Preparation and physicochemical characterization of meloxicam orally fast disintegration tablet using its solid dispersion

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Meloxicam (MLX) is a non-steroidal, anti-inflammatory drug that is prescribed in the treatment of rheumatoid arthritis and osteoarthritis. MLX is practically insoluble in water and exhibits a slow onset of action. In this study, MLX solid dispersions (MLX SDs) were prepared to improve the water solubility of this poorly water-soluble drug. Then orally disintegrating tablets (ODT) of MLX were developed using MLX SD to decrease the onset of action of this drug. MLX, poloxamer 188, and crospovidone of different ratios were melted in molten poloxamer 188 as a hydrophilic carrier. The optimum SD with the highest saturation solubility in water (13.09±0.34 microgram/mL) consisting of MLX: poloxamer 188: crospovidone in the ratio of 1:2:0 was used for the preparation of MLX ODTs. MLX ODTs were prepared by the direct compression method and optimized by the 2^3 factorial design. The effect of the superdisintegrant concentration, the mannitol–avicel ratio, and the level of compression force on the disintegration time, hardness, and percent of dissolved MLX from MLX ODTs after 30 min was evaluated. DSC and XRD analysis approved an amorphous form of MLX in SDs. The optimized ODT formulation containing 10% of superdisintegrant, and mannitol and avicel in the ratio of 4:1 respectively was compressed using a high level of compression force. The optimized ODT showed hardness (34.37±2.1 N) and friability (1.26±0.04%). This formulation showed a rapid disintegration in 12.66±2.5 seconds, which 82.66±5.1% of the MLX released within 30 min. MLX ODTs, prepared from MLX SD, could be introduced as a suitable dosage form of MLX with improved solubility and the onset of action.

Keywords: Meloxicam/physicochemical characterization. Meloxicam/onset of action. Solubility.

INTRODUCTION

Meloxicam (MLX) is a non-steroidal anti-inflammatory drug that is prescribed in the treatment of rheumatoid arthritis and osteoarthritis with low gastrointestinal complications (Pairet *et al.,* 1998; Distel *et al.,* 1996; Ahmed, Khanna, Furst, 2005; Aoki *et al.,* 2006). MLX is practically insoluble in water (belonging to BCS Class II) and exhibits a slow oral absorption and slow onset of action (Budavari *et al.,* 2001; Ghorab *et al.,* 2004). A rapid onset of action is important for patients, particularly under the pain condition of rheumatism and osteoarthritis. Consequently, a suitable oral dosage form of MLX, with enhanced aqueous solubility, could facilitate

its oral absorption and reduce its onset of action for the treatment of acute pain. Different methods such as salt formation (Serajuddin*,* 2007), emulsification (He, He, Gao, 2010), and nano-pulverization (Merisko-Liversidge, Liversidge, Cooper, 2013) had been used to improve the solubility and bioavailability of poorly soluble drugs. The preparation of solid dispersion (SD) is a feasible and effective method to improve the dissolution bioavailability of poorly water-soluble drugs including MLX (Leuner, Dressman, 2000). SDs are dispersions of one or more active pharmaceutical ingredients (API) in an inert carrier or matrix such as biodegradable polymers in solid state, prepared by melting (fusion), solvent, or a melting–solvent method (Chiou, Riegelman, 1971). It has been suggested that orally disintegrating tablets (ODT) have a faster onset of action compared to conventional tablets, and are more appropriate for the treatment of acute pain (Rauck *et al.,* 2009). In addition, ODTs could reduce dysphagia in older patients suffering from arthritis (Shen *et al.,* 2007). With

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these in mind, the objective of this study was to enhance the solubility of MLX through the preparation of its SDs by the melting method and then decrease its onset of action by the preparation of ODTs from the prepared solid dispersion of this poorly water-soluble drug.

MATERIAL AND METHODS

Material

Poloxamer188 was supplied by BASF (Germany). Crospovidone was purchased from Sigma-Aldrich (Germany). Meloxicam (MLX), mannitol, microcrystalline cellulose (Avicel PH-101), aspartame and magnesium stearate were purchased from the Farabi Pharmaceutical Company (Iran). All other solvents and chemicals were of an analytical grade.

Preparation of SD of meloxicam with poloxamer188

Accurately weighed quantities of MLX and crospovidone in different ratios were dissolved in melted poloxamer 188 and mixed carefully to obtain a homogenous mixture. The amount of MLX, crospovidone and poloxamer188 utilized for the preparation of MLX solid dispersions (MLX SD) are mentioned in Table I. After the preparation of homogenous mixtures, the prepared mixtures were immediately cooled in ice.

Preparation of physical mixtures of MLX and carriers

The physical mixtures were prepared by weighing the calculated amounts of MLX, poloxamer 188, and crospovidone in the same ratio of solid dispersion samples and mixing them in a mortar by triturating. The resultant physical mixtures were passed through a 16-mesh sieve.

Characterization of SD

Drug content determination in SD samples

An accurately weighed amount of each solid dispersion sample was dissolved in 5 mL of methanol and, then, 1 mL of 0.1 N NaOH was added. A phosphate buffer of pH 7.5 was added until the volume reached 100 mL. The resulting suspension was filtered through a 0.22-μm filter. The concentration of MLX was determined spectrophotometrically at 362 nm (UV mini/420 Shimadzo, Japan). The concentration of each sample was determined in triplicates and the mean value and standard deviation were reported.

Determination of saturation solubility

Saturation solubility studies were performed on pure MLX, physical mixtures, and SD samples. An excess amount of the samples was added to a volumetric flask containing 20 mL of distilled water and stirred at 100 rpm for 48 h at 25 °C. The resulting suspension was filtered through a 0.22-μm filter. The concentration of MLX was determined spectrophotometrically at 362 nm. The solubility of each sample was determined in triplicates and the mean value and standard deviation were reported.

Differential scanning calorimetry (DSC) analysis

The thermal behaviors of MLX, poloxamer 188,

TABLE I - The amount of MLX, poloxamer 188 and crospovidone that utilized for preparation of MLX SDs and the characteristics of prepared MLX SDs

Formulation	MLX	Poloxamer	MLX/ poloxamer 188 ratio	Crospovidone	Saturation solubility (μg/ml)	Drug content %	Saturation solubility of physical mixture (μg/ml)
SD1	200 mg	200 mg	1	-----	10.41±1.71	82.7±2.36	8.43±1.142
SD2	200 mg	400 mg	2	-----	13.09±0.34	92.4±3.14	9.01±0.345
SD3	200 mg	800 mg	4	-----	12.1±1.19	94.1±3.16	9.17±0.239
SD4	200 mg	200 mg	1	200 mg	2.6±0.011	74.8±4.25	7.1±0.471
SD5	200 mg	400 mg	2	200 mg	3.1±0.38	84.1±2.85	8.6±0.609
SD6	200 mg	800 mg	4	200 mg	4.3±0.305	82.5±2.45	8.79±0.61

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crospovidone, selected sample of SDs with higher saturation solubility and their physical mixture were analyzed using NETZSCH DSC 200 F3 instrument (NETZSCH, Germany). Five milligrams of samples were placed in aluminum pans. The samples were heated from 20 to 280 °C at a scanning rate of 10 °C/min. The melting point and enthalpy of fusion were automatically calculated using the software provided.

XRD Analysis

The crystallinity of MLX, poloxamer188, crospovidone, and the selected samples of SDs with higher saturation solubility and their physical mixture were evaluated with an X-ray diffractometer (Philips X'PERT, Germany). The diffraction patterns were measured with a voltage of 40 kV and a current of 30 mA. X-ray diffraction data were collected at room temperature in the range of $10° < 2\theta < 40°$.

Experimental design

A 2^3 full-factorial experimental design was applied to determine the optimum condition for the preparation of MLX orally disintegrating tablets (MLX ODTs) using the Design-Expert 7 software (State Ease. Inc., Minneapolis, MN, USA). The percent of crospovidone as a superdisintegrant (X1), the mannitol–avicel ratio (X2), and the compression force applied for tablet compression (X3) were selected as independent variables. Each factor was set at high and low levels. The actual values of different variables are given in Table II. Eight formulations of MLX ODTs (F1 to F8) were prepared according to the design as shown in Table II. The hardness, disintegration time, and the percent of meloxicam that dissolved in the dissolution medium after 30 min. were taken as response parameters.

TABLE II - The actual values of different independent variables that used for determination of the optimum conditions for preparation of MLX orally disintegrating tablets

Variable	High Level	Low level
Percent of disintegrant	10%	5%
Mannitol/avicel ratio	4	2
Compression force	High	low

Preparation of orally disintegrating tablets (ODT)

ODT of MLX was prepared by the direct compression method. All ingredients were separately passed through a 60-mesh sieve. MLX SD, mannitol, avicel, crospovidone (as superdisintegrant) and aspartame (as sweetener) were accurately weighed and properly mixed up. The blends were lubricated with 1% magnesium stearate. An evaluation of the mixed blends of MLX SD and excipients were carried out for angle of repose, bulk density, tapped density, compressibility and flowability (Lieberman, Lachman, 1989).

The tablets were directly compressed using a single-punch tableting machine (Erweka AR 4100, Germany) equipped with a 6-mm round flat punch. The tablets were compressed to a target weight of 150 mg.

Characterization of MLX ODTs

Drug content determination in tablets

Ten tablets from each batch were weighed separately. Each tablet was accurately weighed, dissolved in 5 mL of methanol and 1 mL of 0.1 N NaOH and the volume was made up to 100 mL with PBS (pH 7.5) and stirred until MLX was dissolved completely. The resulting suspension was filtered through a 0.22-μm filter. The concentration of MLX was determined spectrophotometrically at 362 nm. The result of each sample was determined in triplicate and the mean value and standard deviation were reported.

Determination of friability

A friability analysis was performed on 20 tablets at a speed of 25 rpm with tablets dropping from a height of six inches for 100 revolutions using a Roche type friabilitor (Erweka, TB-24, Germany). The accurate weights of the tablets were determined before and after the test. The friability was measured as a percentage of weight lost during a standardized abrasion.

Tablet disintegration time

The *in vitro* disintegration time of MLX ODTs was determined using an Erweka ZT (Germany) disintegration apparatus with 1000 mL of purified water, maintained at 37 ± 0.5 °C. The disintegration time was recorded once the tablets were completely disintegrated and passed through the mesh. Six tablets per formulation were tested and the mean value and standard deviation reported.

Tablet hardness

The hardness of MLX ODTs was evaluated by individually measuring the breaking strength in the radial

direction of 8 tablets using a tablet hardness tester with an Erweka TBH 30 MD equipment (Germany).

Dissolution test

The release rate of MLX from MLX ODTs (n=3) was determined using a USP apparatus Type II at 75 rpm (Electro lab, TDT-08L). The dissolution test was performed using 900 mL of phosphate buffer pH 7.5 as a dissolution medium, at 37 ± 0.5 °C. A sample (2 mL) of the dissolution medium was withdrawn from the dissolution vessels at 2, 5, 10, 15, 20 and 30 min and replaced with a fresh dissolution medium. The samples were filtered through a 0.22-µm membrane filter. The absorbance of these solutions was measured at 362 nm using a Shimadzu spectrophotometer. The cumulative percentage of the release of MLX was calculated using an equation obtained from a standard curve.

RESULTS AND DISCUSSION

Saturation solubility of MLX SDs and physical mixtures

The results of the solubility studies indicated that pure MLX had a very low solubility in water at 25 °C (6.58 ± 0.21 µg/mL). The saturation solubility of MLX increased in the presence of poloxamer 188 and crospovidone in the physical mixtures. An increase in the concentration of poloxamer 188 in the physical mixture samples increased the saturation solubility of MLX. This phenomenon could be attributed to an improvement of the MLX wettability because of high water solubility of poloxamer 188 (Jung *et al.,* 1999). As shown in Table I, MLX SDs that contain MLX and poloxamer 188 (SD1, SD2 and SD3) show a significant increase in saturation solubility compared to the pure MLX and physical mixtures with the same ratios (p value<0.05). In SD1 and SD2, the saturation solubility of MLX increased after the amount of poloxamer 188 was raised. This was because of the high water solubility of poloxamer 188 (Jung *et al.,* 1999). The preparation of the dosage form of solid dispersions (SDs) is a critical aspect that should be considered by scientists. The pulverization of the solid dispersions (SDs) prepared by the melting method is difficult. In addition, these SDs are often soft and tacky and have poor flow characteristics. Consequently, the addition of more excipients to the SDs is often necessary (Serajuddin, 1999; Leuner, Dressman, 2000; Shibata *et al.,* 2009). These difficulties can be overcome by the addition of crospovidone, as a carrier, to SDs (Fujii *et al*, 2005;

Shibata *et al.,* 2009). However, crospovidone does not melt or dissolve in melted poloxamer but crospovidone possesses several useful characteristics that can improve the SD proprieties when added to them. Firstly, a good flow property and compressibility of crospovidone can improve the fluidity and tableting ability of the SD powder (Fujii *et al.*, 2005). Secondly, the same chemical structure of crospovidone and polyvinylpyrrolidone (PVP), which is commonly used as a carrier of SDs (Leuner, Dressman, 2000), can improve the water solubility of poorly soluble drugs in SDs.

In this study, crospovidone was added to three formulations of MLX SDs to improve their flow and compressibility properties. But the saturation solubility of MLX SD samples that contained crospovidone (SD4, SD5, and SD6) was lower than the values predicted, according to the saturation solubility of the physical mixtures having the same ratios (Table I). The lower saturation solubility of MLX SDs that contained crospovidone (SD4, SD5, and SD6) compared to the predicted value may be related to a decrease in the water sorption of MLX SDs due to MLX-crospovidone interaction in the solid dispersion. The interaction could decrease the number of available polar groups that could interact with water during the water sorption and dissolution phenomena. Moreover, the formation of the gel formed by crospovidone around the solid dispersions could increase the viscosity in the donor phase and decrease the saturation solubility of MLX (Jung *et al.,* 1999; Punčochová *et al.,* 2014).

As shown in Table 1, batch number SD2 (containing MLX: poloxamer 188: crospovidone in the ratio 1:2:0) exhibited the maximum saturation solubility equal to 13.09 ± 0.347 µg/mL and was used for the preparation of MLX ODTs.

Drug content of MLX SDs

The prepared MLX SDs showed excellent entrapment of MLX. The MLX content in the solid dispersions was found to be in the range of 74.8 ± 4.25 to $94.1 \pm 3.16\%$ as shown in Table I. Batch SD3 formulation (containing MLX: poloxamer 188: crospovidone in the ratio of 1:4:0) showed the highest drug content of $94.1 \pm 3.16\%$, while batch SD4 (containing MLX: poloxamer 188: crospovidone in the ratio of 1:1:1) showed the least drug content of $74.8 \pm 4.25\%$.

Differential scanning calorimetry (DSC) analysis

A DSC analysis was performed in order to screen the solid-state properties of solid dispersions (SDs) and

physical mixture samples. This analysis could be used to evaluate any interaction between MLX, poloxamer 188, and crospovidone. The DSC thermograms of poloxamer 188, crospovidone, pure MLX, SD2 (MLX: poloxamer 188: crospovidone ratio=1:2:0), SD5 (MLX: poloxamer 188: crospovidone ratio=1:2:1) and MLX, poloxamer 188, and crospovidone physical mixture have been depicted in Figure 1. MLX showed a sharp endothermic peak at 262.5 °C, indicating its melting points. Poloxamer 188 showed a sharp endothermic peak at 60.6 °C, indicating its melting. The DSC thermogram of physical mixture showed two endothermic peaks at 55.4 °C and 250.5 °C, indicating the melting points of poloxamer 188 and MLX respectively. The presence of polymer in the physical mixture sample decreased the melting temperature of MLX and its fusion enthalpy, perhaps due to the miscibility of drug/polymer, thus resulting in a partial dissolution of MLX in polymers during the heating process (Jahangiri *et al.,* 2015; Shah *et al.,* 2007). Furthermore, these reductions in the melting point and enthalpy of fusion were greater for solid dispersion samples (SD2 and SD5). The melting temperature of MLX and enthalpy of fusion were 250.5 °C and ΔH=422 J/g for physical mixture, while these records were 209.6 °C and ΔH=97.98 J/g for SD2 and 207.3 °C and ΔH=209.5 J/g for SD5. These results show that the method of solid dispersion preparation could generate a more amorphous state of MLX in solid dispersion samples (because of a lower melting point) and also produce a more homogenous matrix of drug/polymer compared to physical mixtures (because of a lower enthalpy of fusion). Similar results had been reported before for rofecoxib and poloxamer 188 (Shah *et al.,* 2007; Barzegar-Jalali *et al.,* 2012).
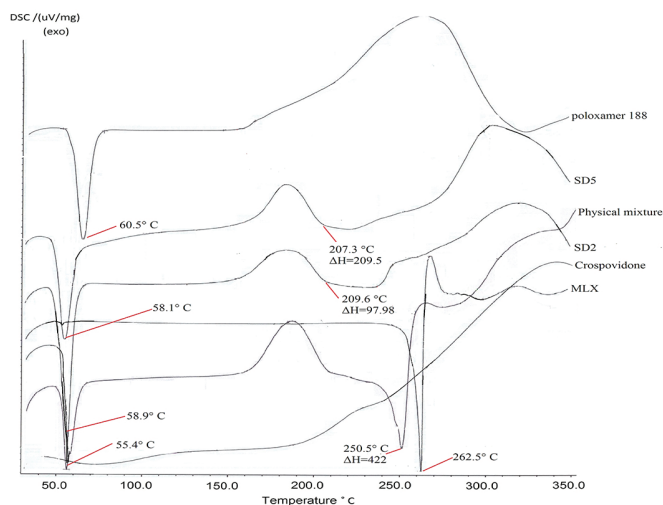
FIGURE 1 - The DSC thermograms of poloxamer 188, crospovidone, pure MLX, physical mixture of MLX and polymers and MLX SDs (SD2 and SD5).

XRD studies

The XRD pattern of pure MLX, crospovidone, poloxamer, MLX SDs (SD2 and SD5), and physical mixture are exhibited in Figure 2. X-ray diffraction of MLX showed sharp peaks at *2θ* values of 13°, 14.9°, 18.5° and 25.7°. The X-ray diffraction spectrum of crospovidone exhibited a halo pattern, indicating a completely amorphous state of these polymers. Moreover, the X-ray diffraction spectrum of poloxamer 188 showed characteristic peaks at 18.2° and 25.1°. The intensity of the MLX characteristic peaks in the physical mixture of MLX and polymers reduced due to the polymer dilution effect, while a significant decrease in the intensity of characteristic peaks of MLX in MLX SDs, compared to pure MLX, suggested a significant reduction in MLX crystallinity due to MLX amorphization and its incorporation in the carrier structure (Barzegar-Jalali *et al.,* 2012).
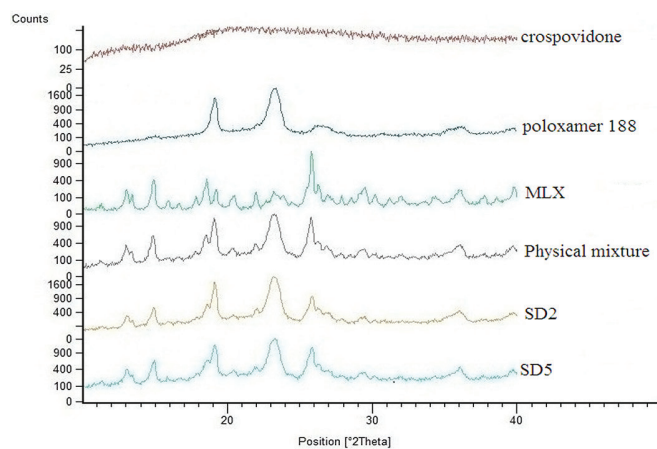
FIGURE 2 - XRD pattern of pure MLX, poloxamer 188, crospovidone, their physical mixture and MLX SDs (SD2 and SD5).

Preparation and characterization of ODTs

The optimized MLX SD, which showed the highest saturation solubility (SD2), was selected to develop MLX ODTs. The ODT compositions in this study are listed in Table III.

On a large scale, the flowability of powder blends could affect the content uniformity of tablets. Thus powder blends were evaluated for Hausner's ratio and Carr's index before tablet compression. Hausner's ratio and Carr's index of powder blends were less than 1.2 and 11 respectively, indicating a good flowability of powder blends (Shah, Tawakkul, Khan, 2008). MLX ODTs were prepared by the direct compression method because it is an easy and low-cost method (Medina, Kumar, 2006).

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TABLE III - Factorial design of MLX ODTs (F1 to F8) and the response parameters

Ingredients (mg/tablet)	Formula code							
	F1	F2	F3	F4	F5	F6	F7	F8
MLX-SD (equivalent 7.5 mg MLX) (mg)	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3
Mannitol (mg)	76.8	92.16	71.8	86.16	76.8	92.16	71.8	86.16
Avicel (mg)	38.4	23.04	35.9	2154	38.4	23.04	35.9	21.54
Mannitol/ Avicel ratio	2	4	2	4	2	4	2	4
Crospovidone (mg)	7.5	7.5	15	15	7.5	7.5	15	15
Aspartam (mg)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Mg stearate (mg)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Total weight (mg)	150	150	150	150	150	150	150	150
Force (kN)	low	low	low	low	high	high	high	high
Hardness	23.25±5.8	25.75±4	22.42±5.5	17.87±3.6	44.87±4.3	45.5±5.4	45.75±6.1	34.37±2.1
Disintegration time	18±13.8	25±5	13.33±1.1	14.3±3.6	31.6±4.3	32.5±3.1	12±2	12.66±2.5
% of dissolved meloxicam after 30 min	76.36±3.4	79.33±4.9	77.2±3.06	80.4±1.6	77.8±4.3	80.16±2.5	78.1±3.91	82.66±5.1
Friability%	1.34±0.08	0.88±0.03	1±0.054	1.33±0.04	0.87±0.06	1.12±0.03	0.7±0.09	1.26±0.04

The average MLX content of the prepared MLX ODT formulations were in the range of 74.8±4.25-94.1±3.16% and met the United States Pharmacopeia (USP) content uniformity requirements (USP, 2007).

Friability

Tablet friability could reflect the tablet's physical strength. The acceptable friability range for ODTs was mentioned to be 0.95% to 1.5% (Mendes, Anaebonam 1990). The friability of conventional tablets must be less than 1% (USP, 2006). The friability of the prepared MLX-ODT formulations did not exceed 1.34±0.08% (Table III). Moreover, no tablet had cracked, split or broken in formulations.
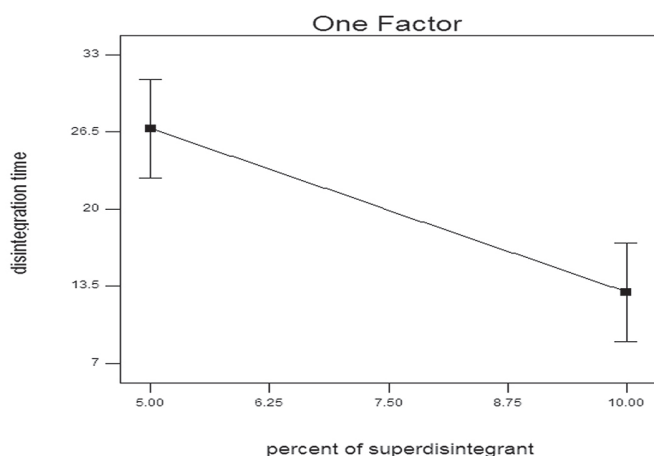
Disintegration time

ODTs should disintegrate rapidly after placement in the mouth, thus the disintegration time is one of the most crucial characteristics of ODTs. Moreover, ODTs should have sufficient hardness and friability to withstand handling without substantial breakage and attrition. Ideally, ODTs showed a disintegration time of 60 s or less, and showed the hardness of at least 40 N (Ramtoola, Pabari, Kelly, 2008). However, increasing the hardness of tablets could increase the disintegration time and decrease the amount of dissolved drug after known time. One of the important aims of this study was the preparation of ODTs with hardness greater than 40 N without any significant effect on the disintegration time and the percentage of the dissolved MLX after 30 min. Therefore, the crucial responses that were selected as dependent variables were disintegration time, hardness, and the percent of dissolved MLX in the dissolution media after 30 min. The results obtained for the disintegration time of the prepared MLX-ODT tablets are summarized in Tables III. Six formulations

showed a disintegration time of lower than 30 sec and two formulations showed a disintegration time more than 30 sec. F6 showed the longest disintegration time (32.5±3.1 sec) and F7 showed the shortest disintegration time (12±2 sec). An ANOVA analysis showed that only one factor, namely, percent of superdisintegrant (C) had significant effects on the disintegration time of the prepared MLX ODTs at $p < 0.0001$ (Figure 3). The results show that the disintegration time decreased as the percentage of superdisintegrant increased. However, the mannitol–avicel ratio and compression force did not have significant effects on the disintegration time. The resulting equation for responses, Y1 (disintegration time), is presented below:

Disintegration time = +40.58250 - 2.75850 * percent of superdisintegrant.

FIGURE 3 - Effect of percent of superdisintegrant on the disintegration time of MLX ODT.

Hardness of MLX ODTs

The hardness of the prepared MLX-ODTs was in the range of 17.87–45.75 N (Table III) with the highest hardness values observed in F5, F6, F7, and F8 with the mean hardness values of 44.87±4.3, 45.5±5.4, 45.75±6.1, 34.37±2.16 N respectively. An ANOVA analysis showed that only one factor, namely, compression force (A; $p < 0.0007$), had a significant effect on the hardness of the prepared MLX-ODTs (Figure 4). The results show that the hardness of tablets increased as the compression force was increased. Other factors (the percentage of superdisintegrant and mannitol–avicel ratio) did not have a significant effect on the hardness of MLX ODTs. The resulting equation for responses, Y2 (hardness), is presented below:
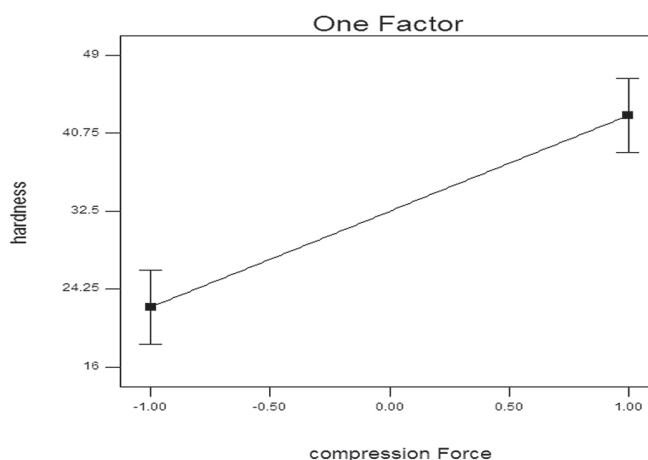

FIGURE 4 - Effect of compression force on the hardness of MLX ODT.

Hardness = +32.47250 + 10.15000 * compression Force

In vitro dissolution studies

Figure 5 represents the dissolution profiles of the prepared MLX ODTs. According to the United States Pharmacopeia (USP), an MLX tablet should release 70 percent of its drug content after 30 min. F4 and F8 showed the highest percentage of MLX release after 30 min; 80.4±1.6 and 82.66±5.1 respectively. This high amount of release could be due to the high amount of water-soluble mannitol and low amount of low water-soluble avicel in their formulations. The use of a high amount of mannitol in tablet formulation could help the dissolution of poorly water-soluble drugs (Myers, Battist, Fuisz, 1995). Moreover, F4 and F8 released about 50% of their drug content only after 2 min. This burst release of MLX might be due to the effect of water-soluble mannitol, which could increase the degree of cracking and bursting (Shirai *et al.*, 1994). An ANOVA analysis showed only one factor, namely, mannitol–avicel ratio ($p < 0.0001$) had a significant effect on the percentage of dissolved MLX (after 30 min) from the prepared MLX ODTs (Figure 6). The results also showed that the percentage of MLX dissolved after 30 min increased as the mannitol–avicel ratio become greater. The compression force and percentage of super disintegrant did not show any significant effects on the percent of MLX released after 30 min. The resulting equation for responses, Y3 (percent of MLX that dissolved after 30 min), is presented below:

Percent of dissolved meloxicam after 30 min
= + 74.09250 + 1.63625 * mannitol – avicel ratio
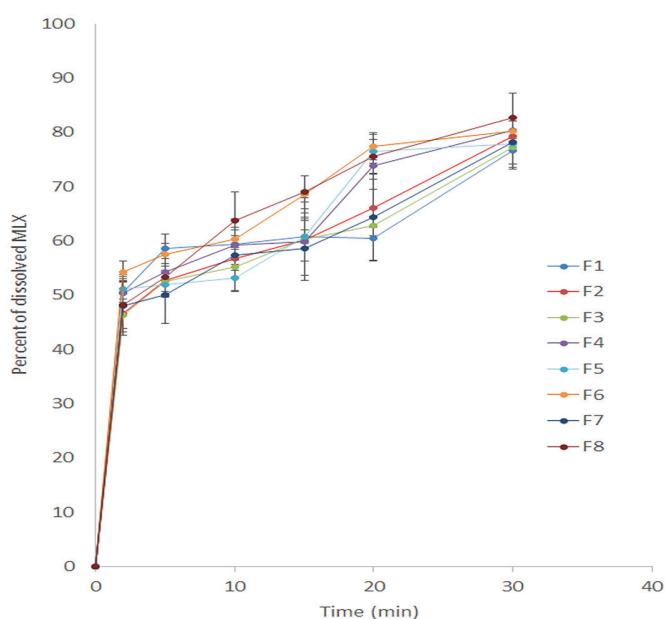
FIGURE 5 - The dissolution profiles of the prepared MLX ODTs.
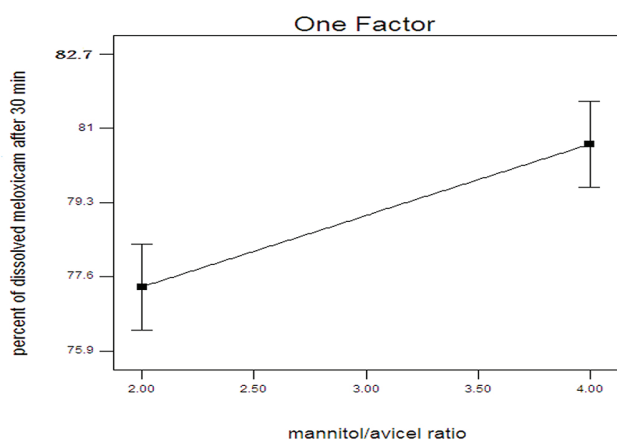
FIGURE 6 - The effect of mannitol/avicel ratio on the percent of dissolved meloxicam that dissolved after 30 min in the dissolution medium.

Optimum ODTs formulation

Based on the responses, the software was used to perform a hot spot analysis to obtain the optimum formulation variables (compression force, percent of superdisintegrant and mannitol/avicel ratio) to produce ODTs with the desired characteristics. The request was to minimize the disintegration time, and maximize the hardness and percent of released MLX from the formulation after 30 min. Therefore; the F8 formulation was determined to be the optimal formulation.

CONCLUSION

The main goal of a solid dispersion drug delivery system is to improve the water solubility of poorly water-soluble drugs. Solid dispersion prepared by the melting method with crospovidone and poloxamer 188 with special physicochemical properties have shown to be one of the most attractive approaches to enhance the solubility of the poorly water-soluble drug meloxicam. On the other hand, orally disintegrating tablets prepared from solid dispersion represent a promising approach to improving the solubility and slow onset of action of drugs, especially for BCS Class II of drugs, including meloxicam with poor dissolution properties. The present study demonstrated an effective method for the preparation of a suitable dosage form of meloxicam with improved solubility and onset of action. This dosage form could be suitable for administration in elderly patients with dysphagia.

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