Ad-Dawaa' Journal of Pharmaceutical Sciences
ISSN: 2654-7392, E-ISSN: 2654-6973
Vol. 9, No. 1, June 2026, p. 131 – 143
DOI: https://doi.org/10.24252/djps.v9i1.65617

Preparation of Telmisartan Orally Disintegrating Tablets Based on Microencapsulation

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Article history:
Submited: 10-2-2026
Revised: 28-2-2026
Accepted: 15-3-2026

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Cite this article: Az-Zahra, D., Anggryanti, A., Hasanah, R., Nazwa, N. I., Annisa, N. N., Purwanto, A.. (2026). Preparation of Telmisartan Orally Disintegrating Tablets Based on Microencapsulation. Ad-Dawaa' J. Pharm. Sci. 9(1): 131-143.

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ABSTRACT

Introduction*: Telmisartan is an angiotensin II receptor blocker widely prescribed for hypertension management. As a Biopharmaceutics Classification System class II drug, it exhibits low aqueous solubility, which may limit its dissolution rate and oral absorption. Conventional tablets may also present swallowing difficulties, particularly in pediatric and geriatric patients.* ***Aims:*** *This study aimed to develop a microencapsulated telmisartan formulation incorporated into an orally disintegrating tablet (ODT) system to enhance dissolution behavior and optimize tablet characteristics.* ***Result:*** *Telmisartan was microencapsulated using the solvent evaporation method with Eudragit L100 at a 1:1 ratio and characterized by particle size analysis, X-ray diffraction, scanning electron microscopy, and Fourier transform infrared spectroscopy. ODTs were prepared by direct compression using sodium starch glycolate and evaluated for weight uniformity, hardness, friability, wetting time, disintegration time, and dissolution profile. Microencapsulation reduced particle size from 0.930 µm to 0.816 µm and decreased crystallinity. The tablets exhibited acceptable physical properties, including weight uniformity of 241.5 ± 2.6 mg, hardness of 2.4 ± 0.49 kg/cm^2, friability of 0.10 ± 0.02%, and a disintegration time of 26.83 ± 1.47 s. Dissolution testing showed a higher release rate for ODT compared with the conventional tablet, reaching 54.46% at 2 minutes and 62.12% at 5 minutes.* ***Conclusion*** *Microencapsulation combined with an ODT system improved the physicochemical characteristics and dissolution performance of telmisartan without compromising tablet quality.*

KEYWORDS*: Telmisartan, microencapsulation, orally disintegrating tablet, sodium starch glycolate, dissolution*

INTRODUCTION

Telmisartan is an angiotensin II receptor blocker widely prescribed for the management of hypertension. It is classified as a BCS class II drug, characterized by low aqueous solubility and high permeability (Bhagwat et al., 2025). Although its permeability is favorable, its low aqueous solubility may limit the dissolution rate, resulting in reduced drug absorption and suboptimal therapeutic effectiveness. Therefore, improving the dissolution behavior of telmisartan remains an important challenge in pharmaceutical formulation development. Telmisartan is commonly formulated as conventional tablets due to

their ease of administration and dose accuracy. However, this conventional dosage form may present swallowing difficulties and can produce an unpleasant or bitter taste, potentially reducing medication adherence, particularly among pediatric and geriatric patients. In Indonesia, specific epidemiological data regarding swallowing difficulties during medication intake remain limited. Nevertheless, Nayoan (2017) reported that approximately 22% of adults over 50 years of age experience dysphagia, which may negatively affect the success of pharmacotherapy.

To improve therapeutic efficacy and patient compliance, telmisartan can be formulated into an orally disintegrating tablet (ODT) dosage form. ODTs are designed to rapidly disintegrate in the oral cavity upon contact with saliva without the need for chewing or water, thereby providing greater convenience for patients with swallowing difficulties. Previous studies have reported that ODT formulations enhance patient acceptability and are particularly beneficial for individuals experiencing dysphagia. Moreover, ODTs demonstrate shorter wetting and disintegration times and may enhance drug dissolution compared with conventional tablets under similar formulation conditions (Mahrous et al., 2016).

Several previous studies have demonstrated that orally disintegrating tablets exhibit improved disintegration and dissolution characteristics compared with conventional tablets. For instance, an atenolol ODT formulation showed a wetting time of 9.33 ± 0.58 seconds, a disintegration time of 15.48 ± 1.16 seconds, and a dissolution rate of 95.23 ± 0.14% (Rani et al., 2017). These findings indicate that the incorporation of appropriate superdisintegrants and optimized excipient composition plays an important role in accelerating tablet disintegration and enhancing drug release performance. In addition, the formulation of candesartan cilexetil ODT using a combination of croscarmellose sodium (0.5%) and crospovidone (5%) demonstrated improved tablet characteristics, including reduced hardness, shorter wetting and disintegration times, and acceptable friability (Ayuningtyas et al., 2021).

These results further emphasize that formulation strategy and the selection of super disintegrants significantly influence the physical properties and dissolution behavior of ODT systems. With specific regard to Telmisartan, several studies have reported the development of ODT formulations using combinations of super-

disintegrants that demonstrated favorable disintegration and dissolution characteristics. For example, a Telmisartan ODT prepared using combined superdisintegrants exhibited a wetting time of 14 seconds, a disintegration time of 17 seconds, and a dissolution rate of up to 97.12% within 12 minutes (Upreti et al., 2024). These findings indicate that superdisintegrant selection plays an important role in accelerating tablet disintegration and improving drug release. Other formulation strategies have also been investigated to enhance the dissolution behavior of Telmisartan. Solid dispersion–based formulations using PEG 4000, meglumine, and Pharmaburst® 500 resulted in a dissolution rate of 83.1% within 5 minutes (Hussien et al., 2019) . In addition, the incorporation of a cyclodextrin– surfactant system in a Telmisartan ODT formulation produced a disintegration time of 15.4 seconds, achieved 90% drug dissolution within 7.3 minutes, and increased drug solubility from 0.006 mg/mL to 2.86 mg/mL (Potti et al., 2022). Various formulation approaches for improving the solubility and dissolution rate of BCS class II drugs, including the use of polymer-based microspheres, have also demonstrated enhanced dissolution performance (Gozali et al., 2021). These studies collectively suggest that modification strategies targeting solubility enhancement and rapid disintegration can substantially influence the dissolution behavior of Telmisartan formulations. However, the application of microencapsulation technology in the development of Telmisartan ODT has not been extensively investigated.

Despite these advantages, ODT formulations still have several limitations, including inadequate taste masking that may cause a bitter taste, low stability, limited permeability, and hygroscopic properties requiring special packaging (Ghourichay et al., 2021). Therefore, this study aims to develop an ODT formulation of Telmisartan using microencapsulation technology as a novel approach compared with previous studies. Microencapsulation is a pharmaceutical technique in which an active drug substance is surrounded or coated by a polymeric material to modify its physicochemical properties (Andayani et al., 2023). This technique uses a core material, polymers, and solvents to produce microcapsules ranging from 5–5,000 μm in size. Microencapsulation may help mask unpleasant taste or odor, reduce gastrointestinal irritation, combine incompatible substances, control drug release, and improve the stability of active pharmaceutical ingredients. By applying this technology to ODT formulations, it is expected to facilitate drug administration

for patients with swallowing difficulties (Ozkan, et. al, 2019).

Solvent evaporation was selected as the microencapsulation method because it provides better control over particle size and stability without the use of high temperatures, making it suitable for Telmisartan, which has low aqueous solubility and requires improved stability and controlled drug release (Budhraja et al. 2025). The incorporation of microencapsulated Telmisartan into an ODT system represents a rational strategy to overcome the dissolution limitations associated with this BCS class II drug while maintaining the rapid disintegration properties required for ODT dosage forms. This study hypothesizes that microencapsulation may reduce crystallinity and modify particle morphology, thereby improving the dissolution behavior of Telmisartan compared with conventional Telmisartan tablets.

MATERIAL AND METHODS

Materials

This study employed an experimental laboratory design and was conducted over four months, from July to October 2025, at the Pharmaceutical Formulation and Technology Laboratory, Faculty of Pharmacy, Muhammadiyah University of Banjarmasin. The materials used in the microencapsulation process included Telmisartan and Eudragit L100 in a 1:1 ratio, along with liquid paraffin, acetone, n-hexane, magnesium stearate, methanol, sodium hydroxide (NaOH), potassium dihydrogen phosphate (KH_2PO_4), and distilled water. The materials used in the formulation of orally disintegrating tablets (ODT) consisted of Telmisartan microcapsules, mannitol DC, sodium starch glycolate (as a superdisintegrant with varying concentrations), Avicel PH 102, magnesium stearate, aerosil, talc, aspartame, and mint flavor.

Telmisartan Microencapsulation Preparation Using Solvent Evaporation Method

Telmisartan microcapsules were prepared using the solvent evaporation method. (Rosi, 2022). Eudragit L100 (2 g) and telmisartan (2 g) were dissolved in acetone (10 mL) in a beaker (mass 1). Magnesium stearate (0.7 g) was dissolved in acetone (6 mL) in a separate beaker (mass 2). Both solutions were then added into a beaker containing liquid paraffin (100 mL) and homogenized using an Ultra-Turrax homogenizer at 4000 rpm for 10 minutes. The formed microcapsules were separated from liquid paraffin by filtration, washed with n-hexane to remove residual oil, and subsequently dried using a freeze dryer.

Microencapsulated Telmisartan ODTs

Microencapsulation Characteristics Test

Particle Size Analyzer (PSA)

The microcapsule size of the best formulation was measured using a Malvern Mastersizer Particle Size Analyzer (PSA) (Malvern Instruments). Analysis was performed using single-cell measurements in liquid media samples and the Dynamic Light Scattering (DLS) method. The measurement temperature and duration were 25ºC and 70 seconds, respectively (Putri et al., 2020).

X-Ray Diffraction (XRD)

X-ray diffraction analysis was conducted to evaluate the crystalline properties of telmisartan before and after microencapsulation. The samples were analyzed using Cu-Kα radiation filtered with a nickel filter at a voltage of 40 kV and a current of 30 mA. Data were collected over a diffraction angle (2θ) range of 10° to 80°, with a step size of 0.02° and a scanning speed of 2° per minute. This analysis was used to determine changes in the crystalline or amorphous characteristics of the material (Rosaini et al., 2018).

Scanning Electron Microscopy (SEM)

SEM analysis was performed on pure Telmisartan and Telmisartan-Eudragit microcapsule preparations. Prepare a sample measuring 1 spatula. Place the sample on a 1 cm holder that has been coated with carbon tab. Smooth the specimen on the carbon tab, then spray it to remove any specimen that does not stick to the carbon tab so it is not sucked during the vacuum process. Measure the height of the specimen that has been placed on the holder. Adjust the pressure conditions used, set the type of vacuum used and set the voltage (10 kV). Then vacuum and observe the morphology of the sample under various microscope magnifications (Rosaini et al., 2018).

Fourier Transformation Infra-Red Spectroscopy (FTIR)

Tests were conducted on pure Telmisartan and Telmisartan Eudragit microcapsules. A small sample was taken and the FTIR program was run. Then, rotate the sample counterclockwise and insert the sample into the sample holder. (Rosaini et al., 2018).

Preparation of ODT Preparations with Superdisintegrant Sodium Starch Glycolate

In this study, it was made by direct compression method using sodium starch glycolate as superdisintegrant (Table 1). Telmisartan and some of Aerosil were mixed evenly in a v mixer for ± 3 minutes. Then, some of Avicel PH 102 was added, mixed evenly in a v-mixer for ± 5 minutes. In the next stage, sodium starch glycolate as a superdisintegrant, aspartame, mint flavor, mannitol DC, and the remaining Avicel were

Table 1. Composition of Telmisartan ODT formulation with sodium starch glycolate

Component	(% w/w)	Function
Telmisartan Microcapsule	20	Active ingredient
Manitol DC	38	Filler
Sodium starch glycolate	4	Superdisintegrant
Avicel PH 102	30	Binder
Aspartame	1	Sweetener
Mint flavor	1	Flavoring agent
Magnesium stearat	1	Lubricant
Aerosil	3	Glidant
Talc	2	Anti-adherent

added.

These ingredients were mixed until homogeneous for ± 10 minutes. After the molding stage, the molding mass was mixed with magnesium stearate, talc and aerosil for 3 minutes using a v-mixer until homogeneous. The powder mixture was then molded into tablets (Rani et al., 2017).

Physical Evaluation of Tablets

Organoleptic

Organoleptics

Organoleptic evaluation was performed by observing the physical characteristics of tablets from each formulation, including color, odor, and shape of the prepared Telmisartan ODT (Rani et al., 2017).

Weight Uniformity

Weight uniformity was evaluated by weighing 20 tablets individually from each formulation and calculating the average weight. The acceptance criteria followed pharmacopeial requirements, where no more than two tablets deviate from the average weight beyond the acceptable limit (column A) and none deviate beyond column B (Sa'adah and Sandra, 2019).

Tablet Hardness.

Tablet hardness testing was conducted using 10 tablets from each formulation, and the hardness of each tablet was measured using a hardness tester. The results were expressed as the average value of the measurements. (Rani et al., 2017).

Tablet Friability

Twenty tablet samples were placed into the friability tester. The tester was operated at 25 rpm for 4 minutes. The weight of all tablets was then reweighed and the difference between the tablet weights before and after the test was calculated. The tablet friability percentage was calculated using the formula (Rani et al., 2017):

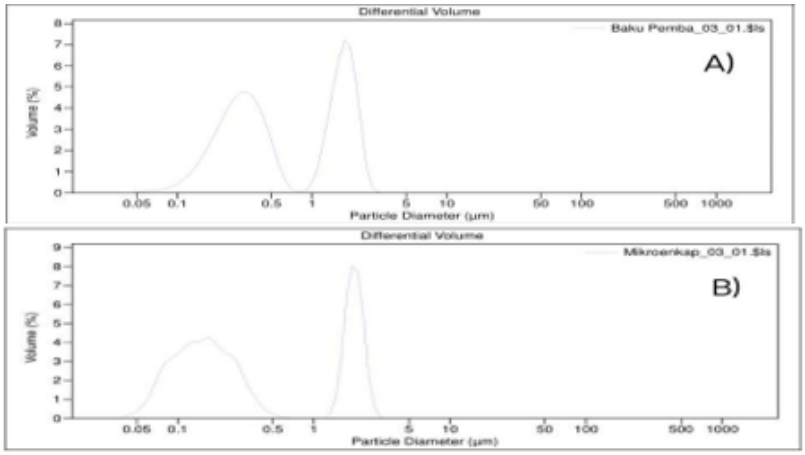


Figure 1. A) Telmisartan reference standard and B) microencapsulation of telmisartan

$$\% \text{ Friability} = \frac{a-b}{a} \times 100\%$$

where a is the total weight of tablets before testing and b is the total weight of tablets after testing.

Disintegration Time

Disintegration time was determined using six tablets from each formulation. Each tablet was placed in a disintegration tester containing 900 mL of medium at 37 ± 0.5°C. The time required for the tablet to completely disintegrate, with no palpable core remaining, was recorded as the disintegration time (Rani et al., 2017).

Dissolution

The dissolution test of Telmisartan ODT preparation was carried out in 0.1 N phosphate buffer pH 6.8 dissolution media with a volume of 900 ml. The dissolution tester used type 2 (paddle) with a speed of 50 rpm. The initial stage was to insert 3 tablets of each formula into the dissolution tester. Then, take samples of 5 ml per time unit, namely 2, 5, 10, 15, 20, 25, 30, 45, and 60 minutes. Then, return 5 ml of 0.1 N phosphate buffer pH 6.8 to the device. The dissolution tester. Then, take samples of 5 ml per time unit, namely 2, 5, 10, 15, 20, 25, 30, 45, and 60 minutes. Then, return 5 ml of 0.1 N phosphate buffer pH 6.8 to the device. The next stage was to determine the Telmisartan content of each sample using a UV-Vis Spectrophotometer at a wavelength of 274 nm (Rani et al., 2017).

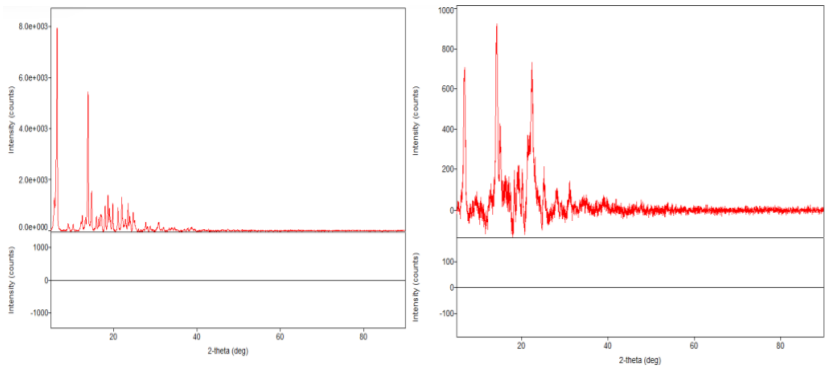
RESULTS AND DISCUSSION

The Characterization of Telmisartan Microencapsulation

Characterization tests (PSA, XRD, SEM, and FTIR) of pure Telmisartan compared with microencapsulated Telmisartan.

Particle Size Analyzer (PSA) Test

The PSA results showed a decrease in particle size from 0.930 µm to 0.816 µm (Figure 1). Although this is a relatively small reduction, smaller particle sizes generally increase the dissolution rate by providing a larger surface area for interaction with the dissolution medium. However, for BCS Class II drugs like Telmisartan, the phase



(a) (b)

Figure 2. (a) Standard temisartan, (b) microencapsulated telmisartan

transition from crystalline to amorphous is likely to have a more significant impact on dissolution. Amorphous forms typically exhibit higher solubility than crystalline forms due to their disordered structure, which allows for easier dissolution. Therefore, while the small decrease in particle size may contribute to a slight increase in dissolution rate, the transition to an amorphous form is probably the more crucial factor in improving Telmisartan's dissolution.

X-Ray Diffraction (XRD) Test

The diffractogram of standard Telmisartan (Figure 2) shows sharp peaks with high intensity, especially at 2θ 10–25° up to ±8000 counts, while in microencapsulation the peak intensity decreases drastically to ±800 counts and the peaks broaden. Some standard peaks are still visible, but with lower intensity, indicating a decrease in crystallinity or a shift towards an amorphous form. The peak intensity ratio (microencapsulated/ standard) was calculated at approximately 0.10, indicating a substantial reduction in crystallinity. The estimated degree of crystallinity decreased from ~85% in standard Telmisartan to 30% in the microencapsulated form, suggesting a significant amorphization during the encapsulation process. These results confirm that the interaction between Telmisartan and the encapsulant material produces a more amorphous phase than the initial raw material.

Scanning Electron Microscopy (SEM) Test

The observation results (Figure 3) showed that the raw Telmisartan particles were sharp and elongated with an average length of about 22.5 µm, while the microencapsulated particles became more irregular, fragmented, and smaller in size with the longest length of about 14.2 µm. Size analysis from SEM images (n = 20 particles per sample) confirmed a mean particle length reduction of approximately 36.9%, with scale bars of 10 µm used for reference in all images. This change is thought to be caused by the interaction

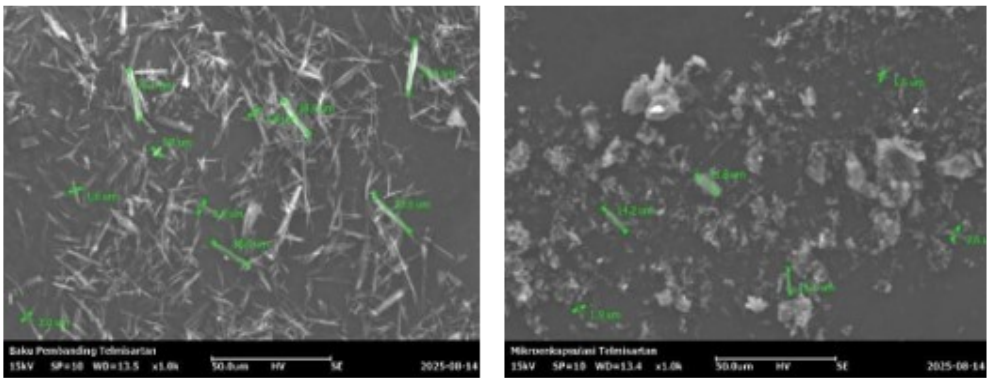


Figure 3. SEM test results

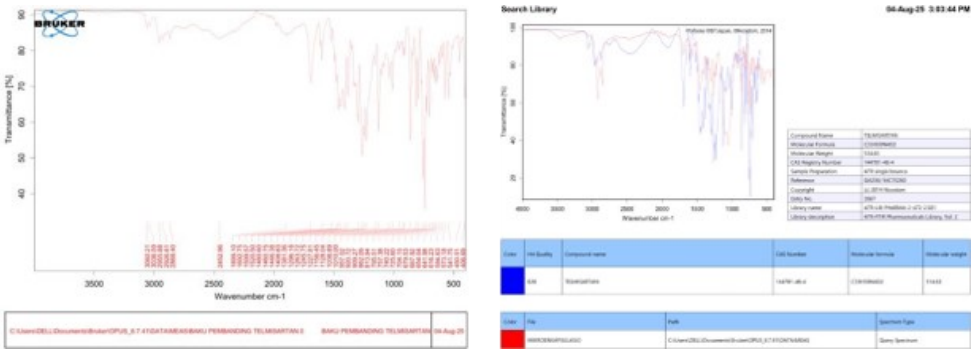


Figure 4. FTIR Test Results

between Telmisartan and the coating material which changes the surface structure of the particles. This indicates that the microencapsulation process isable to modify the morphology of Telmisartan, thereby improving the physicochemical and pharmaceutical characteristics of the preparation.

Fourier Transform Infrared Spectroscopy (FTIR) Test

A systematic peak assignment of the FTIR spectra (Figure 4) is presented as follows: the aromatic C–H stretching band appeared at 3060–3036 cm^{-1} in the standard Telmisartan; the N–H bending vibration was observed at ~1600 cm^{-1}; the C=O stretching of the carboxyl group appeared at ~1700 cm^{-1}; and the C–N stretching was detected at ~1250 cm^{-1}. Important peaks due to Telmisartan functional groups are still visible in the microencapsulation spectrum, but some experience shifts and changes in intensity, indicating interactions with the encapsulant material. The standard spectrum displays a band of 3060–3036 cm^{-1} (aromatic C–H), while the encapsulant material has a broad O–H band around 2452 cm^{-1}. In the microencapsulation, a broader O–H band appears at 2450–2500 cm^{-1}, indicating the formation of hydrogen bonds between Telmisartan and the encapsulant. These shifts and 6 peak changes confirm that microencapsulation not only encapsulates Telmisartan, but also modifies the environment of its functional

Table 2. Physical evaluation results of tablets

Physical Evaluation	Evaluation Results	Condition
Organoleptic	White and round tablets	White and round tablets
Weight Uniformity	241.5 ± 2.6 mg	223.4 – 259.6 mg, (Column A) 205.3 – 277.7 mg, (Column B) (FI VI, 2020)
Hardness	2.4 ± 0.49 kg/cm^2	2-4 kg/cm^2, (Rani et al, 2017)
Friability	0.10 ± 0.02%	<1, (Rani et al, 2017)
Disintegration Time	26.83 ± 1.47 seconds	<30 Seconds, (Rani et al, 2017)

groups through heteromolecular interactions.

Physical Evaluation of Tablets

Evaluation of the physical properties of the tablets (Table 2) showed that the preparation was round and white in color, in accordance with the expected characteristics of ODT. The weight uniformity test on 20 tablets showed an average result of 241.5 ± 2.6 mg and still met the requirements of the Indonesian Pharmacopoeia, which indicates that the mixing and molding process took place evenly. The average hardness value of 2.4 ± 0.49 kg/cm^2 from ten tablets indicated that the tablets had sufficient strength to maintain their shape during the manufacturing and storage process, but were still easily disintegrated in the oral cavity. The average friability value of 0.10 ± 0.02% from 20 tablets was also well below the maximum limit of 1%, indicating that the tablets were quite strong and not easily damaged. The average disintegration time of 26.83 ± 1.47 seconds from 6 tablets indicated that the tablets could disintegrate quickly. These results are in accordance with the characteristics of ODT preparations which are expected to disintegrate in less than 30 seconds.

Image of Wetting Time Test Results of Orally Disintegrating Telmisartan Tablets test results showed that the wetting time of the Telmisartan ODT tablet was 22 seconds with a water absorption ratio of 98%, indicating that the tablet was able to absorb liquid almost twice its initial weight. This ability is influenced by the presence of sodium starch glycolate, which is hydrophilic and can draw liquid into the tablet matrix through a swelling mechanism. The presence of this material helps form micropores that facilitate water entry and spread evenly throughout the tablet, resulting in good water absorption capacity.

The dissolution profile of the Telmisartan ODT was compared with a self-made conventional (non-disintegrating) Telmisartan tablet of the same dose strength (40 mg), prepared without super disintegrant and without microencapsulation, under identical test

conditions (900 mL phosphate buffer pH 6.8, 50 rpm, 37 ± 0.5°C). This comparison was conducted to specifically evaluate the contribution of the ODT formulation strategy including microencapsulation and sodium starch glycolate to the dissolution enhancement. Test results showed that the percentage of Telmisartan dissolved in the ODT preparation was higher than that of conventional tablets. At the 2nd minute, the Telmisartan ODT had a dissolution percentage of 54.46%, while the conventional tablet was only 10.17%. At the 5th minute, the ODT dissolution value increased to 62.12%, whereas the conventional tablet reached only 34%. Concentration Absorbance Equation of straight-line Y=bx + a Y= 0.0368x + 0.2373 (A = 0.2373; B = 0.0368; R^2 = 0.9932).

The concentration–absorbance equation obtained in this study was based on a linear regression analysis, which is commonly used in UV-Vis spectrophotometric measurements to determine the relationship between drug concentration and absorbance value. The equation obtained was: (y = 0.0368x + 0.2373) In this equation, Y represents the absorbance value measured by the instrument, while X represents the concentration of Telmisartan. The value A (0.2373) is the intercept, which means the absorbance value when the concentration is zero. Meanwhile, B (0.0368) is the slope of the line, showing how much the absorbance increases when the concentration increases. The R value refers to the correlation coefficient that describes how strong the relationship is between concentration and absorbance. Then, R^2 or coefficient of determination shows how well the data fit the straight-line equation. Since the R^2 value in this study was 0.9932, it means the data had a very strong linear relationship and the calibration curve was considered accurate and reliable for the dissolution analysis of Telmisartan ODT preparations.

CONCLUSION

Microencapsulation using Sodium Starch Glycolate successfully enhanced the physical characteristics and dissolution performance of Telmisartan orally disintegrating tablets (ODTs) compared to conventional tablets. Characterization via PSA, XRD, SEM, and FTIR confirmed reduced particle size and crystallinity, fragmented morphology, and favorable heteromolecular interactions. All physical evaluation parameters met standard ODT requirements, achieving a 79.15% cumulative drug release at 60 minutes. While these results demonstrate significant in vitro improvements in solubility and physical quality, further in vivo studies are required to validate its bioavailability, pharmacokinetics, and therapeutic efficacy.

ACKNOWLEDGEM-ENT

The authors would like to express their sincere gratitude to the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) for the financial support provided during the course of this research. Authors also extend their thanks to the academic community of Universitas Muhammadiyah Banjarmasin and all other parties involved.

REFERENCES

Andayani, R., Hasbi, and Febriyenti. (2023). Analysis of Chlorpheniramine Maleate in Microcapsules Formulation with Eudragit E PO Polymer Using Spray Drying Method. *Research Journal of Pharmacy and Technology,* 16(11):5279–82.

Ayuningtyas, N. D., Febrianto, Y., and Lutfi, T. (2021). Formulasi Orally Disintegration Tablet (ODT) Candesartan Cilexetil dengan Croscarmellose Sodium dan Crospovidone Sebagai Superdisintegrant. *Jurnal Farmasi & Sains Indonesia,* 4(1):21–28.

Bhagwat, G., Arkate, R. A, H., Shaikh, S.I.P. dan Vishwakarma, S.R. (2023). Improvement in Solubility of BCS Class II Drug: Telmisartan. *World Journal of Biologi Pharmacy and Health Sciences*, 14 (1): 222-230.

Budhraja, Umang, Prasad, A., Shaikh, M. F., and Mishra, A. (2025). Review on Techniques of Microencapsulation. *Asian Journal of Pharmacy and Technology* 127–33. doi:10.52711/2231-5713.2025.00021.

Ghourichay, Parsa, M., Kiaie, S. H., Nokhodchi, A., and Javadzadeh, Y. (2021). Formulation and Quality Control of Orally Disintegrating Tablets (ODTs): Recent Advances and Perspectives. *BioMed Research International,* 2021(1): 6618934. doi: 10.1155/2021/6618934.

Gozali, D., Rusdinana, T., and Purwanto, A. (2021). Peningkatan Laju Disolusi dan Kelarutan Gliklazid Menggunakan Teknik Nano-Confined Coamorphous (NCCA) dari Kokristal Ke Keadaan Koamorf. *Jurnal Ilmu Dan Inovasi Fisika,* 5(1):41–49.

Hussien, M. A., Essa, E. A., and El-Gizawy, S. A.. (2019). Investigation of the Effect of Formulation Edditives on Telmisartan Dissolution Rate: Development of Oral Disintegrating Tablets." *European Journal of Biomedical and Pharmaceutical Sciences,* 6(4):12–20.

Kementerian Kesehatan Republik Indonesia (2020). *Farmakope Indonesia* (6th ed.). Jakarta, Indonesia: Ministry of Health of the Republic of Indonesia.

Mahrous, G. M., Kassem, M. G., Ibrahim, M. A., and Auda, S. H. (2016). Formulation and Evaluation of Orally Disintegrating Clopidogrel Tablets. *Brazilian Journal of Pharmaceutical Sciences,* 52:309–18.

Nayoan, C. R. (2017). Gambaran Penderita Disfagia yang Menjalani Pemeriksaan Fiberoptic Endoscopic Evaluation of Swallowing di RSUP DR. Kariadi Semarang periode 2015-2016. *Healthy Tadulako Journal (Jurnal Kesehatan Tadulako)*, 3 (2): 47-56.

Ozkan, G., Franco, P., Marco, I. D., Xiao, J., and Capanoglu, E. (2019). A Review of Microencapsulation Methods for Food Antioxidants: Principles, Advantages, Drawbacks and Applications. *Food Chem*. 272: 494-506.

Potti, L., and Avula, P. R. (2022). Orodispersible Tablet of Telmisarta

Through Cyclodextrin-Surfactant Complexation: A Quality by Design Approach. *Journal of Research in Pharmacy*, 26(5): 1202-1213.

Putri, A., Rusli, M. S., and Setyaningsih, D. (2020). Enkapsulasi Campuran Minyak Atsiri sebagai Produk Sediaan Aromaterapi dengan Teknik Koaservasi Kompleks. *Jurnal Teknologi Industri Pertanian*, 30(3): 299-307.

Rani, K. C., Parfati, N., and Putri, J. W. (2017). Formulasi Sediaan Orally Disintegrating Tablet Atenolol dengan Sodium Starch Glycolat sebagai Superdisintegran. *Jurnal Farmasi Sains dan Komunitas*, 14(1): 55-64.

Rosaini, H., Halim, A., and Astuti, R. (2018). Mikroenkapsulasi Pirazinamida Menggunakan Mannitol dengan Metode Emulsifikasi Penguapan Pelarut. *Jurnal Farmasi Higea*, 10(1): 57- 67.

Rosi, D. H. (2022). Mikroenkapsulasi Parasetamol Menggunakan Eudragit L 100 sebagai Penyalut. Sitawa: *Jurnal Farmasi Sains dan Obat Tradisional*, 1(2): 92-100.

Sa'adah, H., and Sandra, A. A. (2019). Formulasi Orally Disintegrating Tablet (ODT) Asetosal dengan Variasi Konsentrasi Kombinasi Avicel. *Jurnal Ilmiah Ibnu Sina*. 4(1): 31-39.

Upreti, B., and Sah, S. K. 2024. Formulation and Evaluation of Oral Disintegrating Tablet of Telmisartan Using Superdisintegrants. *International Journal of Novel Researh and Development*, 9 (7): 945-9