelles, polymers, carbon tubes, gold, silver and liposomes.[14-16] Nanocarriers are currently exploit in various drug delivery systems due to having their improved bioavailability and sustained delivery when used in various well known chemotherapies. These bio-medically engineered nanocarriers are designed into various modified forms like polymerconjugates, gold nanoshells and nanocages, polymeric nanoparticles, lipid-based carriers, dendrimers, carbon nanotubes, gold nanoparticles and lipid-based nanomaterials like liposomes and micelles. These various types of biomedically engineered nanomaterial being used in nanocarriers which reported to allow their positive hydrophobic and hydrophilic interactions with loaded drugs which showed safe and sustained delivery of

loaded drugs throughout the body. Only problem associated with long term administration of nanocarriers based drug delivery is their unwanted or untraced toxicity at physiological and molecular level.[16,17] Gardea-Torresdey et al. reported the synthesis of gold and silver nanoparticle by using herbal extracts for exploring their delivery potency as safe and cost effective herbal based therapeutic approach being used as herbonanoceuticals.[15-17] In past recent years, vitamins, carbohydrates, plant extracts and biodegradable polymers are used to prepare green technology based nanoparticles and herbal plant extracts are considered to be the best reducing agents due to their pilot-scale production.[18,19] Polyphenols of plant extracts have well known excellent reducing potential and their side chain groups (mostly –OH group) due to which herbal plant extracts have more potent antioxidant properties for scavenging free radicals. Hence, plant extracts are observed to have key role in capping and stabilizing nanoparticles to increase the biocompatibility of designed formulations.[19,20] Gold nanoparticle were also synthesized by using flower of *Couroupita guianensis* tree that showed very rapid and cost-effective which also possess good chemical or photo-thermal functionality. These prepared herbal based gold nanoparticle are studied for their anticancer activity by using MTT assay, DNA fragmentation, apoptosis by DAPI staining and comet assay for DNA damage.[15-17] Glucoxylans are extracted from seeds of *Mimosa pudica* and being used to prepare gold nanoparticle without using any stabilizing agent and tested for their clinical efficacy.[18-21]

Conclusion

This mini review might be helpful to highlight the use of herbal plants to synthesize nanomaterials for exploring biomedical applications leading to a newer concept of Herbonanoceuticals as a safe and cost-effective green technology. Hence, herbs can be considered as bio-medically engineered materials to be manipulated at nanoscale level and designed formulations. These designed herbo-metal nanoformulations can be further explored to study their respective biological activity, conjugation potential, toxicity profile and stability as herbonanoceutical approach for future therapeutics.

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Conflict of Interest

None.

References

1. Roco MC (2003) Nanotechnology: convergence with modern biology and medicine. *Curr Opin Biotechnol* 2003;14:337-46.
2. Silva GA. Introduction to nanotechnology and its applications to medicine. *Surg Neurol* 2004;61:216-20.
3. Wilson M, Kannangara K, Smith G, Simmons M, Raguse B (2002). Nanotechnology: basic science and emerging technologies. CRC Press LLC, Boca Raton, Florida. *Curr Opin Biotechnol* 2002.
4. Walter P, Welcomme E, Hallégot P, Zaluzec NJ, Deeb C. Early use of PbS nanotechnology for an ancient hair dyeing formula. *Nano Lett* 2006;6:2215-19.
5. Sudhakar A. History of Cancer, Ancient and Modern Treatment Methods. *J Cancer SciTher* 2009;1:14.
6. Solecki R (1975) Shanidar IV A Neanderthal flower burial in northern Iraq. *Sci* 190:880-1.
7. Fabricant DS, Farnsworth NR. The value of plants used in traditional medicine for drug discovery. *Environ Health Perspect* 2001;109(1):69-75.
8. Rani K, Terway N. Green synthesis of silver nitrate treated emulsified Elettaria cardamomum herbal suspensions and study their comparative antioxidant properties. *Adv Tissue Engg Regen Med Open Access* 2019;5(3):98-101. DOI: 10.15406/atroa.2019.05.00106.
9. Patra JK, Das G, Fraceto LF, Campos EVR, Rodriguez-Torres MDP, Acosta-Torres LS et al, Nano based drug delivery systems: recent developments and future prospects. *J Nanobiotechnology* 2018;16:71. https://doi.org/10.1186/s12951-018-0392-8
10. Lombardo D, Mikhail A. Kiselev and Maria Teresa Caccamo. Smart Nanoparticles for Drug Delivery Application: Development of Versatile Nanocarrier Platforms in Biotechnology and Nanomedicine. *J Nanomaterials* Article ID 3702518, 2019, 1-26. https://doi.org/10.1155/2019/3702518
11. Sarkar PK, Das S, Prajapati PK. Ancient Concept of Metal Pharmacology Based on Ayurvedic Literature. *Anc Sci Life* 2010;29:1-6.

12. Chaudhary A. Ayurvedicbhasma: nanomedicine of ancient India--its global contemporary perspective. *J Biomed Nanotechnol* 2011;7:68-9.
13. Pavani T, Shilpa Chakra Ch, Venkateswara Rao K. A green approach for the synthesis of nano-sized iron oxide, by Indian Ayurvedic modified bhasmikaran method. *Am J Biol Chem Pharm* Sci 2013;1:1-7.
14. Paul S, Chugh A. Assessing the role of Ayurvedic 'Bhasmas' as Ethnonanomedicine in the metal based nanomedicine patent regime. *J Intellect Pro Rig* 2011;16:509-15.
15. Gardea-Torresdey JL, Parsons JG, Gomez E, Peralta-Videa J, Troiani HE, Formation and growth of Au nanoparticles inside live Alfalfa plants. *Nano Letters* 2002;2:397-401.
16. Gardea-Torresdey JL, Gomez E, Peralta-Videa J, Parsons JG, Troiani HE, Alfalfa sprouts: A natural source for the synthesis of silver nanoparticles. *Langmuir* 2003;19:1357-61.
17. Iravani S. Green synthesis of metal nanoparticles using plants. *Green Chem* 2011;13:2638-50.
18. Bhattacharya R, Mukherjee P. Biological properties of "naked" metal nanoparticles. *Adv Drug Deliv Rev* 2008;60:1289-1306.
19. Geetha R, Ashokkumar T, Tamilselvan S, Govindaraju K, Sadiq M. Green synthesis of gold nanoparticles and their anticancer activity. *Cancer Nanotech* 2013;4:91-8.
20. Iram F, Iqbal MS, Athar MM, Saeed MZ, Yasmeen A. Glucoxylanmediated green synthesis of gold and silver nanoparticles and their phytotoxicity study. *Carbohydr Polym* 2014;104:29-33.
21. Franco-Romano M, Gil ML, Palacios-Santander JM, Delgado-Jaén JJ, Naranjo Rodríguez I, Sonosynthesis of gold nanoparticles from a geranium leaf extract. *Ultrason Sonochem* 2014;21:1570-7.

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