CHARACTERIZATION TESTS FOR SOLID SELF-EMULSIFYING SYSTEMS: A REVIEW STUDY

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Introduction

Poor water solubility, physical instability and low bioavailability are crucial factors during the development of an oral dosage form. The Solid Self-Emulsifying Drug Delivery Systems (SSEDDS) can be a new approach to reduce these potential problems. The SSEDDS is a formulation made of oils (natural or synthetic), surfactants, co-surfactants and a solid carrier. They form an emulsion promoted by peristalsis in the gastrointestinal tract [1].

Characterization tests are fundamental to drug development but considering the SSEDDS, there are many tests that are not listed in the official compendiums. These techniques and the quality specification have been developed and described in scientific papers. Methods in these studies can involve imaging, physical and/or chemical analysis [2].

This study aims to identify main tests and methodologies to characterize the SSEDDS published in scientific journals. The research was developed at the core collection of Web of Science referential platform using the advanced search to select specific strings and date range.

Material and Methods

The research was carried out on the Web of Science database, on August 10th, 2021. The searched keywords were: *"TS = (solid AND self-emulsi*)"*, using the *"Exact Research"* parameter. Articles were selected if the words were in their title or abstract. In addition, the research was refined to articles published from 2017 to 2021. The exclusion parameters were: (i) review articles; (ii) incomplete articles; (iii) articles that did not use SSEDDS as the unique pharmaceutical dosage form.

Results and Discussion

The platform generated 102 results, and the inclusion of the refined search and exclusion parameters resulted in 40 studies, mostly originated from India (17 of 40), followed by China and South Arabia (6 of 40, respectively). This result can be explained by the incentives to produce medicines and the technological development of the Indian pharmaceutical industry, generated by public policies in the country since the 1970s [3]. In addition, the year of 2019 has the largest number of publications (15 of 40).

The results involved macro- and microstructural analysis: Dissolution tests were the most used characterization method, cited in 85% of the articles, followed by Droplet Size (DS) (77%), Scanning Electron Microscope (SEM) (72%), Differential Scanning Calorimetry (DSC) (62%), X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) (57%, respectively), Micromeritics studies

(Angle of Repose, Carr's Index and Hausner's Ratio) (45%), and Transmission Electron Microscope (TEM) (12%).

Most of the papers that involved Dissolution tests did not specify the source of used parameters. Among those mentioned, cited the United States Pharmacopeia (USP), the United States Food and Drug Administration's Recommended Dissolution Methods (FDA) and methodologies from different researchers as basis. Dissolution test has an important role during preformulation studies because they will impact on the delivery aspects and bioavailability of the formulation [4].

The cited techniques for Droplet Size analysis were Photon Correlation Spectroscopy (PCS) and dynamic light scattering (DLS). All articles used samples containing SSEDDS or the self-emulsifying liquid system (SEDDS). The 1:1000 ratio of water and sample was the most used dilution method. The droplet size has a great relevance in emulsified systems and influences their stability, bioavailability and drug loading. Furthermore, it can be used to categorize different types of emulsions, such as microemulsions and nanoemulsions.

SEM and TEM are imaging techniques used to obtain information about interactions between the formulation components of the SSEDDS. The FTIR helps to identify structures and composition of the formulation and XRD can identify crystalline structures, since the polymorphism can have biopharmaceutical and physical characteristics that can change the bioavailability of the drug. Finally, DSC is a macrostructural characterization method that consist in the tracking of enthalpy changes [3].

Conclusion

Dissolution test and droplet size were the most cited methods, since bioavailability, stability and categorization are correlated to these processes. Imaging, macro- and microstructural analysis were listed in articles. It was observed a concentration of studies using SSEDDS in Asian countries.

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