Formulation And Development of Aspirin Immediate Release Tablet

Ms. Siddhi D. Pawar[1], Mr. Akshay R. Gadhari[2]
Student, Sayali Charitable Trust College of Pharmacy
Assistant Professor, Sayali Charitable Trust College of Pharmacy

Abstract— **Aspirin (acetylsalicylic acid) remains one of the most extensively used analgesic, antipyretic, and antiplatelet agents worldwide, necessitating robust and efficient formulation strategies for its immediate-release (IR) dosage forms. The development of an aspirin IR tablet requires careful consideration of the drug's physicochemical properties, particularly its susceptibility to hydrolysis and moisture sensitivity, which can influence stability, bioavailability, and therapeutic performance. This review presents a comprehensive overview of the formulation and development approaches employed in designing effective aspirin IR tablets. Key formulation componentsincluding diluents, disintegrants, binders, lubricants, and stabilizersare discussed with emphasis on their functional roles and selection criteria. The importance of disintegration and dissolution performance is highlighted, as these parameters largely determine the rapid onset of action expected from IR formulations. The article also examines processing techniques such as direct compression, dry granulation, and wet granulation, comparing their advantages and limitations in relation to aspirin's inherent instability. Additionally, quality evaluation parameters including hardness, friability, weight variation, disintegration time, dissolution rate, assay, and stability testing are reviewed to ensure the final product complies with pharmacopeial standards. Recent advancements in excipient technology, particle engineering, and process optimization aimed at enhancing tablet performance and stability are also addressed. By outlining current formulation practices and technological advancements, this review aims to support researchers and formulators in developing safe, effective, and high-quality aspirin immediate-release tablets.**

Index Terms— **Aspirin; Acetylsalicylic acid; Immediate-release tablet; Formulation development; Excipients; Disintegration; Dissolution.**

I. INTRODUCTION

Aspirin, chemically known as acetylsalicylic acid (ASA), is one of the most widely used nonsteroidal anti-inflammatory drugs (NSAIDs) with established roles in analgesic, antipyretic, anti-inflammatory, and antiplatelet therapy. Since its introduction in the late 19th century, aspirin has remained central to global healthcare because of its multifaceted therapeutic applications, low cost, and well-characterized pharmacological profile. Its mechanism of action primarily involves the irreversible inhibition of cyclooxygenase (COX-1 and COX-2) enzymes, leading to reduced synthesis of prostaglandins and thromboxanes. This makes aspirin valuable not only for symptomatic relief of pain and fever but also for cardiovascular prevention, where low-dose formulations help reduce the risk of heart attacks and strokes. Immediate-release (IR) aspirin tablets are particularly important because they are designed to offer a rapid onset of action, making them suitable for conditions requiring quick therapeutic effect, such as acute pain and inflammatory episodes. The demand for effective IR formulations has therefore increased significantly. However, the formulation of aspirin poses unique challenges due to its moisture sensitivity, tendency to undergo hydrolytic degradation, and interaction with certain excipients. These stability concerns require careful selection of manufacturing processes and formulation components to maintain product quality. This section highlights the need for a deeper understanding of aspirin's physicochemical properties, pharmacological significance, and formulation challenges. As the global burden of chronic pain, cardiovascular diseases, and inflammatory disorders persists, the development of optimized aspirin IR tablets remains essential in

ensuring safe, effective, and immediate therapeutic outcomes.

The development of immediate-release (IR) aspirin tablets is inherently complex due to the compound's chemical instability, particularly its tendency to undergo hydrolysis in the presence of moisture. This degradation results in the formation of salicylic acid and acetic acid, which compromise both therapeutic efficacy and patient safety. Therefore, one of the primary formulation challenges is ensuring optimal stability throughout manufacturing, storage, and usage conditions. This demands strict control over environmental factors, especially humidity and temperature, as well as careful selection of excipients that do not promote degradation.

Another major challenge lies in achieving rapid disintegration and dissolution, which are essential for IR formulations. Aspirin's relatively low aqueous solubility can hinder its dissolution rate, affecting bioavailability and therapeutic onset. To overcome this, formulators often rely on superdisintegrants, optimized particle size, and the use of suitable diluents and binders. However, the choice of excipients must be approached cautiously because some common excipients, such as alkaline substances, can accelerate aspirin degradation, while certain lubricants may retard dissolution.

Manufacturing method selectionwhether direct compression, dry granulation, or wet granulationalso significantly influences product performance. While direct compression is preferred for its simplicity and cost-effectiveness, aspirin's sensitivity to moisture often necessitates alternative methods like dry granulation. Each method presents trade-offs in terms of tablet hardness, friability, and content uniformity. Overall, the formulation of aspirin IR tablets requires a balanced understanding of its physicochemical behavior, excipient compatibility, and processing constraints. Addressing these challenges is critical to ensuring the development of an IR product that is both stable and therapeutically effective.

Rationale for Immediate-Release Formulation Development

The rationale for developing immediate-release aspirin tablets is rooted in the need for a fast therapeutic response, which is vital for conditions requiring swift symptom management. IR formulations ensure that the drug is released and absorbed quickly, leading to a rapid onset of analgesic and antipyretic effects. This is particularly beneficial in treating acute pain, headache, musculoskeletal discomfort, and inflammatory flares. Additionally, in cardiovascular emergencies such as suspected myocardial infarction, a rapidly dissolving aspirin tablet can provide prompt antiplatelet action, improving clinical outcomes.

From a patient perspective, IR tablets offer advantages such as ease of administration, predictable performance, and faster relief compared to modified-release formulations. These benefits contribute to improved patient compliance and overall therapeutic success. Pharmaceutically, the development of IR tablets allows formulators to optimize key parameters like disintegration time, dissolution profile, and bioavailability, all of which are crucial for meeting regulatory expectations outlined in pharmacopeial standards. Moreover, advances in formulation science and excipient technology have made it feasible to engineer IR tablets with improved stability despite aspirin's inherent moisture sensitivity. The incorporation of high-performance disintegrants, moisture-protective excipients, and optimized manufacturing strategies has enabled the production of tablets that are both rapid-acting and stable. Developing aspirin IR tablets thus represents a continuous effort to balance therapeutic effectiveness, stability, and manufacturability. As healthcare demands evolve, the emphasis on creating efficient, safe, and reliable IR formulations continues to grow, underscoring their relevance in modern pharmaceutical development.

Objectives

- To evaluate the key formulation challenges associated with aspirin, including its moisture sensitivity, hydrolytic degradation, and compatibility issues with commonly used excipients.
- To review the roles and selection criteria of essential excipientssuch as diluents, binders, disintegrants, lubricants, and stabilizersin designing effective aspirin IR tablets.
- To compare different manufacturing techniques (direct compression, dry granulation, and wet granulation) and analyze their suitability for formulating stable and efficient aspirin IR tablets.
- To examine critical quality control parametersincluding hardness, friability, weight

variation, disintegration time, dissolution rate, assay, and stabilityto ensure the final product meets pharmacopeial standards.
- To analyze recent advancements in formulation strategies, including modern disintegrants, moisture-protecting excipients, and process optimization techniques that enhance the stability and performance of aspirin IR tablets.
- To provide a comprehensive overview of current research findings and technological developments in the field of aspirin immediate-release tablet formulation.
- To identify knowledge gaps and future research prospects that can guide further innovation and improvement in aspirin IR tablet development.

II. LITERATURE REVIEW

1. Aulton, M. E., & Taylor, K. – Aulton's Pharmaceutics: The Design and Manufacture of Medicines

Aulton's Pharmaceutics is one of the most authoritative sources for understanding the principles of dosage-form design, including tablet formulation. The book provides detailed discussions on powder flow properties, compression behavior, and tablet manufacturing technologies, all of which are crucial for formulating aspirin immediate-release tablets. The authors explain the fundamental principles governing the selection of diluents, binders, disintegrants, and lubricants, and highlight how each affects tablet quality, stability, and performance. The text also emphasizes factors affecting drug–excipient compatibility, especially important for aspirin, which is prone to hydrolysis when exposed to moisture and reactive excipients. The sections on direct compression, dry granulation, and wet granulation help readers understand which method is better suited for moisture-sensitive drugs. Overall, this reference supports the scientific basis for designing stable, rapidly disintegrating aspirin IR tablets.

2. Allen, L. V., & Ansel, H. C. – Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems

This widely used text provides an in-depth overview of tablet dosage forms, offering foundational knowledge essential for aspirin IR tablet development. Ansel's book explains the mechanisms of tablet disintegration and dissolution, which are critical performance parameters for immediate-release systems. The authors discuss how excipients influence the mechanical strength, bioavailability, and release characteristics of tablets. Special attention is given to chemical stability, including pathways of degradation such as hydrolysis, oxidation, and thermal breakdown, which directly relate to aspirin's instability challenges. The text highlights the importance of quality control tests such as hardness, friability, disintegration, and dissolutiondata that form the backbone of most research studies reviewed in this article. The principles presented in Ansel's book help justify formulation choices, such as the inclusion of superdisintegrants and granulation techniques, in modern IR aspirin tablets.

3. Rowe, R. C., Sheskey, P. J., & Quinn, M. E. – Handbook of Pharmaceutical Excipients

The Handbook of Pharmaceutical Excipients is a definitive reference guide for understanding the functionality and compatibility of excipients used in tablet formulation. This text provides detailed profiles of excipients such as microcrystalline cellulose, lactose, croscarmellose sodium, sodium starch glycolate, PVP, magnesium stearate, and others frequently used in aspirin IR tablets. Each monograph includes information on physicochemical properties, mechanism of action, compatibility, stability, and application in immediate-release dosage forms. For aspirin formulations, excipient compatibility is particularly important because certain alkaline or moisture-retaining excipients can accelerate aspirin degradation. The handbook's data help formulators identify suitable excipients that promote rapid disintegration while minimizing stability risks. This source strongly supports the rationale for excipient selection in aspirin IR development.

4. Saito et al. – Stability Characteristics of Acetylsalicylic Acid Tablets under Accelerated Conditions

This study investigates the degradation behavior of aspirin tablets subjected to varying humidity and temperature. The authors report that exposure to moisture significantly increases conversion of acetylsalicylic acid to salicylic acid, confirming aspirin's well-known hydrolytic instability. The paper also evaluates the influence of excipients and

packaging systems on stability outcomes. Findings from this study reinforce the importance of controlling environmental conditions during manufacturing and storage of aspirin IR tablets. It supports formulation strategies such as using moisture-protective excipients, selecting dry granulation processes, and employing aluminum–aluminum blister packaging.

III. MATERIALS & METHODOLOGY

The following materials are commonly described across research studies on the formulation of aspirin immediate-release (IR) tablets. These can be included in your review to summarize standard excipients used in the field.

1. Active Pharmaceutical Ingredient (API)
- Aspirin (Acetylsalicylic Acid) – USP/Pharmacopoeial grade

Property	Description	Impact on Formulation
Chemical Name	Acetylsalicylic Acid	Determines API identity and purity requirements
Molecular Weight	180.16 g/mol	Influences dissolution and absorption
Solubility	Slightly soluble in water; freely soluble in organic solvents	Poor solubility may slow dissolution in IR tablets
Stability	Hydrolyzes in presence of moisture to form salicylic acid	Requires low-moisture excipients and packaging
Melting Point	134–136°C	Important for thermal stability considerations
pKa	~3.5	Affects dissolution in varying pH environments
Hygroscopicity	Moderate sensitivity to humidity	Critical factor in processing and storage

Table 1: Physicochemical Properties of Aspirin Relevant to IR Tablet Formulation

2. Excipients
- Diluents:
  - Microcrystalline Cellulose (MCC)
  - Lactose Monohydrate
  - Starch
- Binders:
  - Polyvinylpyrrolidone (PVP K30)
  - Hydroxypropyl Methylcellulose (HPMC)
  - Gelatin
- Disintegrants:
  - Sodium Starch Glycolate (SSG)
  - Croscarmellose Sodium
  - Crospovidone
- Lubricants:
  - Magnesium Stearate
  - Talc
  - Aerosil (Colloidal Silicon Dioxide)
- Stabilizers / Moisture-Control Agents:
  - Anhydrous Lactose
  - Citric Acid (as stabilizer in some studies)
  - Desiccants (for storage)

Equipment:

1. Processing Equipment
- Analytical Balance
- Mortar and Pestle
- Sieve Shaker / Sieves
- Mixer / Blender
- Granulator (dry or wet, depending on method)
- Tablet Compression Machine (Single punch or Rotary press)
- Hot Air Oven / Tray Dryer
- Desiccator

2. Evaluation Equipment
- Hardness Tester (Monsanto / Pfizer / Digital)
- Friabilator (Roche Friabilator)
- Vernier Caliper
- Disintegration Test Apparatus
- Dissolution Test Apparatus (USP Type I/II)
- UV–Visible Spectrophotometer / HPLC System
- Stability Chamber

Methodology:

1. Pre-Formulation Studies:

Pre-formulation is conducted to understand the physicochemical characteristics of aspirin and its behavior with excipients.

1.1 Physicochemical Evaluation

- Examination of melting point, solubility, hygroscopicity, and hydrolytic stability of aspirin.
- Study of particle size, polymorphism, and flow properties to determine suitable processing methods.

1.2 Drug–Excipient Compatibility

- Compatibility is assessed using methods such as differential scanning calorimetry (DSC), FTIR, and accelerated storage tests.
- Special focus is given to avoiding excipients that promote aspirin hydrolysis or chemical instability.

2. Selection of Excipients:

Aspirin IR tablets require excipients that support rapid disintegration, good compressibility, and stability.

- Diluents (e.g., microcrystalline cellulose) are chosen for compressibility.
- Binders help maintain mechanical strength.
- Superdisintegrants facilitate fast tablet breakup for immediate action.
- Lubricants enable smooth compression but must be used in controlled amounts to avoid slowing dissolution.
- Moisture-protective agents are selected to enhance aspirin stability.

3. Choice of Manufacturing Method

Because aspirin is moisture-sensitive, the manufacturing method is selected based on stability and tablet performance considerations.

3.1 Direct Compression (Preferred When Feasible)

- Used when API and excipients possess adequate flow and compressibility characteristics.
- Minimizes exposure to heat and moisture.

3.2 Dry Granulation

- Used when flowability must be improved without water or heat.
- Roller compaction or slugging is typically referenced in literature.

3.3 Wet Granulation (Least Preferred for Aspirin)

- Applied only when the formulation demands strong granules and no dryness-related instability issues.
- Extra measures are needed to protect aspirin from hydrolysis.

4. Tablet Compression Development:

After blending or granulation, the powder mixture is compressed into tablets.

- Compression parameters such as hardness, thickness, and compression force are optimized for mechanical strength and fast disintegration.
- Uniform drug distribution is ensured through mixing validation and blend uniformity studies.

5. Formulation & Development of Aspirin Immediate Release:

Ingredients (mg)	F1	F2	F3	F4	F5	F6	F7	F8	F9
Aspirin	100	100	100	100	100	100	100	100	100
Microcrystalline Cellulose (MCC)	75	73	71	75	73	71	75	73	71
Croscarmellose Sodium	2	4	6	–	–	–	–	–	–
Sodium Starch Glycolate	–	–	–	2	4	6	–	–	–
Crospovidone	–	–	–	–	–	–	2	4	6
Lactose Monohydrate	20	20	20	20	20	20	20	20	20
Colloidal Silicon Dioxide	1	1	1	1	1	1	1	1	1
Magnesium Stearate	1	1	1	1	1	1	1	1	1
Talc	1	1	1	1	1	1	1	1	1
Total Tablet Weight (mg)	200	200	200	200	200	200	200	200	200

Table 1: Formulation Table of Aspirin Immediate-Release Tablets

6. Post-Compression Evaluation:

spirin IR tablets must meet pharmacopeial quality standards. Studies typically include:

- Weight variation
- Hardness and friability
- Disintegration time (must be rapid for IR tablets)
- Dissolution profile (ensuring immediate drug release)

- Assay and content uniformity
- Moisture content due to aspirin's sensitivity

These evaluations ensure consistency, safety, and therapeutic effectiveness.

7. Stability Studies & Formulation Optimization:

Stability testing is performed under accelerated and long-term conditions following ICH guidelines.

- Monitors chemical stability (hydrolysis), physical integrity, dissolution stability, and appearance.
- Helps determine suitable packaging, often with moisture-protective materials.
- Excipients are fine-tuned.
- Compression parameters are adjusted.
- Dissolution and stability results guide final formulation decisions.

This iterative optimization ensures that the final aspirin IR tablet meets expectations for rapid release, mechanical strength, and long-term stability.

IV. RESULTS & DISCUSSION

Across the reviewed studies, aspirin immediate-release tablet formulations consistently demonstrated the importance of optimizing stability, disintegration, and dissolution behavior. Most researchers highlighted that moisture sensitivity remains a crucial limitation in aspirin processing. Studies showed that even slight exposure to humidity leads to hydrolysis of acetylsalicylic acid into salicylic acid, causing reduced potency and compromised quality. Therefore, excipients, processing methods, and packaging conditions were frequently selected based on their ability to minimize moisture uptake. In several formulations, microcrystalline cellulose (MCC) emerged as the preferred diluent due to its excellent compressibility and ability to enhance tablet strength without prolonging disintegration time. The use of superdisintegrants such as sodium starch glycolate and croscarmellose sodium consistently improved disintegration time, supporting the rapid release profile needed for IR tablets. Studies noted that optimal concentrations of these disintegrantstypically around 2–5%resulted in rapid tablet breakup and improved dissolution rates.

Influence of Manufacturing Techniques on Tablet Quality:

The literature revealed a clear trend toward using direct compression and dry granulation for aspirin IR tablets. Direct compression was favored in many studies due to its simplicity, fewer processing steps, and reduced exposure of aspirin to moisture or heat. However, the method was only successful when the powder blend exhibited adequate flow and compressibility.

In contrast, dry granulation proved beneficial for achieving better granule flowability and uniformity, particularly when aspirin particles or excipients lacked cohesive properties. Researchers reported that tablets produced via dry granulation showed improved content uniformity and mechanical strength, while still maintaining acceptable disintegration times. Wet granulation was the least preferred, with multiple studies reporting greater drug degradation and reduced stability unless stringent moisture-control strategies were used.

Evaluation Parameters and Their Impact on Immediate Release Performance

Most reviewed studies assessed tablet quality through standard evaluation parameters including hardness, friability, weight variation, disintegration, dissolution, and assay. Results consistently demonstrated that achieving a balance between tablet hardness and disintegration is critical. Excessive compression forces increased tensile strength but delayed disintegration, while lower forces enhanced disintegration but compromised mechanical integrity.

Dissolution results from various studies indicated that optimized formulations reached more than 80% drug release within 30 minutes, aligning with pharmacopeial expectations for IR tablets. The presence of superdisintegrants and the use of highly soluble excipients influenced dissolution positively. Compatibility studies using FTIR, DSC, and stability analysis further confirmed that avoiding alkaline excipients was essential to prevent aspirin degradation.

Parameter	Purpose	Expected Outcome	Parameter
Weight Variation	Ensures dose uniformity	Within pharmacopoeial limits	Weight Variation
Hardness	Measures mechanical strength	Sufficient to withstand handling	Hardness
Friability	Assesses tablet durability	Less than 1% weight loss (typically)	Friability
Disintegration Time	Confirms rapid tablet breakdown	Ideally < 15 minutes for IR tablets	Disintegration Time
Dissolution Profile	Determines rate of drug release	≥80% drug release within 30 minutes	Dissolution Profile
Assay / Content Uniformity	Confirms accurate drug content	95–105% (pharmacopeial range)	Assay / Content Uniformity
Stability Testing	Checks chemical and physical stability	Minimal hydrolysis; stable appearance	Stability Testing

Table 2: Key Evaluation Parameters for Aspirin IR Tablets

Stability Findings and Implications for Formulation Design

Long-term and accelerated stability studies across the literature revealed that aspirin tablets remain stable when protected from humidity, temperature fluctuations, and reactive excipients. Moisture-barrier packaging, such as aluminum-based blister packs, significantly improved stability outcomes. Formulations containing moisture-absorbing excipients showed reduced degradation levels over time, reinforcing the importance of excipient selection. The review findings emphasized that improvements in stability directly impacted the tablet's therapeutic reliability and shelf life, making stability optimization a central goal in aspirin IR development.

Collectively, the literature indicates that successful formulation of aspirin IR tablets depends on three major factors:

1. Maintaining chemical stability by minimizing exposure to moisture and incompatible excipients.
2. Optimizing disintegration and dissolution through the use of efficient superdisintegrants and appropriate processing techniques.
3. Ensuring manufacturability and quality through controlled compression parameters and suitable formulation strategies.

The reviewed studies show that with proper excipient selection, processing methods, and stability safeguards, aspirin IR tablets can achieve rapid onset of action, consistent performance, and acceptable shelf life.

V. CONCLUSION

The formulation and development of aspirin immediate-release (IR) tablets remain a significant area of focus within pharmaceutical science due to aspirin's widespread clinical use and its requirement for a rapid therapeutic effect. This review highlights that the major challenge in developing aspirin IR tablets stems from the intrinsic instability of acetylsalicylic acid, particularly its susceptibility to moisture-induced hydrolysis. Consequently, successful formulation strategies emphasize careful excipient selection, avoidance of alkaline or moisture-reactive substances, and adoption of processing methods that minimize exposure to heat and moisture. The literature consistently supports the use of direct compression and dry granulation as preferred manufacturing approaches, owing to their compatibility with aspirin's sensitive nature.

The incorporation of superdisintegrants, such as croscarmellose sodium or sodium starch glycolate, was shown to significantly enhance disintegration and dissolution, key parameters defining the performance of IR tablets. Quality control assessments across studies demonstrated that optimized formulations could meet pharmacopeial standards for hardness, friability, disintegration, dissolution, and drug content. Overall, the findings indicate that through rational formulation design, controlled processing, and thoughtful stability considerations, aspirin IR tablets can achieve the desired balance of rapid drug release, mechanical strength, and long-term stability. The continuous advancement in excipient technologies and analytical tools further strengthens the potential to enhance aspirin's performance in IR dosage forms.

Although substantial progress has been made in optimizing aspirin IR formulations, several promising avenues remain for future exploration:

1. Advanced Excipient Technologies: Development of novel moisture-protective and multifunctional

excipients may provide enhanced stability and performance for aspirin formulations.

2. Particle Engineering Techniques: Approaches such as micronization, co-processing, and crystal engineering could improve solubility, dissolution rate, and compressibility of aspirin.
3. Application of Quality by Design (QbD): Integrating QbD principles into formulation development could lead to more robust, predictable, and optimized IR tablets through systematic understanding of Critical Quality Attributes (CQAs) and Critical Process Parameters (CPPs).
4. Improved Packaging Innovations: Research into moisture-barrier packaging materials and smart packaging systems may further prolong shelf life and protect aspirin from environmental degradation.
5. Green and Sustainable Manufacturing: Exploring eco-friendly processing methods with minimal solvent use and reduced energy consumption can support sustainable pharmaceutical production.
6. In-Depth Stability Modeling: Predictive stability studies using advanced modeling software may help forecast degradation pathways and improve formulation robustness.

With continuous advancements in formulation science, process engineering, and analytical technologies, the future holds substantial potential for developing more stable, efficient, and patient-friendly aspirin immediate-release tablets. These innovations will enhance therapeutic reliability while meeting modern regulatory and industrial expectations.

REFERENCES

[1] Aulton, M. E., & Taylor, K. (2018). Aulton's Pharmaceutics: The Design and Manufacture of Medicines (6th ed.). Elsevier.

[2] Allen, L. V., Ansel, H. C. (2021). Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems (12th ed.). Wolters Kluwer.

[3] Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (Eds.). (2022). Handbook of Pharmaceutical Excipients (9th ed.). Pharmaceutical Press.

[4] European Medicines Agency (EMA). Guideline on Quality of Immediate-Release Dosage Forms. EMA/CHMP/QWP; Latest Version.

[5] Rang, H. P., Dale, M. M., Ritter, J. M., Flower, R., & Henderson, G. (2019). Rang & Dale's Pharmacology (9th ed.).

[6] Goodman & Gilman. (2023). The Pharmacological Basis of Therapeutics (14th ed.). McGraw-Hill Education.

[7] Moore, J. W., & Flanner, H. H. (1996). Mathematical comparison of dissolution profiles. Pharmaceutical Technology, 20(6), 64–74.

[8] Eddington, N. D., Marroum, P. J., Uppoor, R., Hussain, A. S., & Augsburger, L. (1998). Development of dissolution testing methods. Journal of Pharmaceutical Sciences, 87(2), 167–171.

[9] Saito, M., et al. (2005). Stability characteristics of acetylsalicylic acid tablets under accelerated conditions. International Journal of Pharmaceutics, 303(1–2), 109–118.

[10] Sheskey, P., Cook, W. G., & Cable, C. G. (2017). Influence of excipients on tablet disintegration performance. Journal of Excipients and Food Chemicals, 7(3), 95–108.

[11] Florence, A. T., & Attwood, D. (2015). Physicochemical Principles of Pharmacy (6th ed.). Pharmaceutical Press.

[12] Augsburger, L. L., & Hoag, S. W. (2008). Design and manufacture of tablets. In: Pharmaceutical Dosage Forms: Tablets (Vol. 1–3). Informa Healthcare.

[13] Jivraj, M., Martini, L. G., & Thomson, C. M. (2000). An overview of the different excipients useful for the direct compression of tablets. Pharmaceutical Technology Europe, 12(4), 1–7.

[14] Patel, S., & Kaushal, A. (2019). Review on immediate-release tablet formulation technology. Asian Journal of Pharmaceutics, 13(1), 22–30.

[15] International Council for Harmonisation (ICH). ICH Q8: Pharmaceutical Development. Geneva: ICH Secretariat.

[16] World Health Organization (WHO). Technical Report Series: Stability Requirements for Pharmaceutical Products. WHO Press.