Synthesis, Characterization, and Application of Cyclodextrin-based Nanosponges as Drug Delivery Systems

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Nanomedicine is defined as nanotechnology-based delivery systems that can be utilized to prevent or treat various diseases at the molecular level [1]. Cyclodextrin-based nanosponges (CD-NSs) are one of the most promising nanocarriers to encapsulate therapeutic agents capable of delivering drugs and enhancing their bioavailability and efficacy. CD-NSs, with a three-dimensional nanoporous polymeric network, due to their biocompatibility and versatility have triggered extensive research and applications in various fields. CD-NSs are chemically cross-linked polymers obtained by reacting the cyclodextrin (CD) unit with a suitable multifunctional cross-linking agent at certain conditions. The final CD-NSs polymer network exhibits a cross-linking agent content-dependent behavior and the degree of cross-linking is a fundamental property of their applications as drug delivery systems. Taking into account the chemical composition and properties, CD-NSs can be classified in five consecutive generations beginning from the simple cross-linking reactions to more complex ones. Numerous surveys have shown that CD-NSs have emerged over the years heading towards greener processes such as the CD-NSs synthesis in natural deep eutectic solvents (NADES), and water [2-5]. Due to the peculiar physicochemical properties of CD-NSs, their complete characterization is a great challenge. Therefore, our research serves as an introduction to the extensive literature about the synthesis, characterization, and application of CD-based nano-delivery systems that will further meet the challenges of the twenty-first century for improving drug administration and lowering toxicity issues. Our survey is essential to research for tailoring novel nanocarrier systems with the prospect of increasing their exploitation in countless industrial applications.

References

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Figure 1: Synthesis of Cyclodextrin-based Nanosponges (CD-NSs).