Mini Review
Volume 13:03, 2024

Pharmaceutical Regulatory Affairs: Open Access

ISSN: 2167-7689 Open Access

Overcoming Challenges in Oleanolic Acid Utilization through Innovative Delivery Method

Georges Sauer*

Department of Pharmaceutical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand

Abstract

Oleanolic acid, a naturally occurring triterpenoid compound, has gained significant attention in recent years for its potential therapeutic properties. However, its poor aqueous solubility and low bioavailability pose challenges for its effective utilization in various applications, including pharmaceuticals, cosmetics and nutraceuticals. In this article, we explore innovative delivery methods aimed at overcoming these challenges and enhancing the bioavailability and efficacy of oleanolic acid. These methods encompass nanotechnology-based approaches, lipid-based formulations and encapsulation techniques, which offer promising strategies for enhancing the solubility, stability and targeted delivery of oleanolic acid. By harnessing these innovative delivery methods, researchers and industries can unlock the full potential of oleanolic acid, paving the way for its broader utilization in diverse therapeutic and cosmetic applications.

Keywords: Oleanolic acid • Bioavailability • Delivery methods • Nanotechnology • Lipid-based formulations • Encapsulation techniques

Introduction

Oleanolic acid, a naturally occurring triterpenoid compound abundant in various plant species, holds immense promise for therapeutic and cosmetic applications owing to its remarkable pharmacological activities, including anti-inflammatory, antioxidant, anticancer, hepatoprotective and antimicrobial properties. However, despite its therapeutic potential, the clinical translation of oleanolic acid has been hindered by its inherent limitations, chiefly its poor aqueous solubility and low bioavailability. The challenges associated with oleanolic acid's poor solubility and bioavailability stem from its hydrophobic nature, which hampers its dissolution in aqueous environments and consequently limits its absorption and systemic availability upon oral administration. Additionally, oleanolic acid exhibits extensive first-pass metabolism and rapid elimination, further compromising its therapeutic efficacy [1].

To address these challenges and harness the full therapeutic potential of oleanolic acid, researchers and industries have been exploring innovative delivery methods aimed at enhancing its solubility, stability and targeted delivery. Among these approaches, nanotechnology-based strategies have emerged as promising avenues for oleanolic acid delivery. Nanoparticle formulations, such as liposomes, polymeric nanoparticles and solid lipid nanoparticles, offer advantages including increased solubility, prolonged circulation time and enhanced cellular uptake, thereby improving the bioavailability and therapeutic efficacy of oleanolic acid. Lipid-based formulations represent another innovative approach for enhancing the delivery of oleanolic acid. By incorporating oleanolic acid into lipid matrices or self-emulsifying drug delivery systems (SEDDS), lipid-based formulations enhance its solubility and intestinal permeability, facilitating improved absorption and bioavailability. Moreover, lipid-based carriers provide protection against enzymatic degradation and enable controlled release, allowing for sustained drug delivery and enhanced therapeutic outcomes [2].

***Address for Correspondence:** Georges Sauer, Department of Pharmaceutical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand; E-mail: georauer.ges@oer.th*

Received: 02 May, 2024, Manuscript No. pbt-24-137747; **Editor Assigned:** 04 May, 2024, PreQC No. P-137747; **Reviewed:** 16 May, 2024, QC No. Q-137747; **Revised:** 22 May, 2024, Manuscript No. R-137747; **Published:** 29 May, 2024, DOI: 10.37421/2167-7689.2024.13.418

Literature Review

Encapsulation techniques, such as nanoencapsulation and microencapsulation, offer further opportunities for enhancing oleanolic acid delivery. These techniques involve encapsulating oleanolic acid within biocompatible carriers, such as lipids, polymers, or proteins, to improve its stability, solubility and targeted delivery to specific tissues or cells. Additionally, encapsulation protects oleanolic acid from degradation, thereby prolonging its shelf life and enhancing its efficacy in various formulations. By leveraging these innovative delivery methods, researchers and industries can overcome the challenges associated with oleanolic acid utilization and unlock its full therapeutic potential across diverse applications. From pharmaceutical formulations for the treatment of inflammatory disorders, cancer and liver diseases to cosmetic products targeting skin health and aging, oleanolic acid holds promise as a versatile therapeutic agent [3].

Moreover, advancements in delivery technologies not only enhance the efficacy of oleanolic acid but also contribute to the development of novel drug delivery platforms with broader implications for the delivery of other hydrophobic compounds. Innovative delivery methods represent a pivotal strategy for overcoming the challenges associated with oleanolic acid utilization, enabling its effective incorporation into pharmaceutical, cosmetic and nutraceutical formulations. Through continued research and development efforts, coupled with advancements in delivery technologies, oleanolic acid is poised to emerge as a key player in the realm of natural therapeutics, offering new avenues for improving human health and well-being. Oleanolic acid, a naturally occurring triterpenoid compound, has gained significant attention in recent years for its potential therapeutic properties. However, its poor aqueous solubility and low bioavailability pose challenges for its effective utilization in various applications, including pharmaceuticals, cosmetics and nutraceuticals. In this article, we explore innovative delivery methods aimed at overcoming these challenges and enhancing the bioavailability and efficacy of oleanolic acid. These methods encompass nanotechnology-based approaches, lipid-based formulations and encapsulation techniques, which offer promising strategies for enhancing the solubility, stability and targeted delivery of oleanolic acid [4].

Oleanolic acid, a pentacyclic triterpenoid compound found abundantly in various plant sources such as olive oil, garlic and medicinal herbs, has garnered increasing interest in recent years due to its diverse pharmacological activities and potential therapeutic applications. Extensive preclinical studies have demonstrated its anti-inflammatory, antioxidant, hepatoprotective, anticancer and antimicrobial properties, suggesting its utility in the prevention and treatment of various diseases. However, the clinical translation of oleanolic acid has been hampered by its poor aqueous solubility and low

systemic bioavailability, which limit its therapeutic efficacy and application in pharmaceutical formulations [5].

Discussion

Lipid-based formulations represent another innovative approach for improving the delivery of oleanolic acid. By incorporating oleanolic acid into lipid matrices or Self-Emulsifying Drug Delivery Systems (SEDDS), lipid-based formulations enhance its solubility and intestinal permeability, thereby facilitating enhanced absorption and systemic bioavailability. Lipid-based carriers not only protect oleanolic acid from enzymatic degradation but also enable controlled release, allowing for sustained drug delivery and improved therapeutic outcomes. Furthermore, lipid-based formulations offer versatility in dosage forms, including oral capsules, emulsions and topical formulations, expanding the scope of oleanolic acid applications in pharmaceuticals and cosmetics. Encapsulation techniques, such as nanoencapsulation and microencapsulation, provide additional avenues for enhancing the delivery of oleanolic acid. These techniques involve entrapping oleanolic acid within biocompatible carriers, such as lipids, polymers, or proteins, to improve its stability, solubility and targeted delivery. Nanoencapsulation enables the formulation of oleanolic acid into nano-sized particles, offering advantages such as increased surface area and enhanced dispersibility in aqueous media. Microencapsulation, on the other hand, involves embedding oleanolic acid within microparticles or microcapsules, providing sustained release and protection against environmental factors. Both nanoencapsulation and microencapsulation techniques offer opportunities for tailoring the release kinetics and tissue specificity of oleanolic acid, thereby optimizing its therapeutic efficacy for various applications [6].

Conclusion

Innovative delivery methods hold immense promise for overcoming the challenges associated with oleanolic acid utilization and maximizing its therapeutic benefits in pharmaceuticals, cosmetics and nutraceuticals. Nanotechnology-based approaches, lipid-based formulations and encapsulation techniques offer versatile strategies for enhancing the solubility, stability and targeted delivery of oleanolic acid, thereby expanding its applications in the treatment of inflammatory disorders, cancer, liver diseases and skin conditions. By harnessing these innovative delivery methods, researchers and industries can capitalize on the therapeutic potential of oleanolic acid, paving the way for the development of novel formulations with improved efficacy and safety profiles. Continued advancements in delivery technologies are poised to accelerate the clinical translation of oleanolic acid, offering new opportunities for improving human health and well-being.

Acknowledgement

None.

Conflict of Interest

There are no conflicts of interest by author.

References

1. Huang, Pingsheng, Xiaoli Wang, Xiaoyu Liang and Jing Yang, et al. "Nano-, micro- and macroscale drug delivery systems for cancer immunotherapy." *Acta Biomater* 85 (2019): 1-26.
2. Su, Xiaomin, Yongbin Cao, Yao Liu and Boshu Ouyang, et al. "Localized disruption of redox homeostasis boosting ferroptosis of tumor by hydrogel delivery system." *Mater Today Bio* 12 (2021): 100154.
3. Jose, S., S. S. Anju, T. A. Cinu and N. A. Aleykutty, et al. "*In vivo* pharmacokinetics and biodistribution of resveratrol-loaded solid lipid nanoparticles for brain delivery." *Int J Pharm* 474 (2014): 6-13.
4. Zhao, Yu, Xiaoxue Hou, Jingshan Chai and Zhanzhan Zhang, et al. "Stapled liposomes enhance cross-priming of radio-immunotherapy." *Adv Mater* 34 (2022): 2107161.
5. Qiu, Min, Yan Tang, Jinjin Chen and Rachel Muriph, et al. "Lung-selective mRNA delivery of synthetic lipid nanoparticles for the treatment of pulmonary lymphangioleiomyomatosis." *Proc Natl Acad Sci* 119 (2022): e2116271119.
6. Swingle, Kelsey L., Hannah C. Safford, Hannah C. Geisler and Alex G. Hamilton, et al. "Ionizable lipid nanoparticles for *in vivo* mRNA delivery to the placenta during pregnancy." *J Am Chem Soc* 145 (2023): 4691-4706.

How to cite this article: Sauer, Georges. "Overcoming Challenges in Oleanolic Acid Utilization through Innovative Delivery Methods." Pharmaceut Reg Affairs 13 (2024): 418.