

DESIGN, OPTIMIZATION AND EVALUATION OF ACECLOFENAC FAST DISSOLVING TABLETS EMPLOYING STARCH VALERATE—A NOVEL SUPERDISINTEGRANT

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Received: 15 Feb 2021, Revised and Accepted: 17 May 2021

ABSTRACT

Objective: To synthesize, characterize and evaluate starch valerate as a superdisintegrant in the formulation of aceclofenac fast dissolving tablets by employing 2³ factorial design.

Methods: Starch valerate was synthesized and its physical and micromeritic properties were performed to evaluate it. The fast dissolving tablet of aceclofenac was prepared by employing starch valerate as a superdisintegrant in different proportions in each case by direct compression method using 2³ factorial design for evaluation of tablet parameters like disintegration and dissolution efficiency in 5 min.

Results: The starch valerate prepared was found to be fine, amorphous and free flowing. Starch valerate exhibited good swelling in water with swelling index (125.2%). The study of starch valerate was shown by fourier transform infrared spectra (FTIR). The drug content (200±5%), hardness (3.5–4 kg/sq. cm), and friability (<0.15%) has been effective with regard to all the formulated fast dissolving tablets employing starch valerate. The disintegration time of all the formulated tablets was found to be in the range of 14±0.04 to 25.7±0.02 sec. The optimized formulation F4 had the least disintegration time i.e., 12.8±0.02 sec. The wetting time of the tablets was found to be in the range of 76±0.21 to 217±0.17s. The *In vitro* wetting time was less (i.e., 28±0.02s) in optimized formulation F4. The water absorption ratio of the formulated tablets was found to be in the range of 46±0.12 to 100±0.27%. The percent drug dissolved in the optimized formulation F8 was found to be 99.93% in 5 min.

Conclusion: Starch valerate, when combined with sodium starch glycolate, croscarmellose sodium, with aceclofenac, was found to be an effective super disintegrant which improved the dissolution efficiency and could therefore be used in the formulation of quick dissolving tablets to provide immediate release of the contained drug within 5 min.

Keywords: Superdisintegrant, Fast dissolving, Optimization, Starch valerate

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DOI: <https://dx.doi.org/10.22159/ijap.2021v13i4.41122>. Journal homepage: <https://innovareacademics.in/journals/index.php/ijap>

INTRODUCTION

A numerous developments have been done in different dosage forms from ages and the most popular solid dosage forms were being tablets and capsules [1]. A lot of research was being done from many years in order to acquire many drugs to today's world and among them the fast disintegrating tablets were chosen to make available over the counter as it avoids the swallowing problems and were first developed in the late 1970s as an alternative to conventional dosage forms [2] due to greater bioavailability [3]. Fast dissolving tablets were the dosage forms that disintegrate quickly so to release the drug, disperse and dissolve when placed on tongue [4], with the aid of superdisintegrant. Thus these formulations became an alternative dosage form to geriatrics, paediatrics and also to those people who were bedridden, mentally unwell, fear of swallowing.

United States Food and Drug Administration (USFDA) outlined them as "A solid dose type containing a medicative substance or active ingredient that disintegrate quickly sometimes in a matter of seconds once placed upon the tongue" [5]. Fast dissolving tablets may also be known as mouth dissolving tablets, rapid dissolving, melt-in mouth tablets, or dispersible tablets, quick disintegrating tablets [6].

Aceclofenac was proved to be an effective NSAID with lower indication gastro-intestinal adverse effects and thus resulted in great compliance in treatment [7, 8], hence used in treatment of rheumatoid arthritis, osteoarthritis and ankylosing spondylitis, muscular skeletal studies, dental pain, postoperative pain, post-traumatic pain, low back pain, and gynaecological pain etc. [9].

The main objective of this work was to formulate and characterize fast dissolving tablets of aceclofenac fast dissolving tablets

employing starch valerate—a novel superdisintegrant prepared by modification of starch, sodium starch glycolate, crospovidone as superdisintegrants by using optimization techniques. A 2³ factorial design was applied to investigate the interaction effects of three variables i.e., starch valerate (A), sodium starch glycolate (B), crospovidone (C) in each case so as to find the formula with that of less disintegration time and more dissolution efficiency and to permit arbitrary selection of tablets with immediate release of drug within 5 min.

MATERIALS AND METHODS

Valeric acid was bought from Lotus Chemicals Ltd, Chennai. Methanol was gifted from Thermo Fischer chemicals Ltd, Mumbai. Potato starch, aceclofenac and crospovidone were obtained from Yarrow chem. Products, Mumbai. Distilled water, Mannitol was purchased from Finar chemicals Ltd, Ahmedabad. Microcrystalline cellulose was purchased from Qualigens fine chemicals, Mumbai). Talc and Magnesium stearate were obtained from Molychem, Mumbai.

Methods

Preparation of starch valerate (A novel superdisintegrant)

Potato starch was slurried using distilled water in a beaker and valeric acid was added to it, stirred continuously so that the potato slurry gets mixed properly. Then, the slurry was checked for pH and adjusted to 3.5 by adding 10M sodium hydroxide solution and was then conditioned for 16h at 60 °C. After conditioning, the unreacted valeric acid was drained and the solution remained was washed with distilled water and allowed to dry in the oven at 60 °C for around 2h. The dried solid mass was then sieved with sieve no. #120. The obtained fine powder was Starch Valerate [10].

Characterization of starch valerate (Novel superdisintegrant):

The prepared starch valerate was evaluated for the following;

▪ Solubility	: The solubility of starch valerate was tested in water, aqueous buffer solutions at different pH of 1,2,3,4,5,6 and 7. Also tested in organic solvents such as alcohol, dichloromethane, chloroform, acetone, petroleum ether etc. [11].
▪ pH	: Starch valerate was made into 1% w/v of dispersion or slurry and measured for pH, using ELICO pH Analyser [11].
▪ Viscosity	: Starch valerate was made into 1% w/v of dispersion or slurry and measured its viscosity by using Ostwald's viscometer [11].
▪ Swelling Index	: Two 10 ml graduated tubes were taken; starch valerate was added into them till 1 ml marking. In one test tube distilled water and liquid paraffin into the other tube was poured and mixed well by shaking. The obtained dispersion was allowed to stand for 12h and readings were noted. The sediment volumes in the tubes were recorded. The swelling index was calculated as follows [11]. $S.I(\%) = \frac{V_w - V_L}{V_L} \times 100$ <p>V_w: Volume of sediment in water V_L: Volume of sediment in light liquid paraffin</p>
▪ Gelatinizati on	: A 7% w/v dispersions of starch as well starch valerate were prepared for evaluating the gelling property i.e., gelatinization by heating the dispersions in water bath at 100 °C for 30 min [11].
▪ Particle size	: The prepared starch valerate was sieved by using standard sieves [11].
▪ Density	: Density (gm/cc) was determined by liquid displacement method using benzene as the liquid [11].
▪ Bulk density	: Two graduated cylinders were taken, starch in one and starch valerate in another were taken for determining bulk density (gm/cc) by tapping method [11].
▪ Angle of repose	: Placing a funnel at appropriate height with the help of a stand, starch as well as starch valerate was passed through the funnel, and markings were drawn, measured with scale and calculated [11].
▪ Compressib ility index	: By placing the two graduated cylinders containing starch and starch valerate into Bulk density apparatus and allowed to tap for 100 times, readings were noted [11] and calculated by using the following equation; $\text{Compressibility index(CI)} = \frac{V_0 - V}{V}$ <p>V_0 = Initial volume of the powder V = Final volume of the powder</p>
▪ Melting Point	: Some amount of starch valerate was taken into the capillary tube, then placed into the melting point apparatus to determine the melting point [11].
▪ FTIR	: The spectra of starch valerate was recorded in FTIR i.e., Fourier Transform Infrared spectroscopy, on samples prepared in potassium bromide (KBr) disks by means of a hydrostatic press at 6-8 tons pressure. The scanning range was 500 to 4000 cm^{-1} using a BRUKER FT-IR, (Tokyo, Japan) [11].
▪ Ester test	: In a test tube, starch valerate (1 mg), ethanol (1 ml), (NaOH) sodium hydroxide (0.1 ml) were taken and as an indicator phenolphthalein was added. The colour change was observed [11].

Preparation of aceclofenac fast dissolving tablets

By direct compression method using starch valerate, the aceclofenac quick dissolving tablets were prepared using 2^3 factorial designs in which 3 independent variables [3 superdisintegrants i.e. starch valerate (A), sodium starch glycolate (B), crospovidone (C)] and 5 dependent variables [percentage dissolved in 5 min, dissolution efficiency in 5 min, wetting time, water absorption ratio, disintegration time] were applied. Table 1, in which superdisintegrants were selected at 2 stages, i.e. higher and lower, shows the composition of the different formulations of aceclofenac rapid dissolving tablets. 5% concentration of starch

itaconate (A), sodium starch glycolate (B) and crospovidone (C) at the higher level, and 0% concentration of starch valerate (A), sodium starch glycolate (B) and sodium starch glycolate (B), crospovidone (C) at lower level. Each ingredient was passed through the # 120 mesh sized screen before mixing for uniformity in particle size. Starch valerate, sodium starch glycolate, crospovidone, mannitol, and microcrystalline cellulose were precisely weighed and combined and added to aceclofenac using mortar and pestle. Finally, a powder mixture was applied with talc and magnesium stearate. Lastly, the mixed mixture was compressed by using eight station rotator (Presshakthi Machineries Pvt, Ltd., Ahmedabad, India) [12].

Table 1: Formulae of aceclofenac fast dissolving tablets employing starch valerate

Ingredients (mg per tablet)	F1	F2	F3	F4	F5	F6	F7	F8
Aceclofenac	100	100	100	100	100	100	100	100
Starch valerate	-	25	-	25	-	25	-	25
Sodium Starch Glycolate	-	-	25	25	-	-	25	25
Crospovidone	-	-	-	-	25	25	25	25
Mannitol	130	105	105	80	105	80	80	55
Micro Crystalline Cellulose	250	250	250	250	250	250	250	250
Talc	10	10	10	10	10	10	10	10
Magnesium Stearate	10	10	10	10	10	10	10	10
Total Weight of the tablet	500	500	500	500	500	500	500	500

Evaluation of aceclofenac fast dissolving tablets**Hardness**

The strength required in a diametric manner to split the tablet is called tablet hardness. It is usually measured using the Monsanto hardness tester, which causes the strength to fall diametrically on the tablet with the aid of its built-in spring. This was expressed in terms of kg/cm^2 [13].

Uniformity of weight

For weight variation test to be done, 20 tablets were taken. The individual variation of tablet weight from the average weight of 20 tablets was considered to be the weight variation [13].

Average weight of tablet	% Deviation
80 mg or less	± 10
More than 80 mg or less than 125 mg	± 7.5
125 mg or less	± 5

Friability

The tablets were initially weighed and then put into the Roche friabilator for friability calculation, where the tablets were allowed to rotate for 4 min or up to 100 revolutions at 25 rpm. After removal from the friabilator, the tablets were weighed again and the percentage of weight loss was determined [13] using the formula below,

$$F = \frac{100 \times W(\text{initial}) - W(\text{final})}{W(\text{initial})}$$

Drug content uniformity

10 tablets were weighed and powdered to determine the uniformity of the drug content. Powder equivalent to 10 mg of the medication, i.e., aceclofenac was extracted and filtered into a 7.4 phosphate buffer, whereby the aceclofenac content was determined by spectrophotometric absorption measurement at 274 nm after sufficient dilution with a 7.4 phosphate buffer and was measured as an average of three determinations [13].

Wetting time

By taking a petri dish of about 10 cm in diameter and five tissue papers and an amaranth solution (water soluble dye-for color), the wetting time can be determined. The tissue paper was put in the petri dish and about 10 ml of amaranth solution was poured into it, so that the color solution would be absorbed by the tissue paper. Then, the tablets were placed individually on the surface of the tissue paper and the time taken by the tablet to absorb the color was noted [13].

Water absorption ratio

The same wetting time method was followed to find out the water absorption ratio, but after the tablet absorbs the color water, the tablet should be re-weighed and the following formula should be used [13].

$$R = \frac{100(W_a - W_b)}{W_b}$$

Where,

W_a -weight of tablet after water absorption

W_b -weight of tablet before water absorption

In-vitro disintegration time

The prepared tablets were placed into the disintegration testing apparatus (LABINDIA) containing 900 ml of the 7.4 phosphate as the disintegration media, maintained at a temperature range of 37±0.2 °C. The time taken by the tablet for complete disintegration with no solid, palatable mass in the apparatus was recorded [13].

In-vitro dissolution studies

An 8-stage dissolution apparatus (Electro-Lab, TDT-08L) was used to study the dissolution of aceclofenac fast dissolving tablets. Before dropping the tablets into the apparatus for testing, the buffer (7.4 pH-phosphate buffer) of 900 ml was poured into each basket and it should be reach with the temperature required i.e., 37±0.5 °C,

paddles should be fitted and rpm was set to 50rpm. Once the apparatus was all set to use, the tablets were dropped, at pre-determined time intervals the samples of 5 ml were collected, filtered, diluted if required and assayed at 274 nm using Shimadzu UV-1800 UV/Visible Scanning Spectrophotometer. Cumulative percentage release was calculated using standard absorbance from the calibration curve. All the dissolution experiments were conducted in triplicate (n = 3) [13].

Factorial design

The present study used factorial design to evaluate the individual and combined effects. The formulation contains three superdisintegrants and therefore, to evaluate these effects a 2³ factorial design was applied. The parameters of fast dissolving tablets (disintegration and dissolution efficiency in 5 min) were analysed as per ANOVA of 2³ factorial design. Contour plots and surface plots were drawn with the help of Design Expert 7.11 version software. Based on the results of statistical analysis, the optimum formulation was selected.

Comparison of optimized formulation with marketed formulation

The optimized formulation was compared with marketed formulation (ACECLO) containing 100 mg of aceclofenac after removal of film coating.

Label claim of marketed formulation

Each ACECLO film coated tablet of 100 mg contains titanium dioxide as colour of the tablet to protect from light, moisture and temperature. The tablets used for the experiment were manufactured by ARISTO Pharmaceuticals Pvt. Ltd., Makhnumajra village, Baddi district, Himachal Pradesh-173205 bearing M/736/2016 as manufacturing license number that belongs to 5340K028 batch. The tablets manufactured date was 10/2019 and expiry date was 09/2020.

RESULTS AND DISCUSSION

The prepared starch valerate was found to be fine, amorphous and free-flowing powder. It was insoluble in water, aqueous buffers (pH 1,2,3,4,5,6 and 7) and also in organic solvents (methanol, petroleum ether, dichloromethane, and chloroform) which were tested with 1% w/v of starch valerate dispersion. Also, its physical and micromeritic properties were analysed, indicated good flow and compressibility properties which were needed for a solid dosage form to manufacture and results were summarized in table 2.

Starch valerate had exhibited good swelling property in water when compared to swelling in light liquid paraffin. The swelling index was 125.2%. The density of starch valerate was found to be 0.9908 gm/cc. The FTIR spectra of starch and starch valerate were shown in fig. 1 and 2. The presence of peaks absorption at 1639.97 cm⁻¹, which was a characteristic peak of ester, so from FTIR studies it was concluded that starch valerate (ester) was formed when starch was allowed to react with valeric acid.

The test for ester was performed and disappearance of pink colour confirmed the presence of ester i.e., starch valerate. When starch valerate was taken into capillary tube, for testing its melting point using melting point apparatus, it was found to melt at 182.6 °C.

Table 2: Physical and micromeritic properties of prepared novel superdisintegrant-starch valerate

Parameters	Observation
Solubility	Insoluble in all aqueous and organic solvents that were tested.
pH	3.48±0.02
Viscosity	1.068 0.008 cps
Swelling index (S. I)	125.2%
Gelling property	Np gelation of starch valerate particles, whereas starch particles formed gel.
Particle size	5.82±2.124µm
Density	0.9908±0.0004 gm/cc
Bulk density	0.52±0.03 gm/cc
Angle of repose	13.39 ° (good)
Compressibility index (CI)	25±0.01
Melting point	182.6 °C

*SD Standard Deviation from mean, n=3, mean±SD.

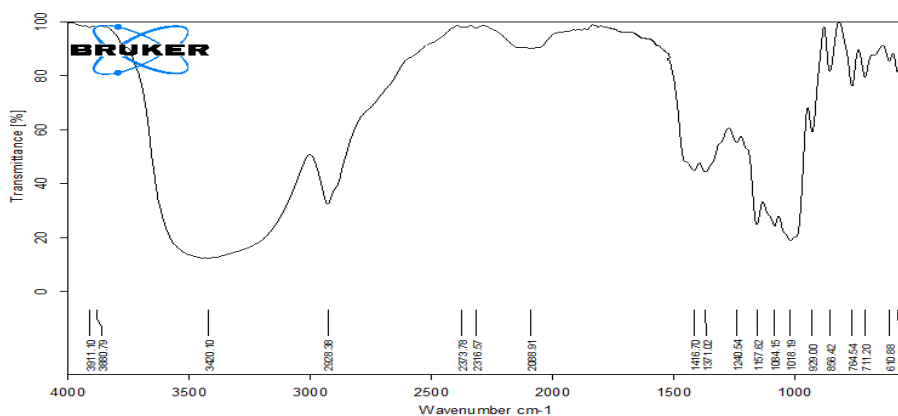


Fig. 1: FTIR spectra of potato starch

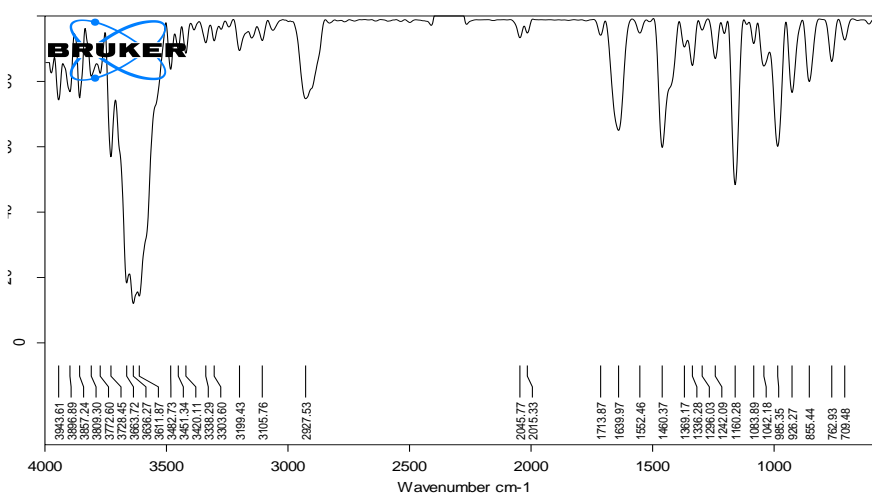


Fig. 2: FTIR spectra of starch valerate

Evaluation of tablets

Hardness

The tablet hardness of the optimized formulation as well as marketed were in the range of 3.5-4 kg/cm², indicates good strength with a capability to resist its physical and pre-functional stress conditions during travelling and handling. The hardness of tablet was greater when compared with the hardness of the tablets i. e 1.23-1.63 kg/cm² prepared by Vivek Dave *et al.* [14].

Friability

By performing friability test to all the optimized formulations as well as marketed formulation, the weight loss was found to be less than 0.15% indicating good mechanical resistance of tablets. Thus, it was proved that tablets could withstand the pressure, mechanical shocks during handling, transportation, storage and manufacturing processes. The friability loss was relatively less when compared with the friability of tablets i. e 0.15-0.72% prepared by C. Mallikarjuna Setty, *et al.* [15]

Drug content

The prepared fast dissolving tablets containing aceclofenac claimed within 200±5 % of that of the label which was higher in comparison to the drug content of tablets i. e 95±5% prepared by Keshav R. Deshmukh, *et al.* [16].

Wetting time and water absorption ratio

Wetting time and water absorption ratio of tablets formulated as well as marketed resulted to be within the limits that were

prescribed and obeyed the criteria of fast dissolving tablets. The wetting time at initial and final times were depicted in the fig. 3. The optimized formulation F-8 had shown less wetting time i. e 25±0.17 seconds when compared to other formulations and marketed formulation which was less when compared to the wetting of tablets that ranged from 29.62±0.87 to 32.66±1.87 seconds which were prepared by Jyotsana Madan, *et al.* [17]. The water absorption ratio was found to be 100±0.27% which was relatively more when compared to the water absorption ratio of tablets i. e 74.48% prepared by Kalpesh Gaur A [18].

In-vitro disintegration time

As mentioned in the table 3, the disintegration time of all formulated tablets and marketed formulation was laid between 14.0±0.04 to 25.7±0.02 seconds which was comparatively lesser the disintegration time of tablets i. e 18-40 seconds prepared by Anas Bahnassi *et al.* [19].

In-vitro dissolution studies

From *in vitro* dissolution studies of fast dissolving tablets containing aceclofenac employing starch valerate, their profile was shown in fig. 4(a) and 4(b) and the optimized formulation with marketed formulation dissolution profile was compared as given in table 4 and 5. The dissolution parameters of all the formulations i.e., F-1 to F-8 and marketed formulations were given in table 4, whereas the optimized formulation i.e., F-8 had shown more PD₅ (percent dissolved in 5 min) which contains 5% starch valerate, sodium starch glycolate and croscopovidone was found to be 99.93±0.11% which was more when compared to the percent dissolved of tablets

i. e 99.5% which were prepared by Garala Kevin C *et al.* [20]. Even DE_{5%} (dissolution efficiency in 5 min) was shown more in the optimized formulation, F-8.

The PD₅ and DE_{5%} reveals that tablets were effective at 5 % starch valerate, 5 % sodium starch glycolate and 5% crospovidone, when

the formulations were made by direct compression using these superdisintegrants. The number of folds in DE_{5%} was given in the table 4. Therefore, from the results it was concluded that starch valerate (novel superdisintegrant) could be used as superdisintegrant in the formulation of fast dissolving tablets of aceclofenac.

Table 3: Comparison of physical properties: Hardness, friability, drug content, disintegration time, wetting time, water absorption ratio of aceclofenac fast dissolving tablets employing starch itaconate with marketed formulation

Formulation	Hardness (kg/cm ²) n±SD	Friability (%) n±SD	Drug content mg/tab n±SD	Disintegration time (sec) n±SD	Wetting time (sec) n±SD	Water absorption ratio (%) n±SD
F1	3.6±0.01	0.11±0.013	96.12±0.71	25.7±0.02	42±0.02	46±0.12
F2	3.5±0.03	0.12±0.015	97.48±0.79	18±0.03	29±0.12	100±0.18
F3	3.6±0.01	0.13±0.012	98.10±0.63	19±0.02	27±0.09	83.3±0.16
F4	3.7±0.04	0.12±0.014	98.32±0.55	12.8±0.02	28±0.02	100±0.15
F5	3.6±0.03	0.12±0.012	99.23±0.56	14±0.01	22±0.21	82.1±0.21
F6	3.9±0.01	0.13±0.012	99.45±0.18	17±0.02	25±0.09	72±0.12
F7	3.8±0.02	0.11±0.014	99.56±0.57	13±0.01	28±0.15	89±0.15
F8	3.8±0.04	0.11±0.013	99.79±0.11	15±0.02	25±0.17	100±0.27
Marketed formulation	3.9±0.01	0.12±0.012	99.12±0.11	14±0.04	23±0.19	75±0.27

*SD Standard Deviation from mean, n=3, mean±SD.

Fig. 3: Wetting times of aceclofenac fast dissolving tablets (employing starch valerate)

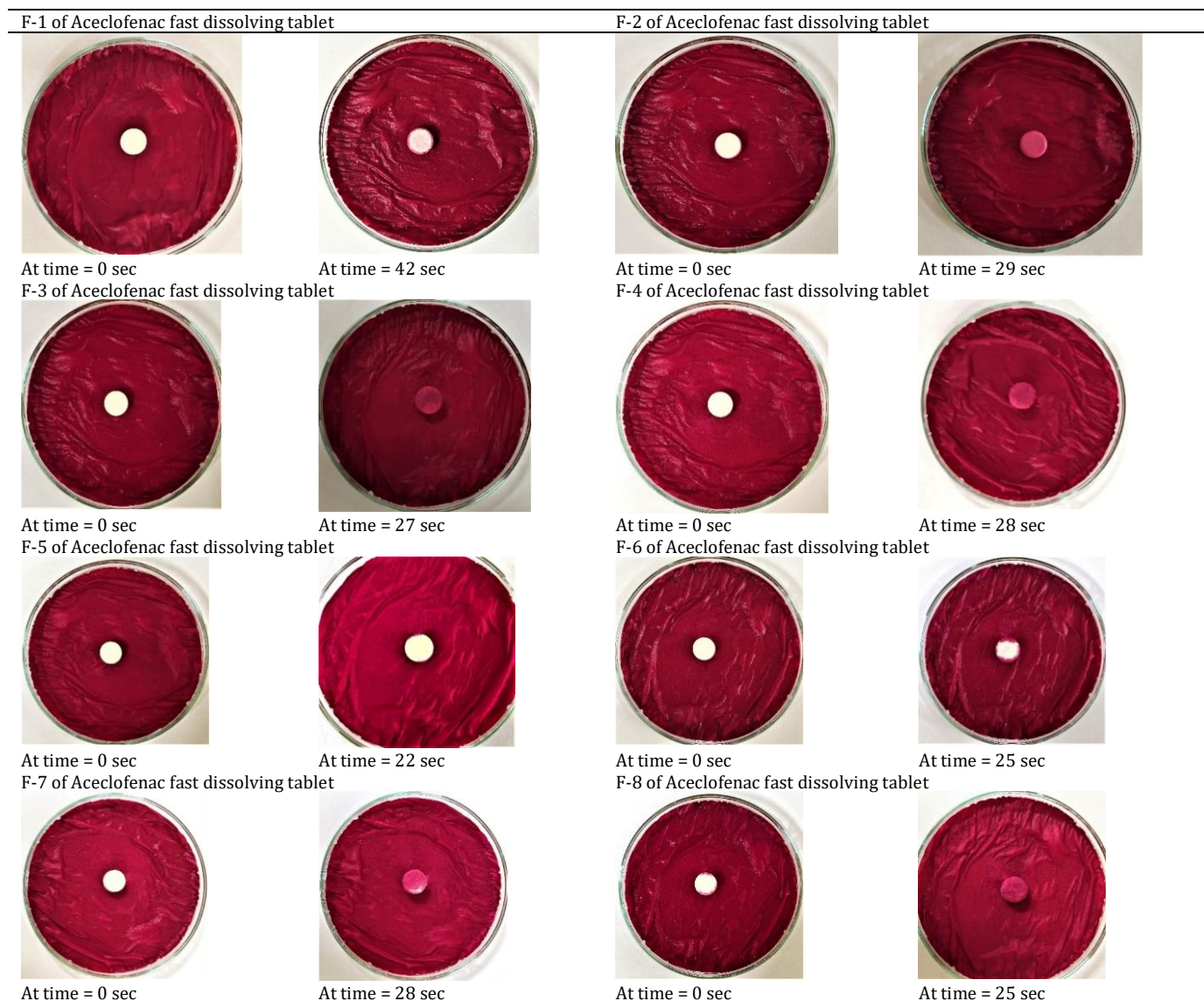
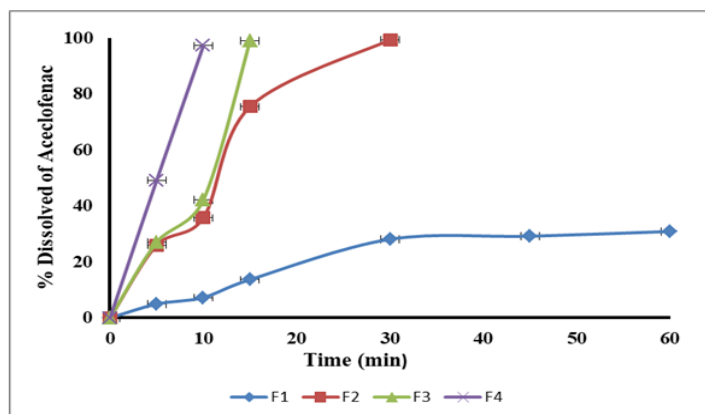
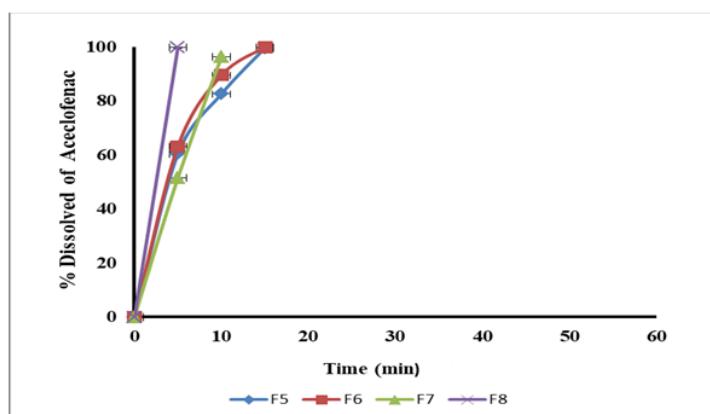


Table 4: Comparison of dissolution parameters of aceclofenac fast dissolving tablets formulated employing starch valerate and other known superdisintegrants with marketed formulation

Time (min)	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	Marketed formulation
PD ₅	04.94±0.12	25.98±0.13	27.07±0.17	49.20±0.18	60.49±0.15	63.26±0.12	51.55±0.14	99.93±0.11	75.20±0.13
DE ₅ %	4.4±0.11	21.8±0.09	25.2±0.05	49.2±0.12	57.8±0.14	64.4±0.08	84.2±0.13	95.4±0.01	28.32±0.12
No of folds increase in DE ₅ %	-	4.95	5.72	11.18	13.13	14.63	10.95	21.68	---

*SD Standard Deviation from mean, n = 3, mean±SD, PD₅-Percent dissolved in 5 min, DE₅%-Dissolution efficiency in 5 min,

**Fig. 4 (a): Dissolution profiles of aceclofenac fast dissolving tablets prepared employing starch valerate (F1-F4)****Fig. 4 (b): Dissolution profiles of aceclofenac fast dissolving tablets prepared employing starch valerate (F5-F8)****Table 5: Comparison of aceclofenac percent dissolved from dissolving tablets employing starch valerate with marketed formulation**

Time (min)	F1	F2	F3	F4	F5	F6	F7	F8	Marketed formulation
5	04.94±0.12	25.98±0.13	27.07±0.17	49.20±0.18	60.49±0.15	63.26±0.12	51.55±0.14	99.93±0.11	75.20±0.13
10	07.26±0.11	35.78±0.12	42.18±0.10	97.30±0.15	82.69±0.10	89.65±0.11	96.48±0.12	---	88.21±0.10
15	13.69±0.10	75.53±0.11	99.00±0.02	---	99.74±0.08	99.94±0.02	---	---	99.32±0.24
30	28.11±0.20	99.42±0.09	---	---	---	---	---	---	---
45	29.18±0.18	---	---	---	---	---	---	---	---
60	30.89±0.12	---	---	---	---	---	---	---	---

*SD Standard Deviation from mean, n=3, mean±SD.

The disintegration time and dissolution efficiency in 10 min indicates that the dependant variables strongly depend on the independent variables.

The fitted equations relating the disintegration time and dissolution efficiency by the end of 5 min to the transform factors were shown in the following equations,

Disintegration time = +45.88+3.38A-5.63B-5.13C+0.63AB-0.37AC-2.12BC+1.12ABC. (R²= 1.000)

Dissolution efficiency in 5 min = +28.76+11.96A+10.26B+16.34+9.01AB+6.64 AC+4.39BC+8.04. (R²= 1.000)

The value of the R² indicates the good fit. The polynomial equations can be used to draw a conclusion after considering the magnitude of coefficient and the mathematical sign it carries (Positive or Negative). Once the polynomial equation, which relate the levels of each factor and their corresponding interactions with disintegration time and percent release in 5 min, the surface response curves and contour plots were constructed using software.

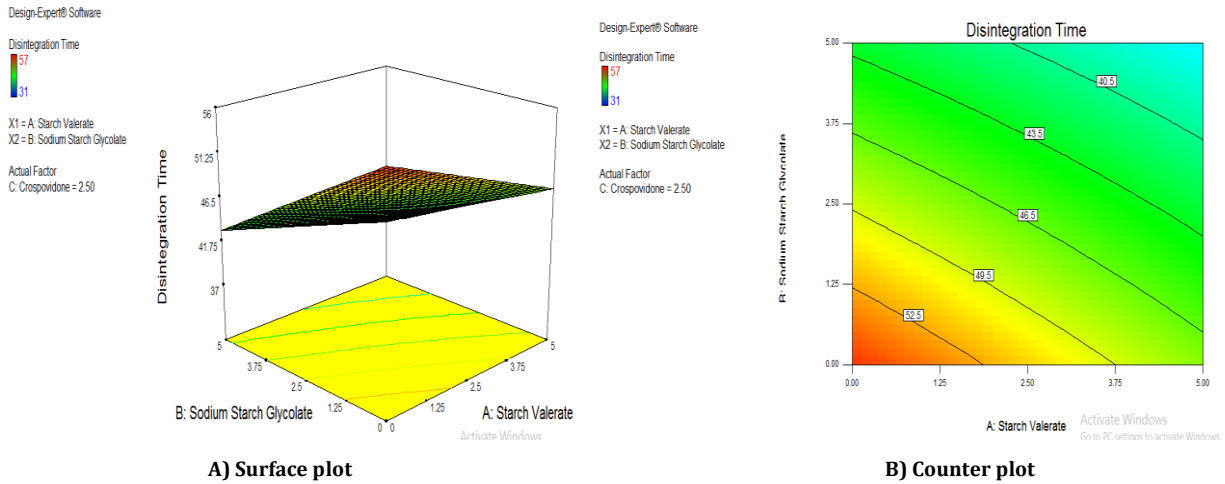


Fig. 5.1: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Starch Valerate and Sodium starch glycolate on disintegration time)

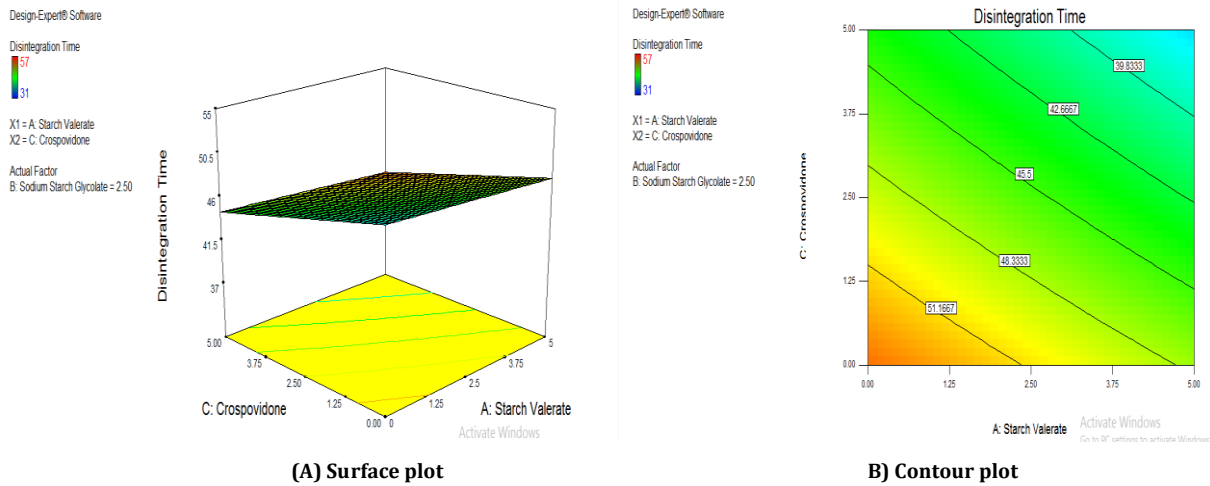


Fig. 5.2: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Starch Valerate and Crospovidone on disintegration time)

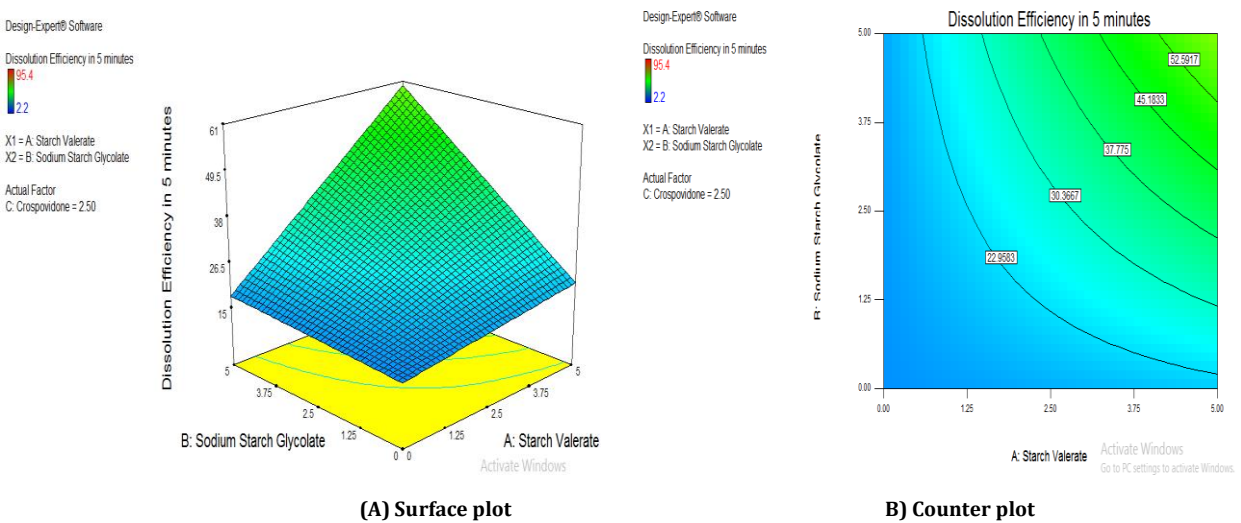


Fig. 5.3: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Sodium starch glycolate and Crospovidone on disintegration time)

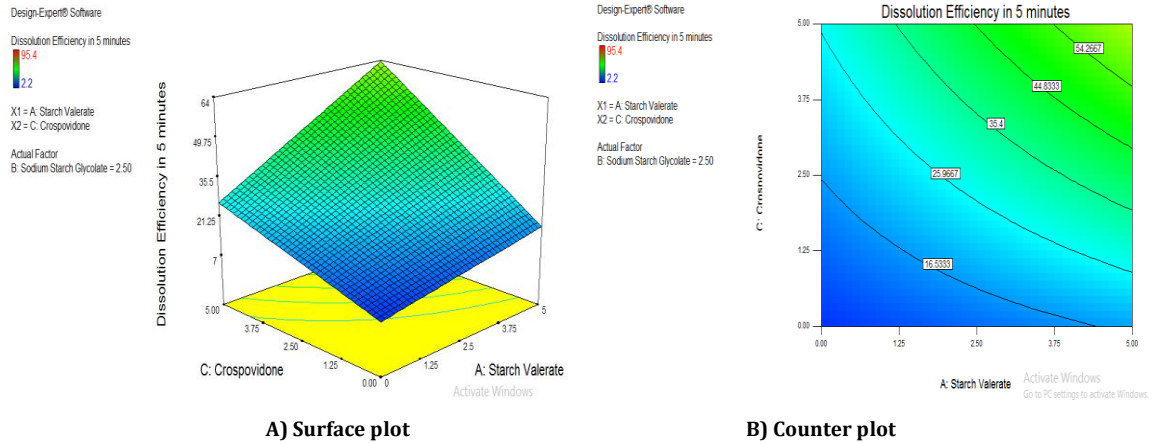


Fig. 5.4: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Sodium starch glycolate and Crospovidone on dissolution efficiency in 5 min)

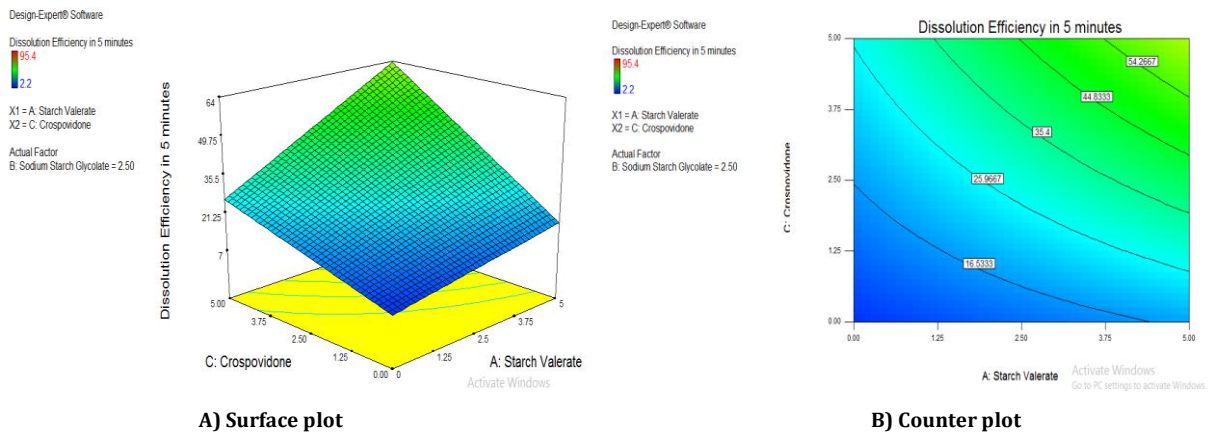


Fig. 5.5: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Starch Valerate and Crospovidone on dissolution efficiency in 5 min)

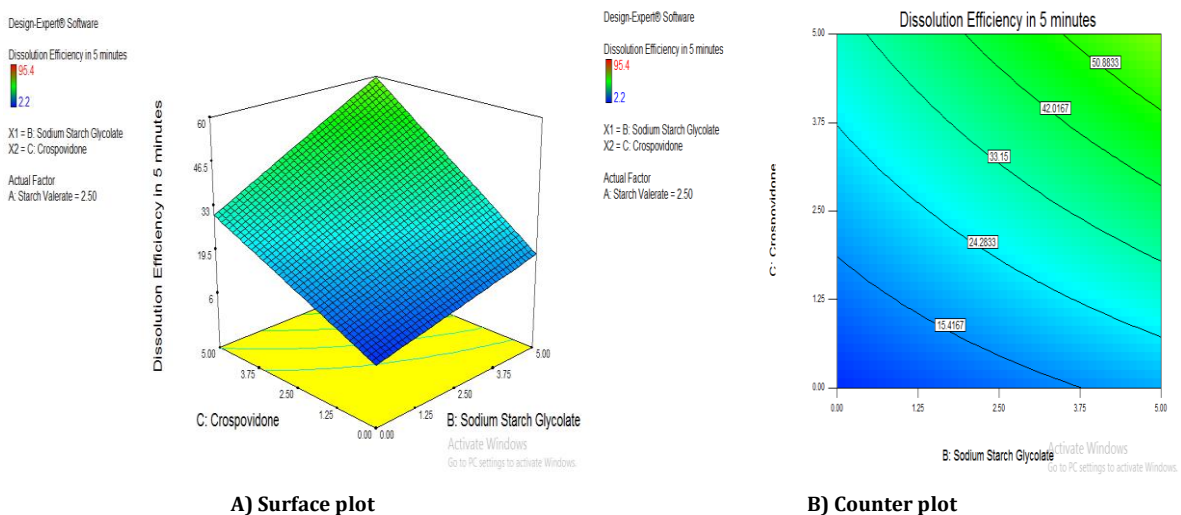


Fig. 5.6: A. Surface plot, B. Contour plot of Aceclofenac fast dissolving tablets (Effect of Sodium starch glycolate and Crospovidone on dissolution efficiency in 5 min)

The response surface plots and contour plots reveal that, with the increase in concentration of starch valerate (A), sodium starch glycolate (B) and crospovidone (C), the disintegration time

decreases. The effects of A and B on disintegration time were shown in fig 5.3. The contour plots were found to be linear up to certain extent, there after they were non-linear. From the contour plot in fig.

5.3, it was determined that a less disintegration time can be obtained with A-level range between 3.75 to 5% and B level range from 3.75 to 5% The effects of B and C were shown in fig. 5.4, where the contour plots were found to be linear indicating linear relationship between B and C. From the contour plots, the linearity was found indicating the linear relationship between B and C. Also, it was determined from the contour plot (fig. 5.4) that, the less disintegration time was obtained with B-level in between 3.75 to 5% and C-level range from 3.75 to 5% The effects of A and C were depicted in fig. 6.5, the contour plots were almost found to be linear indicating a linear relationship between A and C. From the contour plot, it was determined that, less disintegration time was obtained with A-level in between 3.75 to 5% and C-level between 3.75 to 5%. From this we can conclude that, less disintegration time can be achieved when the factor-A was used in the concentration range from 3.75 to 5% B and C-levels in the range of 3.75 to 5% of the total weight of the tablet.

The response surface plots and contour plots reveal that, with the increase in concentration of starch valerate (A), sodium starch glycolate (B) and crospovidone (C), the dissolution efficiency in 5 min increases. The effect of A and B on dissolution efficiency in 5 min were shown in fig. 5.6, the contour plots were found to linear to the maximum extent. From the contour plot, it was determined that, more dissolution efficiency can be obtained with A-level range at 3.75 to 5% and B-level range 3.75 to 5%. The effects of B and C were depicted in fig. 5.7, where the contour plots were found to be linear, indicating the linear relationship between B and C. From the contour plot, it was determined that, more dissolution efficiency can be obtained with B-level range between 3.75 to 5%. The effects of A and C were shown in fig. 5.8, where the contour plots were found to be linear, indicating the linear relationship between A and C. From the contour plot, it was determined that, more dissolution efficiency in 5 min can be obtained in A-level range between 3.75 to 5% and C-level in a range between 3.75 to 5%.

CONCLUSION

The prepared starch valerate was found to be fine, amorphous and free-flowing powder. Also, its physical and micromeritic properties were analysed indicated good flow and compressibility properties which were needed for a solid dosage form to manufacture. Potato starch was amorphous in nature whereas the prepared starch valerate was amorphous, fulfilling the aspects of superdisintegrant characteristics, hence starch valerate, a novel superdisintegrant can be used as a superdisintegrant in the formulation of fast dissolving tablets.

From the above data, the superdisintegrants that to be used in fast dissolving tablets to have less disintegration time and more dissolution efficiency in 5 min were; factor-A i.e., Starch Valerate 5%, factor-B i.e., Sodium starch glycolate 5% and factor-C i.e., Crospovidone were found to be the ideal concentrations to formulate into fast dissolving tablets.

ABBREVIATION

M-Molar, NaOH-Sodium Hydroxide, °C-Degree Centigrade, #-Number, pH-Potential of hydrogen, ml-millilitre, S. I-Swelling Index, W/V-Weight/Volume, LBD-Loose bulk density, TBD-Tapped bulk density, FTIR-Fourier Transform Infrared Spectra.

FUNDING

Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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