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Original Article

Formulation Development of Sustain Release Tablets of Lornoxicam using Chemically Modified Xanthan Gum

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ABSTRACT

Background: In the medical and pharmaceutical fields, man has made successful use of natural origin things for millennia. Natural medications and excipients have piqued the interest of the entire globe today. Obtained from plant polymers have flashed a lot of attention in current decades because of their various pharmacological applications, such as gelling agents in gels as well as in, cosmo products, tablets, oral fluids, suspensions, and bases in a suppository. **Objectives:** Polymers are biocompatible, inexpensive, readily existing, and they are chosen over semi-synthetic and artificial excipients. However, they have some drawbacks, including microbial contamination, lot to lot variation, reduced viscosity throughout storage, inappropriate mechanical properties, low strew and uninhibited rate of hydration. **Materials and Methods:** The thiol-esterification technique, which uses thioglycolic acid (TGA) in the presence of a catalytic quantity of hydrochloric acid, was used to modify xanthan gum chemically. Microwave irradiated thiolated xanthan gum was also made by irradiating thiolated xanthan gum with a 750W frequency after it had been microwave irradiated. Modified and crude xanthan gum was used to make the sustained release tablet of Lornoxicam. Pre-compression and post-compression tests were performed on compressed tablets. **Results:** FT-IR, DSC, and X-ray diffraction investigations all show that grafting was successful. Additional peaks were identified in thiolated Xanthan gum and microwave irradiated gum, which were not present in pure Xanthan gum, according to FT-IR research. The presence of the SH stretch of the thiol group may be seen in the bands closer to 2568.00 cm^{-1} and 2584.70 cm^{-1}. Modified xanthan gum had a high swelling index. When compared to tablets made from crude xanthan gum, an *in-vitro* release study utilizing a pH 6.8 phosphate buffer indicated a sustain release of Lornoxicam from modified xanthan gum. **Conclusion:** Chemically modified xanthan gum sustains the drug over a prolonged period and could be a promising carrier in oral delivery to enhance anti-nociceptive and anti-inflammatory efficiency.

Keywords: Xanthan gum, Thiolated Xanthan gum, Micro-wave irradiated, Lornoxicam, Sustain drug release.

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INTRODUCTION

Natural polymers are polymers that break down in a normal and biocompatible way and lose their individuality when they come into contact with biological components.[1] These polymers are chosen over semi-synthetic and synthetic excipients. Bacterial growth, lot to lot variation, unpredictable ratio of hydration, and lower thickness during preservation are all issues that need to be addressed. Incorrect mechanical characteristics and low strew.[2] Chemical adjustments were performed to improve the stability and process ability of newly discovered gums. If the newly created gums are biodegradable and biocompatible, they can be employed; if not, a biodegradable component can be added to make them biodegradable.[3]

To alter of molecular interaction between polymers, a variety of techniques can be applied. There are two approaches to choose from: physical and chemical.[4] Physical technique Dry heat, water-logged steam, microwave, UV, even gamma radiation can all be utilized to generate a molecular interaction between polymers.[5] Polymers are treated with chemicals such aldehydes, epichlorohydrin, borax, or glutaraldehyde in the chemical approach. Temperature cross-linking is single of the greatest advantageous cross-linking operations as it eliminates the need for harsh organic chemicals in large-scale production, as well as the associated equipment and methods.[6] Because of the increased dose flexibility for design, the oral route of delivery for sustained release systems had gained considerable attention. The type of delivery system, the ailment being handled, the patient, the duration of medication, and the drug quality are all significant considerations in the design of oral sustained release delivery systems.[7]

The major goal of therapy is to keep the amount of drug in the blood at a steady level for a longer time. A major component of reaching this goal is the establishment of appropriate dose regimens. Sustained-release dosage forms are a type of drug administration that releases medication continuously over time to give long-term therapeutic benefit. Dosage is given in a single dose.[8] Lornoxicam, a non – steroidal anti- inflammatory medication (NSAID) from the oxicam family, has been proven to have significant anti-inflammatory and analgesic properties. Lornoxicam is commonly used to treat symptomatic ache and infection in people with osteoarthritis and rheumatoid arthritis, as well as pain from gynecological, orthopedic, gastrointestinal and dental treatment.[9-10]

This project's goal is to develop and test Lornoxicam sustained-release tablets made from a chemically modified xanthan gum as release retardant polymer.

MATERIALS AND METHODS

Material

Lornoxicam, Xanthan Gum, Thioglycolic acid HCl, MCC, Mg stearate were procured from Yarrow Chem. Products, Mumbai. Chemicals acquired were analytical grade.

Methods

Synthesis of thiolated xanthan gum

Xanthan Gum (24 gm) was liquefied in 110 ml of warm water and add into it 15 ml Thioglycolic acid (80%) and 3 ml 7 N HCL. This solution was allowed to heat at 80°C for 150 min. Then reaction blend was transferred in 500 ml Methanol. White Precipitate of Thiolated Xanthan Gum was obtained. Thiolated Xanthan gum was wash away two times with methanol and dried at room temperature.[11]

Synthesis of Micro-wave Irradiated Xanthan Gum

The approach was the same as for thiolated Xanthan gum synthesis, but the sample was then microwaved at 750W frequency and for 30 sec. time intervals (LG microwave oven MC2886BLT, Black). After cooling for a while, the microwave-irradiated material was precipitated with a 4:1 acetone: ethanol ratio. The precipitate was washed away with 30% aqueous ethanol to eliminate unreacted polymer and additional chemicals. At 45°C, the precipitated material was dried to a uniform weight before being converted into fines. Final product called Grafted xanthan gum.[12]

Characterization of Modified Xanthan Gum

Fourier Transform Infrared Spectroscopy (FTIR)

The Fourier transform infrared spectroscopy was used to detect functional groups and the molecular structure of crude thiolated as well as micro-wave irradiated xanthan gum. Samples were prepared by press pellet technique. The pellet was scanned and infrared spectra were obtained in the range of 4000 to 400 cm^{-1} during 3 scans, with 2 cm^{-1} resolution. This research used a Shimadzu FTIR-8400S IR spectrophotometer.[13]

Thermal behaviour by Differential Scanning Calorimetry

To study the thermal properties of crude, thiolated, and microwave irradiated xanthan gum (Shimadzu DSC-60, Shimadzu Limited Japan). The samples were heated in a thermetically sealed aluminium pans. Heat runs for 3 gm of sample was set from 10°C to 350°C at a heating rate of 10°C/min, using nitrogen as blanket gas.

Scanning Electron Microscopy (SEM)

The surface morphology of crude Xanthan gum, thiolated xanthan gum, and microwave irradiated xanthan gum was studied by a scanning electron microscope (Quanta 250 FEG Model No. 1027641, Czech Republic) The samples were gold coated to increase the conductivity of the electron beam. An accelerating voltage of 10 kV and a working distance of 12 mm at spot size of 45 were used.

X-ray diffractometry analysis (XRD)

Pure gum, thiolated xanthan gum, and micro-wave irradiation xanthan gum were examined using an X-ray diffractometry (Bruker AXS D8 Advance) The X-ray source was Cu, with wavelength 1.5406 °A and Si (Li) PSD detector employed. The diffractometer was run at a scanning speed of 2°/min, a chart speed of 2°/2 cm per 2θ and an angular range fixed between 3° and 80°.[14]

Formulation Design of Sustain Release Matrix Tablet

Lornoxicam sustained release matrix tablets were made using the direct compression process. Lornoxicam was kept at the same weight of 16 mg per tablet throughout the whole manufacturing process. As polymeric matrix materials, Xanthan gum, cross-linked Xanthan gum, and irradiated Xanthan gum were employed. The tablet diluent was microcrystalline cellulose (Avicel pH 102) to improve the compressibility and flow ability of the contents while keeping the weight of the tablets constant. Mg stearate concentration of 3.0% by weight of the tablet, incorporated as a lubricant. A 40# mesh screen was used to distribute and filter all of the components properly. Before adding the polymer, the medication was geometrically mixed with diluents. Dry mixing took 30 min in a polybag before sifting through a 22# mesh filter. 5 and 2 min were spent on pre-lubrication and lubrication, respectively. The pre-formulation features of the blends were investigated, and compression was carried out using a 12-station rotating tablet machine (Lab Press India). For further examination of tablet characteristics, the produced tablets were maintained at room temperature in an airtight container Table 1.[15]

Evaluation of Tablets Formulation

Pre-compression Evaluation Parameters

Angle of repose (θ), bulk density (Dv), true density (Dt), compressibility index (CI), and Hausner ratio were all tested before compression on powder mixes (H). The flow properties and compressibility qualities of powder blend were calculated using the given parameters. The method prescribed in official books.

Parameters of Produced Tablets After Compression

Evaluations of sustain release matrix tablets

Tablets were assessed for drug content uniformity, weight variation, tablet hardness, friability, thickness, drug content, *in-vitro* drug release studies, and stability studies, among other things, after compression.[16-17]

Determination of Weight Variation

The weight of a tablet was routinely determined to ensure that it contained the correct amount of medicine. By USP weight variation test.

Hardness of Tablets

It is measured by the Monsanto hardness tester. Five different assessments were used to get the average hardness of tablets.

Thickness of Tablets

Counting and packaging may be hampered by differences in tablet thickness. With the help of Vernier callipers thickness of the tablets was measured.

Friability of Tablets

The weight loss of tablets in bottles due to frication particle removal from the tablet surface is referred to as friability. A lack of cohesion amongst tablet ingredients is usually the source of friability. Place 20 pills in a Roche friabilator, weigh them, and record their initial weight. Rotate them for 100 revolutions at a speed of 25 revolutions per minute. The tablets were then removed from the friabilator, dusted, and reweighed, with the results recorded. Calculate % friability.

Content Uniformity of Tablets

The tablets content homogeneity was also evaluated. After weighing and crushing 10 tablets individually, crushing tablet powder diluted in phosphate buffer at pH 6.8. Then solution filtered by using a Millipore filter (0.45 m pore) after sufficient dilution, than solution of crushed tablets subjected to spectrophotometry for evaluate drug contain at wave length 358 nm.

In-vitro Drug Release Studies

For up to 24 hr, rate of release of all formulations is examined. The procedure was determined using the USP-II dissolving test device (paddle method, paddle speed 50 revolutions per minutes. The experiments were conducted in triplicate for 24 hr under sink conditions (first 2 hr in 900 ml 0.1 Normal HCl, then 22 hr in 900 ml buffer pH 6.8), with 5 ml samples withdrawn from the medium and replaced with fresh

medium at when the sample is withdrawn time interval to maintain the volume constant. On a UV spectrophotometer, the extracted samples are then diluted with pH 6.8, filtered, measured at 358 nm using pH 6.8 as a blank. The cumulative percentage of drug release was determined, and a plot was created by charting the cumulative percentage drug release VS. Time.[18]

Mathematical Modeling of Release Kinetics

The *in-vitro* release of drug from all formulations was estimated by using different mathematical modeling methods like Zero order equation, First order equation Higuchi model equation, Korsmeyer–Peppas equation.[19]

Stability Testing

Stability tests of the formulated Lornoxicam sustain release tablets were carried out in a stability compartment (LAB TOP, Mumbai) for three months at 25°C/60 percent Relative Humidity and 45°C/75 percent Relative Humidity. The tablets were removed after one, two, and three months, and drug content as well as *in-vitro* dissolution studies are also conducted.[20]

RESULTS

Modification of Xanthan Gum

The thiolated xanthan gum is made by esterifying xanthan gum with thioglycolic acid and hydrochloric acid as precursor. To accomplish the reaction of xanthan gum to thiolated xanthan gum, ester linkages were generated between the hydroxyl group of galacturonic acid moieties of xanthan gum and the carboxyl group of thioglycolic acid. The chemically converted into a yellow, odorless powder which will be the esterified xanthan gum as a precept. After precipitation purified with methanol and water. Subsequent washing by keeping the precipitate overnight, the purification of Thiolated xanthan gum was determined to be excellent. The grafted sample was then exposed to micro-wave irradiation for a predetermined period of time to produce Irradiated Xanthan gum Figure 1.

The FTIR spectra of crude, Thiolated, and microwave irradiated xanthan gum are shown in Figure 2-4. In the spectrum of crude xanthan gum Thiolated and microwave irradiated xanthan gum peeks are summarized in tabular manner in Table 2.

There were no substantial changes in functional groups as a result of chemical alterations. When the same thiolated xanthan gum was microwave irradiated and the spectrum was compared to that of crude xanthan gum, all of the peaks identified in crude xanthan gum were present in the microwave irradiated xanthan gum as well. In study

Table 1: Composition of Lornoxicam matrix tablets in various forms.

Formulation (mg)	F1	F2	F3	F4	F5	F6	F7	F8	F9
Lornoxicam	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Avicel pH 102	106.3	101.3	91.3	106.3	101.3	91.3	106.3	101.3	91.3
Xanthan gum	21.2	26.2	31.2	--	--	--	--	--	--
Cross linked-XG	--	--	--	21.2	26.2	31.2	--	--	--
Irradiated-XG	--	--	--	-	--	--	21.2	26.2	31.2
Magnesium Stearate	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Aerosil 200	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total Weight	150	150	150	150	150	150	150	150	150

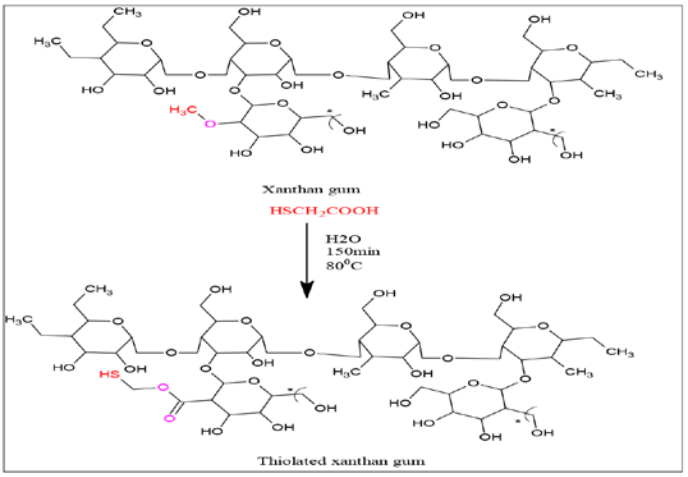

Figure 1: Reaction involved in synthesis of modified Xanthan Gum.

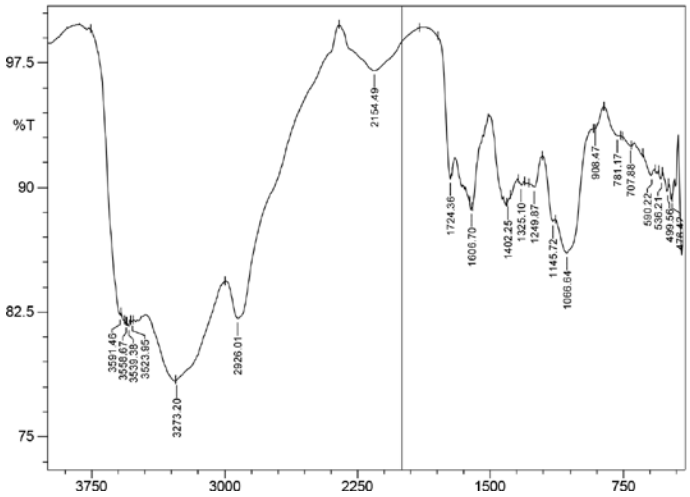

Figure 2: FTIR of crude xanthan gum.

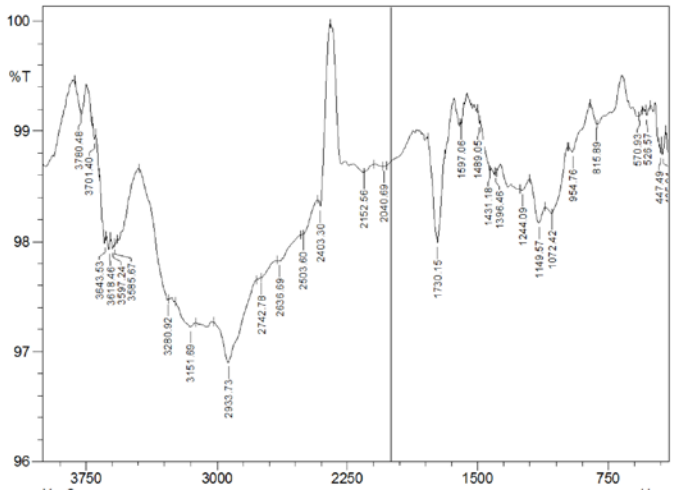

Figure 3: FTIR of thiolated xanthan gum.

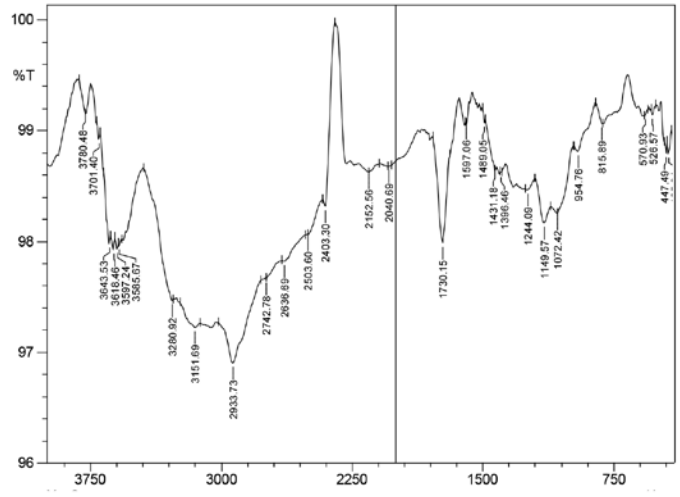

Figure 4: FTIR of microwave irradiated xanthan gum.

Table 2: **Result of FTIR.**

Xanthan Gum				
Functional group	IR Spectrum Standard range (cm^{-1})	Crude (cm^{-1})	Thiolated Xanthan gum (cm^{-1})	Micro-wave Irradiated (cm^{-1})
OH (s, vib)*	3550–3200	3547.21	3556.85	3556.85
CH (s, vib)* of CH2	3000–2850	2928.04	2929.97	2928.04
C=O (s), of acetyl group	1710–1665	1670.41	1668.48	1668.48
COO- (s, vib)* of COOR	1760–1690	1629.90	1610.61	1614.47
CO (s, vib)* of C-O-C	1320–1000	1024.24	1035.81	1003.02
S-H (s)	2600–2500	--	2503.60	2636.69

* s, vib; stretching vibration * s; stretching

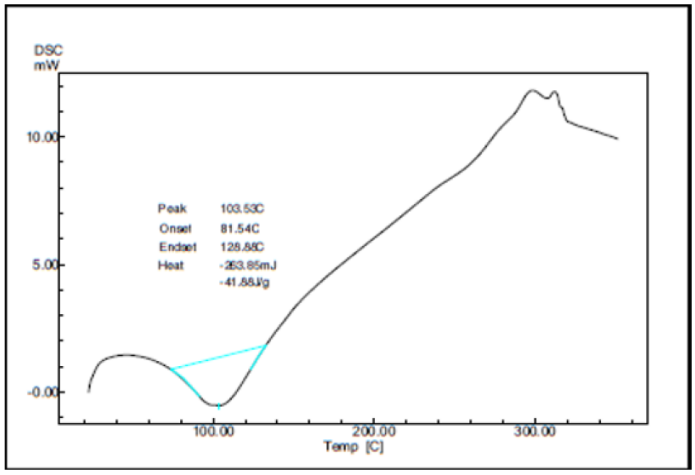

Figure 5: DSC curve of thiolated Xanthan gum.

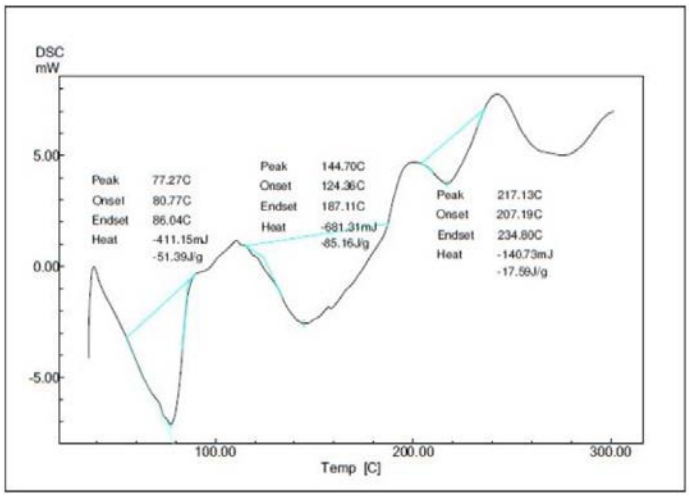

Figure 6: DSC curve of thiolated Xanthan gum.

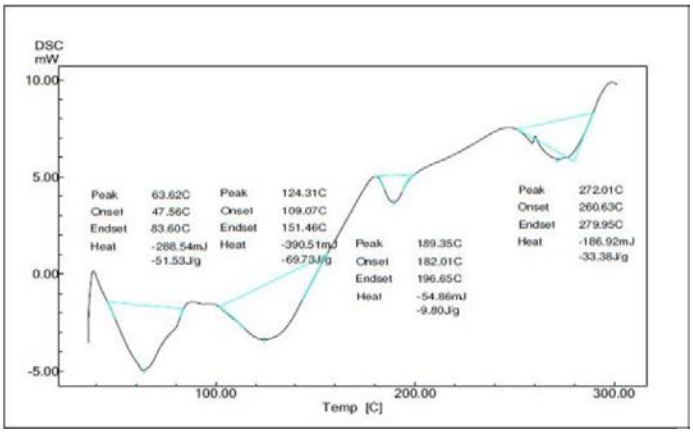

Figure 7: DSC curve of micro-wave irradiated Xanthan gum.

thiolated xanthan gum and microwave irradiated gum, additional peaks were discovered that were not present in crude xanthan gum.

Using thermal characterization by diffraction scanning calorimetry, the physical morphologies, thermal transitions, melting behaviour, chemistry, and stability features of crude, thiolated, and micro-wave irradiated Xanthan gum were examined (DSC). The DSC curves of the tested materials are shown in Figure 5-7. Gum has a large endothermic peak between 90 and 120 degrees Celsius. Despite the crude Xanthan gum was dried at 120°C for half an hour before to the research. Figure 5 indicates that the endothermic peak of moisture was still visible in the thermogram.

X-ray diffractogram of crude, thiolated, and microwave irradiated xanthan gum is shown in Figure 7-9. X-ray diffractometry was used to identify the sample's nature (crystallinity or amorphous). Figure 7 shows the diffractogram of crude xanthan gum, which is amorphous nature. In the diffractogram of xanthan gum, has just 1 crystalline peak with 2 value of 22.30 o with relative intensity 60.23 percent. Crystallinity of native Xanthan gum is improved by thiolated Xanthan gum, as seen in Figure 8. The presence of nineteen distinct and apparent diffraction peaks in the grafted xanthan gum attests to this. 2θ values were found to be ranging from 11.873o to 75.18°. Peaks of thiolated Xanthan gum substantially higher than the only peak generated by crude Xanthan gum. The extreme grafting ensued when the thio-group reacted with xanthan gum, yielding thiolated grafted xanthan gum and microwave irradiation Figure 9 as the final product, diffraction peaks in the microwave-irradiated gum at two different values ranging from 11.90° to 75.35°.

The surface morphology of xanthan gum, thiolated, and micro-wave irradiated xanthan gum are studied using SEM (Figure 10-12). The SEM of each sample was analyzed at a magnification of X4000. Crude xanthan

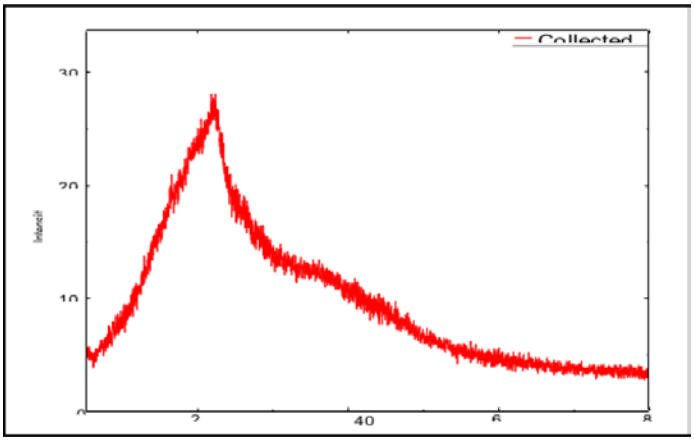

Figure 7: X-ray diffraction pattern of crude xanthan gum.

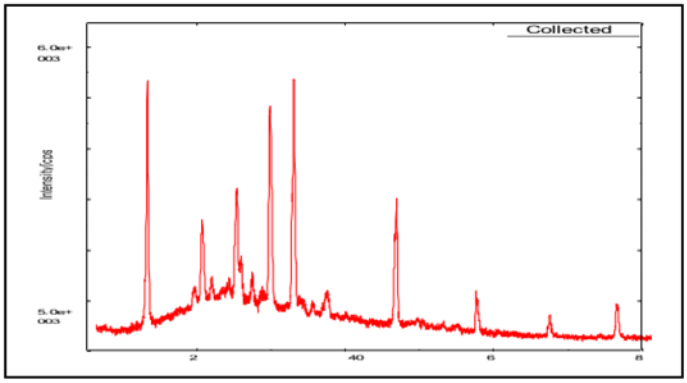

Figure 8: X-ray diffraction pattern of thiolated Xanthan gum.

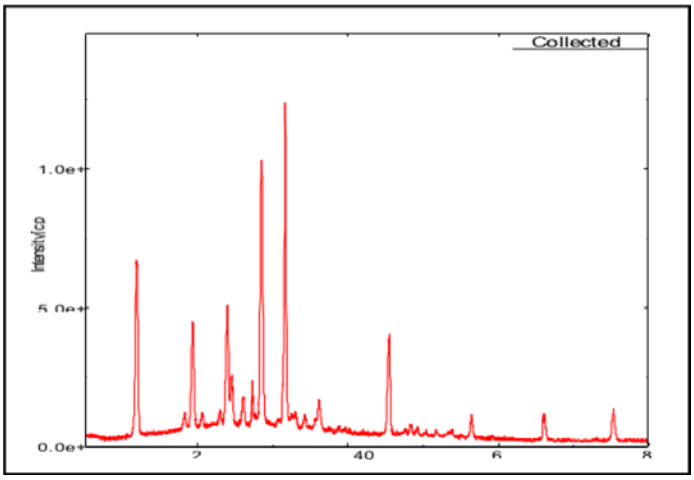

Figure 9: X-ray diffraction pattern of micro-wave irradiated xanthan gum.

gum is found to be additional granular as well as fibrous in SEM images. Xanthan gum fibers appeared to be present in a crosslinked form.

Pre-formulation Studies

For each type of formulation, Lornoxicam and various excipient blends were created and tested for pre-compression tests such as bulk

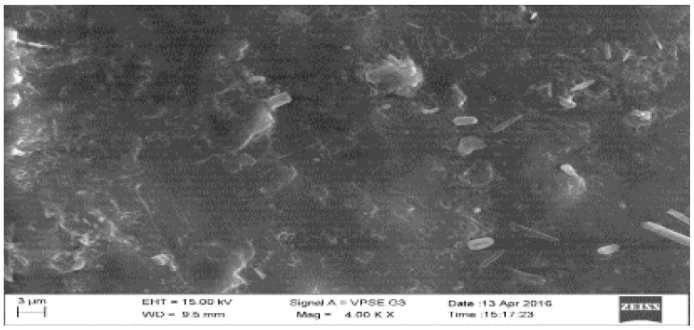

Figure 10: SEM image of crude xanthan gum.

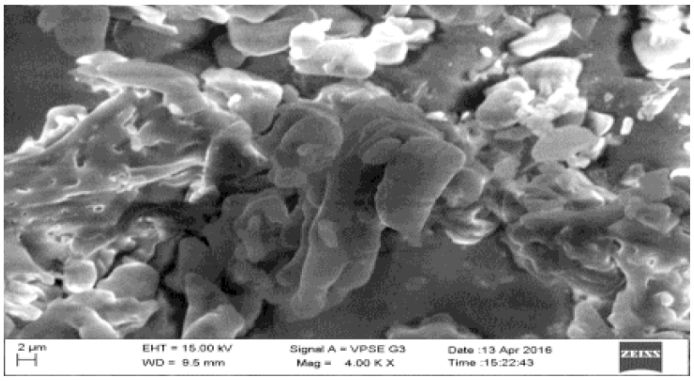

Figure 11: SEM image of thiolated xanthan gum.

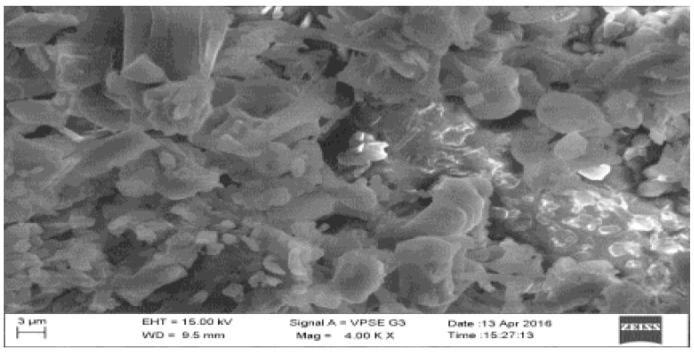

Figure 12: SEM image of microwave irradiated xanthan gum.

density, tapped density, Carr's compressibility index, Hausner's ratio, and angle of repose. Bulk density is found to be between 0.373±58 and 0.398±78 grams/cm^3 whereas the tapped density was found to be between 0.416±25 and 0.446±23 g/cm^3. The evaluation test is discovered within permissible limits. The above density values were used to calculate Carr's compressibility index. Compressibility index and Hausner's ratio of all powder mixes were in the range of good to acceptable, as determined by the compressibility index and Hausner's ratio (6.73±26-16.49±41% and 1.012±15-1.169±24, respectively). Angle of repose is better explain the flow behaviour of powdered mixtures. Angle of repose was shown to be between 17.34-28.44°. The angle of repose data revealed that all powder mixes had good to acceptable flow properties (SD n=3).

Post-compression Evaluation

The produced tablets are subject to a variety of qualitative tests, which revealed the following organoleptic properties: color, odor, and shape.

All of the formulations were yellow in color, odorless, and circular in shape with a biconvex. Thickness of the tablets was measured with vernier callipers. The average thickness of all formulations was found to be between 3.82±56 and 3.91±35 mm, which is within the standard deviation of 5% of the standard value. The hardness is determined by a Monsanto hardness tester. Tablet hardness is a key factor for defining a tablet's resistance to capping, abrasion, and various proses of handling before administration. The hardness of all batches of formulations ranged from 10.78±11 to 15.82±47 Kg/cm^2. This ensures that all formulation batches are easy to work with. Friability testing is a method of measuring the physical strength of compressed and uncoated tablets after mechanical shock and attrition. Friability of the manufactured tablets was tested by Roche friabilator. All Lornoxicam sustained release tablet batches were tested for percent friability. All batches of the formulations had an average percentage friability of 0.15 to 0.31%, as per Pharmacopoeial range (i.e. less than 1%). Preparation tablets can withstand mechanical shock and attrition, making them suitable for handling. Because the powder was free-flowing, the tablets produced are equal in weight, with allowed variance according to IP standards, thanks to uniform die fill. The weight variation for formulations is ranging from 147.42±0.31 to 158.70±0.11 mg (SD *n*=3). Because the percent weight variation is within the limits (7.5 percent), all formulated tablets passed the weight variation test. Average weight of a Lornoxicam matrix tablet is 150 mg, with lower and upper limits of 138.75±11 mg and 161.25±33 mg, respectively. The weights of all batches of tablet formulations are found identical, by small standard variations. All of the developed formulations were evaluated for drug content, the results are spotted in. The drug content of all batches is found between 96.03 percent and 99.18 percent w/w. All reading are the average of three replicates with the SD *n*=3

In-vitro drug release studies

To study *in-vitro* drug release behaviour of polymer matrix in simulated intestinal conditions. Dissolution test is performed by using USP type II equipment. Tablets are subjected in a 900 mL phosphate buffer solution with a pH of 6.8 that was kept at 37±1°C and the equipment was turned on for 24 hr at 50 rpm. To test the influence of the release retardant (polymers) on drug release, polymer-drug ratio is adjusted. Formulas F1, F2, and F3 had crude xanthan gum, Formulas F4, F5, and F6 had thiolated xanthan gum, and Formulas F7, F8, and F9 had irradiated xanthan gum, in order of polymer drug ratio. Table 2 illustrates the % of drug release from matrix tablets, revealing that increased polymer ratio hinders drug release from formulations, independent of the polymer used. At pH 6.8, lornoxicam release from the matrix tablet was similarly sustained for a long time, and the arrangement of drug release retardation is discovered like irradiated xanthan gum > cross linked xanthan gum > crude xanthan gum. Among 9 formulations, cross linked Xanthan gum demonstrated to be the finest sustainable material with respect formulation F6 (containing 20.8% cross linked Xanthan gum) was considered as best formulation as this formulation sustained release behaviour up to 24 hr. Figure 13 represents the cumulative percentage release of Xanthan gum-based formulations. Lornoxicam disintegrated relatively slowly in acidic settings due to its pH-dependent solubility; in fact, less than 10% of the medication was dissolved after 2 hr.

Drug Release Kinetics

An *in-vitro* release profile gives crucial information about the formulation's structure and behaviour, as well as probable interactions between the drug and carrier composition and their impact on drug release rate and mechanism. The data was treated with first-order, Higuchi kinetics model, and Korsmeyer/ Peppas equations, as well as zero order pattern to determine the mechanism of drug release from formulations. Formulations did not follow a zero-order release, as seen in

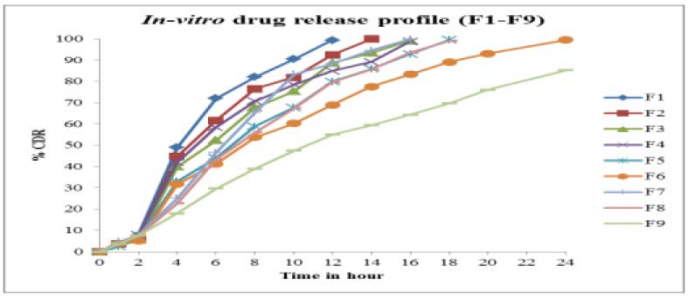

Figure 13: *In-vitro* release profile of prepared tablets (F1-F9).

(R^2; 0.843-0.874). Data is plotted for first-order equation, presented good linearity, with regression values ranging from (R^2: 0.926 and 0.979). The time for diffusion rises, the drug diffuses at a slower rate, a phenomenon known as Higuchi's kinetics. Higuchi's equation best reflected the *in-vitro* release of drug from formulations in this experiment, since the charts demonstrated strong linearity (R^2: 0.989 to 0.996). Data entered into Korsmeyer/ Peppas equation gives confirmation of fitting into Korsemeyer diffusion mechanism, Formulations F1 to F9 presented good linearity (R^2; 0.982 to 0.991), with ranging of slope (n) reading in between 0.453 to 0.932.

Stability Studies

Formulation F6 and F9 are subjected to physical appearance; drug content as well as *in-vitro* drug release were all evaluated. By the data we got no significant changes in color, odor, shape and drug release profile occurred during the trials. The drug had not degraded appreciably after three months of stability testing, showing that the developed formulations were physically and chemically stable.

DISCUSSION

Thiolated xanthan gum was prepared by, generating ester linkages between the hydroxyl group of galacturonic acid moieties of xanthan gum and the carboxyl group of thioglycolic acid. The grafted sample was then exposed to micro-wave irradiation for a predetermined period of time to produce Irradiated Xanthan gum. The presence of the thiol group's SH stretch may be noticed in the bands between 2568.00 cm^{-1} and 2584.70 cm^{-1}. [21] The Tp value (denotes thermostability) of thiolated as well as irradiated xanthan gum was more than crude gum. The macromolecule becomes more thermodynamically stable as the bond between the polymer chain and the Thio-group of side chains becomes stronger. The thermogram of crude Xanthan gum indicated an endothermic peak at 103.53°C, which matched to its melting point, with a normalized energy of -41.88 J/g. The appearance of an endothermic peak at 103.53°C suggests that the Xanthan gum in question is amorphous. In thiolated Xanthan gum, four endothermic peaks are existing. At 63.62°C, the first broad endothermic peak was noticed, which could be due to moisture loss in the sample. At 124.31°C, the 2 endothermic peak was found, corresponding to a fusion enthalpy (ΔH) of -69.73 J/g. The enthalpy value of thiolated Xanthan gum increased somewhat when compared to that of its crude form. Thioglycolic acid had a fourth peak at 272.01°C (endothermic peak). Third endothermic peaks were identified during the interpretation of DSC curves of microwave irradiated Xanthan gum (Figure 7). 77.27°C, 144.70°C and 217.13°C for The 1, 2, and 3 endothermic peaks are the first, second, and third endothermic peak, respectively.

X- ray diffraction data it's possible that thioglycolic acid contributed to the increase in crystallinity of grafted gum. When thiolated Xanthan gum is additional exposed with microwave irradiation, its crystallinity

was considerably amplified. In the diffractogram of xanthan gum, it has just 1 crystalline peak with 2 value of 22.30° with relative intensity 60.23% Crystallinity of native Xanthan gum is improved by thiolated Xanthan gum, as seen in Figure 8. The presence of nineteen distinct and apparent diffraction peaks in the grafted xanthan gum attests to this. 2θ value ranging from 11.873° to 75.18°. Peaks of thiolated Xanthan gum substantially higher than the only peak generated by crude Xanthan gum. Diffraction peaks in the microwave-irradiated gum at two different values ranging from 11.90° to 75.35°.

The surface morphology of microwave irradiated xanthan gum was similar to that of thiolated xanthan gum, however the clumpy mass appeared in irradiated xanthan gum was same that of the Thiolated form. Granules of thiolated gum and microwave-irradiated xantha gum was bigger than pure xanthan gum.

For each type of formulation, Lornoxicam and various excipient blends were created and tested for pre-compression tests such as bulk density, tapped density, Carr's compressibility index, Hausner's ratio, and angle of repose. The density values were used to calculate Carr's compressibility index. Angle of repose, Compressibility index and Hausner's ratio of all powder mixes were in the range of good to acceptable.

The content uniformity of for all batches of tablets was found to be in the range of 97.50% w/w to 99.32% w/w. The IP limit for content uniformity is NLT 85% and NMT 115% of the label amount of the drug. Amount of gum is increased in formulation gum would get more hydrated and swell at the same time. The drug diffusion pathway would be extended as a result, and the drug release rate would be reduced. Linear drug release was present in the majority of the formulations. Such linear drug release from hydrophilic matrices has been recognized to the synchronization of swelling and erosion of the polymer in sustaining a continuous gel layer. Thiolated and microwave-irradiated xanthan gum had no effect on pH. All of the formulations swelled after retaining in dissolution medium, outer layer of the tablets appeared as hydrated, with an upsurge in the size of hydrated layer, especially visible for matrices having irradiated gum, tracked by a gradual loss of integrity, resultant from the dissolution apparatus's hydrodynamic stress. It is clear that all matrix tablets made with crude Xanthan gum at concentrations of 14% and 20.8% failed to sustain Lornoxicam, a painkiller. This is most likely owing to the tablets' considerable breakage at the start of the release trial, which prevented the establishment of a continuous gel layer on their surfaces, which modulates drug release. Matrix tablets, on the other hand, have a cross-linked Xanthan gum content of 20.8% (F6) they were able to keep their integrity. At the same polymer concentration, tablets made with the cross-linked polymer had greater extended-release properties than those made with crude Xanthan gum. However, at 14% and 17%, cross linked gum does not show sustain release of the drug.[21] At 20.8% of cross-linked polymer concentration, the tablets indicated a sustained drug release effect. Diffusion considerations are usually involved release of the medication from tablets containing hydrophilic polymers. The diffusion refers movement of drug from a dose matrix to *in-vitro* study medium at a specific deliberation. Drug is released as the gradient changes, and the time for diffusion rises.[22] On the basis "n" value proves formulation follows of Fickian diffusion as well as shows a collective effect of diffusion and erosion on this we can canceled that formulation gives controlled drug release. From stability studies showing that the developed formulations were physically and chemically stable.

CONCLUSION

In this study, thioglycolic acid was utilized to chemically modify Xanthan gum, and then thiolated xanthan gum was generated. Grafting was successful, according to FT-IR, DSC, and X-ray diffraction examinations. Lornoxicam sustained release matrix tablets were effectively made by changing ratio of polymers such as Xanthan gum, thiolated Xanthan gum, and irradiated Xanthan gum. Because of the high compressibility index of the powder mixture, the direct compression method is chosen. The thickness, hardness, weight variation, and friability of compressed tablets all satisfied regulatory limits. The manufacturing of ideal-property tablets is made easier with free-flowing powder. The kind and concentration of polymers were the main determinants of drug release, a little various in polymer ratio caused by a change in drug release. On these findings, it can be indicates that if Xanthan gum is cross-linked and employed at the proper concentration, the drug release can be prolonged. The study's goal was achieved by developing a new Lornoxicam sustained-release formulation that will aid to plasma drug level variations, improves patient compliance, decrees dosing time and related side effects.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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