International Journal of Pharmaceutics & Drug Research
ISSN: 2347-6346
Available online at http://ijpdr.com

Review Article

CURRENT REVIEW ON FAST DISSOLVING DRUG DELIVERY SYSTEM

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***Article History:**

Received: 26/04/2023
Revised: 09/05/2023
Accepted: 15/05/2023

ABSTRACT

Fast dissolving drug delivery systems (FDDS) are designed to improve the bioavailability and patient compliance of pharmaceutical drugs by ensuring rapid disintegration and dissolution in the oral cavity. This review provides a comprehensive overview of recent advancements in FDDS, including formulations, technologies, and applications. It examines various techniques used to develop FDDS, such as lyophilization, direct compression, and electrostatic assembly. The review also addresses the challenges associated with FDDS, including stability issues and manufacturing constraints. By synthesizing recent research and technological developments, this review aims to highlight the potential benefits and limitations of FDDS in modern drug delivery.

Keywords: Fast dissolving drug delivery systems, Oral disintegration, Bioavailability, Lyophilization, Direct compression, Electrostatic assembly

INTRODUCTION

Fast dissolving drug delivery systems (FDDS) are innovative pharmaceutical formulations designed to dissolve rapidly in the oral cavity, thereby enhancing drug absorption and onset of action. These systems are particularly beneficial for patients with swallowing difficulties, such as the elderly and children, as well as those requiring quick symptom relief. FDDS leverage advanced technologies to improve drug solubility, stability, and bioavailability, presenting a significant advancement over conventional tablet forms.

Definition and Importance

FDDS, also known as orally disintegrating tablets (ODTs) or fast-melt tablets, dissolve quickly upon contact with saliva, releasing the drug for immediate absorption. This rapid dissolution is especially useful for drugs that require a fast onset of action, such as analgesics, antiemetics, and antihistamines (Chen *et al.,* 2019). By eliminating the need for water, FDDS enhance patient compliance and convenience, making them a valuable option in modern medicine.

Technologies Used

Various technologies are employed to develop FDDS, each aimed at improving dissolution rates and drug release profiles. These include:

- **Lyophilization:** This freeze-drying technique removes moisture from drug formulations to create porous tablets that dissolve rapidly. It enhances both drug stability and dissolution rate (Cheng *et al.,* 2021).
- **Direct Compression:** This method involves compressing powdered ingredients directly into tablets, which dissolve quickly in the mouth. It is a

simple and cost-effective approach (Patel *et al.,* 2021).

- **Spray Drying:** In this process, a drug solution is sprayed into a hot chamber to rapidly dry it into fine particles that form rapidly dissolving tablets (Lee *et al.,* 2022).
- **Sublimation:** This technique uses volatile substances to create a porous tablet structure, promoting rapid dissolution in the oral cavity (Kumar *et al.,* 2021).

Applications and Benefits

FDDS have a broad range of applications, including pain management, psychiatric treatments, and allergy relief. For instance, FDDS of analgesics offer rapid relief from pain due to their quick absorption (Gupta *et al.,* 2022). In psychiatric treatments, FDDS improve adherence to medication regimens by providing a more convenient dosage form (Patel *et al.,* 2023). Similarly, FDDS for antihistamines enhance patient compliance and provide fast relief from allergic reactions (Sharma *et al.,* 2021).

Challenges

Despite their advantages, FDDS face several challenges, including stability issues, manufacturing complexities, and patient acceptance. The delicate nature of FDDS can lead to moisture absorption and degradation, affecting product stability (Zhang *et al.,* 2022). The manufacturing process can be complex and costly, requiring specialized equipment and conditions (Smith *et al.,* 2021). Additionally, issues such as flavor masking and texture can impact patient acceptance (Lee *et al.,* 2021).

Examples

Orally Disintegrating Tablets (ODTs) for Pain Management:

Orally disintegrating tablets (ODTs) have been developed to provide rapid pain relief by ensuring quick dissolution and absorption of analgesics. An example is the formulation of fast-dissolving tablets containing ibuprofen. These tablets dissolve rapidly in the mouth, offering a convenient option for patients who require immediate pain relief without water. The use of superdisintegrants and novel excipients in these formulations helps achieve rapid disintegration and drug release (Gupta *et al.,* 2022).

Fast-Dissolving Antipsychotic Tablets:

In the field of psychiatric medicine, fast-dissolving tablets have been developed for antipsychotic drugs such as olanzapine. These FDDS enhance patient compliance by providing a dosage form that dissolves quickly in the mouth, facilitating ease of administration and improving medication adherence. This is particularly beneficial for patients with schizophrenia who may have difficulty swallowing conventional tablets (Patel *et al.,* 2023).

Fast-Dissolving Antihistamines:

Fast-dissolving formulations of antihistamines such as loratadine have been developed to provide rapid relief from allergy symptoms. These FDDS are designed to dissolve quickly in the oral cavity, leading to faster onset of action compared to conventional tablets. The use of taste-masking agents and optimized formulation techniques helps improve patient acceptance and adherence (Sharma *et al.,* 2021).

Sublimated Tablets for Anti-Emetic Drugs:

Sublimated tablets have been developed for antiemetic drugs like ondansetron to address nausea and vomiting. This technique involves sublimation to create a porous structure in the tablets, which ensures rapid dissolution and drug release. These tablets are especially useful for patients undergoing chemotherapy who need fast relief from nausea (Kumar *et al.,* 2021).

Spray-Dried Formulations for Antifungal Medications:

Spray drying has been utilized to develop fast-dissolving tablets for antifungal medications like fluconazole. This process produces fine powders that are incorporated into tablets, allowing for rapid dissolution and absorption. These formulations are advantageous for patients needing prompt treatment for fungal infections (Lee *et al.,* 2022).

Fast-dissolving drug delivery systems are increasingly used across various therapeutic areas to improve patient compliance and treatment efficacy. By leveraging technologies such as lyophilization, direct compression, spray drying, and sublimation, these systems ensure rapid drug release and absorption. Examples include FDDS for pain management, psychiatric disorders, allergy relief, antiemetic drugs, and antifungal treatments, each demonstrating the benefits of enhanced dissolution rates and ease of administration. Despite these advancements, challenges related to stability, manufacturing, and patient acceptance continue to be addressed in ongoing research and development.

Advantages of Fast Dissolving Drug Delivery Systems (FDDS)

Improved Patient Compliance:

One of the primary advantages of FDDS is their ability to enhance patient compliance. FDDS are designed to dissolve quickly in the mouth without the need for water, making them especially convenient for patients who have difficulty swallowing pills, such as children and the elderly. This ease of administration encourages adherence to prescribed treatments, improving overall therapeutic outcomes (Chen *et al.,* 2019).

Rapid Onset of Action:

FDDS provide a rapid onset of action by ensuring that the drug is quickly available for absorption. This is particularly beneficial for medications that need to act swiftly to alleviate acute symptoms, such as pain or nausea. The quick disintegration of FDDS in the oral cavity allows for faster drug release compared to conventional tablets, leading to quicker relief (Gupta *et al.,* 2022).

Enhanced Bioavailability:

The rapid dissolution of FDDS can lead to enhanced bioavailability of the drug. By dissolving quickly in the oral cavity, FDDS can bypass some of the barriers associated with gastrointestinal absorption, potentially increasing the amount of drug that reaches systemic circulation. This can be especially advantageous for drugs with poor solubility or absorption issues (Patel *et al.,* 2021).

Convenience and Portability:

FDDS offer significant convenience and portability advantages. These tablets are easy to carry and consume, as they do not require

water for ingestion. This feature is particularly useful for patients on the go or those in situations where access to water may be limited, such as during travel or while at work (Sharma *et al.,* 2021).

Taste Masking:

FDDS can be formulated to mask the unpleasant taste of certain medications, improving patient acceptance. The incorporation of flavor-masking agents and sweeteners into the tablet formulation helps to make the medication more palatable, which is particularly important for pediatric and geriatric patients who may be sensitive to taste (Kumar *et al.,* 2021).

Reduced Dosage Frequency:

Some FDDS formulations can lead to prolonged drug release and thus reduce the frequency of dosing. This is beneficial for medications requiring sustained therapeutic effects while minimizing the inconvenience of frequent dosing schedules (Lee *et al.,* 2022).

Disadvantages of Fast Dissolving Drug Delivery Systems (FDDS)

Stability Issues:

FDDS can face significant stability issues due to their high porosity and the inclusion of certain excipients. The rapid dissolution properties that benefit patients can also make these formulations more susceptible to moisture absorption and degradation. This instability can affect the shelf life and efficacy of the medication (Zhang *et al.,* 2022).

Manufacturing Challenges:

The manufacturing of FDDS often involves complex processes and specialized equipment. Techniques such as lyophilization, sublimation, or spray drying can be costly and require precise control over production conditions. This complexity can lead to higher production costs and potential scalability issues (Smith *et al.,* 2021).

Taste Masking Difficulties:

While FDDS can be formulated to mask unpleasant tastes, achieving effective taste masking can be challenging. The addition of flavor-masking agents or sweeteners may not always fully eliminate the taste of certain drugs, which can affect patient acceptance, particularly in pediatric and geriatric populations (Kumar *et al.,* 2021).

Limited Drug Load:

FDDS are typically limited in the amount of drug they can deliver due to the constraints of their formulation and manufacturing processes. The need for a rapid disintegration matrix and the inclusion of disintegrants can restrict the drug loading capacity, which might not be suitable for drugs requiring higher doses (Cheng *et al.,* 2021).

Potential for Dose Dumping:

FDDS can sometimes lead to dose dumping, where a larger amount of the drug is released at once due to rapid disintegration. This can be particularly problematic for drugs with a narrow therapeutic window, as it may lead to adverse effects or reduced efficacy if not properly controlled (Gupta *et al.,* 2022).

Patient Perception and Acceptance:

Some patients might have negative perceptions of FDDS, such as concerns about the texture or mouthfeel of the rapidly dissolving tablets. This can impact patient adherence to medication regimens.

Addressing these issues requires careful formulation to balance patient comfort with rapid dissolution (Lee *et al.,* 2021).

CONCLUSION

Fast Dissolving Drug Delivery Systems (FDDS) offer notable advantages, including improved patient compliance, rapid onset of action, and enhanced bioavailability. Their ability to dissolve quickly in the oral cavity makes them ideal for patients with swallowing difficulties and those needing immediate relief. Technologies such as lyophilization, sublimation, and spray drying enable these systems to deliver drugs effectively and efficiently.

However, FDDS face challenges including stability issues, complex manufacturing processes, taste masking difficulties, and limited drug loading capacity. Addressing these challenges is essential for optimizing FDDS and ensuring their effectiveness and acceptance. Future research should focus on enhancing the stability and manufacturing of FDDS, improving patient acceptance, and expanding their therapeutic applications.

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