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Solubility Enhancement of Ibuprofen by Different Techniques

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Introduction: -

Ibuprofen, often known as IBU, is a non-steroidal anti-inflammatory medicine that is anticipated to have an immediate effect. However, IBU has a low solubility and high permeability (class 2 drug in the BCS system), which prevents it from dissolving quickly and having a high bioavailability. A drug's solubility and/or dissolving rate affect how bioavailable it is when taken orally.and dissolution may be the stage that dictates how quickly therapeutic activity begins.As a result, low water soluble medications typically exhibit high bioavailability. ability due to decreased absorption, which is a top concern for pharmaceutical firms globally. With a half-life of 1.8 to 2 hours, the phenyl propionic acid derivative ibuprofen is frequently used as a first-line non-steroidal anti-inflammatory, analgesic, and antipyretic drug.The majority of medications that are now on the market are poorly water-soluble. Additionally, poorly water-soluble medicines are included in more than 40% of oral medication products sold in pharmaceutical markets. Poorly water-soluble pharmaceuticals have progressively increased in recent years along with the growth in drug candidates; over 70% of new medication candidates have low water solubility. These medications are taken by mouth. Therefore, increasing their bioavailability is crucial. (BA). Another process for amorphization that converts crystal formations to an amorphous state is adsorption to porous materials. Yonemochi et al. revealed that controlled porous glass was used to amorphize pharmaceuticals.

Ibuprofen, a phenyl propionic acid derivative with a half-life of 1.8 to 2 hours, is frequently used as a first-line non-steroidal anti-inflammatory, analgesic, and antipyretic drug. (Eichie et al., 2009). It has a low water solubility and a slow rate of dissolution during oral absorption, which could cause a bioineqivalence issue (Chowdary & Srinivas, 2000; Hu et al., 2007). Since rapid ibuprofen absorption is necessary for the speedy commencement of its pharmacological effects, it is desired to optimise ibuprofen solubility for its prompt release. Various ibuprofen solid dispersions have been described in earlier literature.methods enhancing its dissolution utilising a variety of carriers have been reported (Xu et al., 2007; Ali &Esnaashari et al., 2005; Loganathan et al., 2000; Sharma, 1991; Khan & Jiabi, 1998;et al., 2007; Islam et al., 2010; Park et al., 2009; Dabbagh & Taghipour, 2007; Neha et al., 2008a; Neha et al., 2008b; Neha et al., 2008c). PEG (polyethylene glycol) and PVC PVP is one of the hydrophilic polymeric carriers that has been studied the most frequently (Kalaiselvan et al., 2006; Wade & Paul, 1994; Kaur et al., 1980; Broman et al., 2001; Trantishaiyakul et al., 1991). Additionally, prior research demonstrated that combining two hydrophilic polymeric carriers, such as PEG and PVP, might enhance the solubility and dissolution profiles of a variety of medications that were poorly soluble in water (Suhagia et al.,Patel & Patel (2008); Shah et al. (2009); and 2006). Ibuprofen solid dispersion utilising a PEG and PVP combination carrier, however, was not documented.

Solubility Study:-

IBU-PVA-SLS solubility in water was evaluated using a UV-VIS spectrophotometer. IBU that has not been treated, IBU-SLS physical mixture, IBU-PVA physical mixture, and IBU-PVA-SLS spray dried are all shown to be soluble in water in Figure 4. Due to its tiny particle size, low degree of crystallinity, and hydrogen bonding, IBU-PVA-SLS is more soluble in water than untreated IBU. Smaller particles have a bigger surface area for reactions, increasing IBU-PVA-SLS's solubility in water. It was anticipated that the alteration in crystallinity would improve IBU-PVA-SLS's solubility in water. PVA is used further in Rachmaniar et al.Improvement of Ibuprofen Solubility and Dissolution by Ultrasonic Spray Drying Marmara Pharma Journal 21/4: 783–792, 2017 788 Given that PVA is a hydrophilic polymer, IBU might result in an improvement in solubility. As a result, it was found that IBU-PVA-SLS had the maximum solubility in water and the highest PVA concentration. As shown in where the increases are 5-, 5-, and 6-fold higher than the solubility of untreated IBU for IBU-PVA-SLS 2:1:2, 2:2:2, and 2:3:2, respectively, the solubility of IBU-PVA-SLS in water increased dramatically. IBU-PVA physical mixture has a solubility that is 19% higher than that of untreated IBU, whereas IBU-SLS physical mixture has a solubility that is 223% higher. In contrast to PVA, which simply serves as a water-soluble polymer that aids in ibuprofen's solubility in water but does not serve as a surfactant, SLS is a surfactant that lowers the surface tension of water to make it easier for ibuprofen to dissolve in water. SLS was added to an IBU-PVA physical mixture, increasing its solubility to 209% more than the IBU-PVA physical mixture. IBU-PVA-SLS spray dried has an 86% higher solubility than IBU-PVA-SLS physical mixture. IBU-PVA-SLS spray dried has a higher surface area to volume ratio because its particle size is smaller than that of untreated IBU. Large particles' surface areas make them more likely to come into touch with water. IBU PVA-SLS spray dried has less crystallinity than untreated IBU. Low crystallinity particles exhibit an irregular atomic configuration, which makes them more reactive. Particles that form hydrogen

bonds are created during the spray drying process.The shift of C=O to a higher wavenumber indicates hydrogen bonding between the IBU and PVA. IBU-PVA-SLS spray dried is more soluble in water than untreated IBU due to smaller particle size, lower crystallinity, and hydrogen produced.

Dissolution Study:-

According to FDA guidance for industry, waiver of in vivo bioavailability and bioequivalence studies for immediate-release solid oral dosage forms based on a biopharmaceutics classification system, immediate release drug products are evaluated using U.S. Pharmacopeia (USP) Apparatus II (paddle) at 50 rpm in a volume of 900 ml or less in each of the following media: 0.1 N HCl. The simulated stomach fluid without enzymes for the dissolving investigation was 0.1 N HCl. According to the temperature of the human body, 37°C +/- 0.5°C was used in the dissolution investigation. Illustrated are the dissolution profiles of untreated IBU and IBU-PVA-SLS. It was shown that the dissolution rate of IBU-PVA-SLS significantly enhanced when compared to untreated IBU. The released IBU-PVA-SLS (2:1:2, 2:2:2, and 2:3:2) had 2.3-, 2.2-, and 2.1-fold greater concentrations than untreated IBU after 30 minutes of dissolution. The released IBU-PVA-SLS (2:1:2, 2:2:2, and 2:3:2) were 4.05, 4.32, and 3.57 fold greater than that of untreated IBU, respectively, after 10 minutes of dissolution.

the various systems' apparent dissolution rate constants (Kp). IBU-PVA-SLS dissolves at a rate determined by the PVA concentration; higher dissolving rates are caused by lower PVA concentrations. Therefore, a smaller particle size did not guarantee an improvement in the dissolving rate; rather, the presence of PVA was what caused the dissolution rate to rise. The results also showed that IBU-PVA-SLS significantly outperformed untreated IBU in terms of dissolution rate, which may be attributable to hydrogen bonding and low crystallinity, as demonstrated by the XRD pattern and shifted peak at wavenumbers 1712.79 and 1713.40 cm-1, respectively. The particles with the lowest PVA concentration (IBU-PVA-SLS with a ratio of 2:1:2) have the highest dissolution rates when IBU-PVA-. Similar to solubility, IBU-PVA-SLS dissolves more readily than untreated IBU because of its smaller particle size and reduced crystallinity. When sampling throughout the dissolution process, a filter was used to stop taking particles that had not yet completely dissolved. Filter clogging during sampling can have an impact on the cumulative IBU emission over time. Therefore, the cumulative IBU emission reduced at specific periods in time.

Spray drying of IBU with PVA and SLS has the potential to enhance IBU solubility in water and dissolution in HCl 0.1 N. In order to create IBU by spray drying, a water-soluble polymer and surfactant were chosen, which allowed for the creation of a dosage form and a drug delivery system in stomach fluid.

Experimental:-

Preparation of ibuprofen solid dispersions by solvent evaporation technique:-

PEG 600 and PVP K 30 were used as carriers in conjunction with each other and separately, in a variety of ratios, to create solid ibuprofen dispersions. To obtain a clear solution, ethanol was used to dissolve the ibuprofen. PEG 6000 and PVP K30 were mixed together to form tiny particles, and the solvent was then evaporated at 60°C on a water bath. The dried bulk was kept in desiccators until a uniform mass could be formed, then it was ground up and sent through sieve number 22.

Determination of percent yield:-

The percent yield of ibuprofen solid dispersions can be determined by using the following expression:

Percent yield = (weight of prepared solid dispersion / weight of drug +carriers) x 100 (1)

Determination of percent drug :-

Content Weight measurements of physical mixes and solid dispersions were taken individually and added to 50 ml of ethanol in stoppered conical flasks; each sample was equivalent to 25 mg of ibuprofen. On a rotary shaker, the sealed flasks were stirred for an hour. The solution was diluted with ethanol before being tested for drug content at 220 nm with a UV-VIS spectrophotometer (SHIMADZU Corporation, Japan) using the formula: 121 Dissolution And Solubility Ibuprofen's improvement... (Theoretical drug content in solid dispersions / Practical drug content in solid dispersions) x 100 equals the percentage of drugs. (2)

Saturation solubility measurement Ibuprofen's saturation solubility was calculated, and the results were contrasted with those from physical mixes of different ratios and pure ibuprofen. The known excess samples (ibuprofen solid dispersions, physical mixes, and pure ibuprofen) were rotated at 20 rpm in a water bath (37 0.5°C) for 48 hours. 0.5 g equivalent weight of ibuprofen was added to 5 ml of phosphate buffer, pH=7.2. The samples were then filtered through 0.45 µm membrane filter, suitably diluted, and analyzed by UV-VIS spectrophotomer (SHIMADZU Corporation, Japan) at 222 nm wavelength. X-ray diffraction (XRD) studies Powder X-ray diffraction patterns were recorded on an X-diffractometer (Phillip PW 1130/00 diffractometer, The Natherlands), employing CuK∞ radiation source operating at 30 mA and 40 kV. Samples were scanned from 6 to 40° 2θ at a scanning rate of 0.02° 2θ s-1.

Differential scanning calorimetry (DSC) analysis The samples were analyzed by differential scanning calorimeter (Model DT-60,Shimadzu) at a constant scanning speed of 10°C min-1 from 0-300°C. The 5-7 mg samples were accurately weighed into solid aluminum pans without seals.

Dissolution studies:-

Utilizing a USP XXIII apparatus (Electrolab, India) with a paddle spinning at 50 rpm, dissolution tests were carried out in phosphate buffer (pH 7.2, 900 ml) at 37 0.5 °C.

The samples containing 100 mg of ibuprofen underwent dissolution. Five millilitre samples (5 ml) were taken out and an equal volume of new dissolving medium was added at predetermined intervals. Withdrawn samples were filtered using a 0.45 m membrane filter before being tested for drug content spectrophotometrically at 222 nm wavelengths with a UV-VIS spectrophotometer. (SHIMADZU Corporation, Japan).

Stability studies:-

Samples were kept in stability chambers (Analytical technology, Bangalore, India) at 25 2 °C and 60 5% relative humidity to conduct stability tests. (RH). Up to six months, samples were routinely collected and examined for drug content and dissolution tests. For all pairwise comparisons in this investigation, one-way analysis of variance (ANOVA) was used to look for any significant differences in all the data gathered from the stability study. MedCalc software, version 9.6.4.0, was used to do the statistical analysis.

Dissolution rate Studies:-

Ibuprofen and its co-milled mixture with different excipients, equivalent to 200 mg ibuprofen,were filled in colourless hard gelatine capsule shells and subjected to dissolution studies in a USP type I (paddle) apparatus (DT-700, Erweka Germany). 900 mL of phosphate buffer (pH 7.4) was selected as the dissolution medium and the temperature maintained at 37 ± 0.4 °C. The paddle speed was set up at 50 rpm. Aliquots of 5 mL were withdrawn at intervals of 5, 10,20, 30, 45, 60 and 90 min and replaced with the equal volume of the fresh dissolution medium in order to maintain a constant volume. Each sample was filtered through a 0.45 μm syringe filter and then diluted adequately (i.e. Amax < 1) for assay by UV spectrophotometry

Particle size determination:-

The dry dispersion laser diffraction technique was used to measure the particle size distribution (PSD) of unmilled ibuprofen and its co-milled mixtures with HPMC or soluplus (1:1) in accordance with the techniques outlined in the literature. (Krause et al., 2011). A laser diffractometer (HELOS H1360, Sympatec, GmbH, Germany) equipped with an R5 lens (Sympatec), which can measure the particle size between 4.5 and 875 m, was used to measure the powder under a pressure of 0.5 bar after it had been dispersed in compressed air at a pressure of 3 0.05 bar using a dispersion unit called RODOS (Sympatec, Germany). The findings were calculated as the average of the three measurements.

Scanning electron microscopy (SEM):-

SEM images of un-milled, milled and co-milled Ibuprofen samples were obtained on a ZEISS EVO HD 15 scanning electron microscope (Carl Zeiss, NTS Ltd. Cambridge, UK) according to the method described (Qiao et al., 2013). The samples were mounted on the carbon adhesive tape fixed on aluminium stubs (Agar Scientific Ltd., Stansted, UK) and flushed with air. The SEM images were taken at the electron beam voltage of 10 KV.

Differential scanning calorimetry (DSC):-

According to the procedure outlined in our prior study, DSC studies of unmilled ibuprofen and its co-milled mixes with various excipients were carried out. (Smith et al., 2015). At a ramp rate of 20 °C/min, the sample was examined over the temperature range of 25 to 150 °C. A sample of crystalline ibuprofen in a non-hermetically sealed DSC pan was vitrified by heating in an oven at 90 °C for 10 min, then quenched by dipping it in liquid nitrogen, in order to compare the results of milled ibuprofen with those of a 100% amorphous sample. A pre-cooled DSC furnace was filled with this pan and heated it from -60 °C to 110 °C.

Attenuated total reflectance (ATR) spectroscopy:-

Ibuprofen's IR spectra were measured using an attachment called the Smart Performer Platinum ATR on a Bruker Alpha FTIR Spectrophotometer (Bruker, Japan). Alpha Opus Software conducted an analysis of the data. An ATR sample cell with a diamond crystal and a 2 m scanning depth was installed in the device. A clutch-style lever was used to secure the sample powder to the crystal's surface. Each sample was scanned 20 times at a resolution of 2 cm-1 against air between 4000 and 400 cm-1.

Enhancement of solubility and dissolution of ibuprofen microparticle prepared by ultrasonic spray drying:-

Ibuprofen (IBU), also known as 2-(4-isobutyl-phenyl) propionic acid, is a non-steroidal anti-inflammatory medicine that is supposed to have an immediate effect. However, IBU has a low solubility and high permeability (class 2 drug in the BCS system), which prevents it from dissolving quickly and having a high bioavailability. IBU has a 2.0 0.5 hour half-life as well. IBU has a relatively low bioavailability since it is difficult to enter into the blood circulation system due to its low solubility and short half-life [1-3]. Thus, a high bioavailability of IBU requires a dissolving rate. By reducing the particle size, one can increase the reaction's surface area and increase the dissolution rate [3–7]. The micronization procedure, which reduces particle size to speed up drug solubility, is frequently used in pharmaceutical technology [8–9].

Figure 1 displays IBU and IBU-PVA-SLS particle XRD patterns. The IBU-PVA-SLS peaks were identical to those of the untreated IBU, according to XRD patterns. Untreated IBU's x-ray diffractogram exhibits strong peaks at typical crystalline patterns at various diffraction angles. In this instance, both the untreated IBU and the IBU-PVA-SLS were already crystallised. In contrast to IBU-PVA-SLS, which had a large FWHM, untreated IBU had a small full width at half maximum (FWHM), indicating that IBU had a low degree of crystallinity. The cosolvent system in which IBU was dissolved prior to the ultrasonic spray drying procedure is to blame for this. The molecular structure of IBU was unable to rearrange to a crystalline configuration (as expected) after cooling off following the evaporation process of the solvent in the reactor [31]. The interactions between IBU, PVA, and SLS were investigated using FTIR. The frequency and bandwidth of interacting groups in the spectrum will change as a result of the molecular level mixing of the constituent parts.

The FTIR spectra of untreated IBU, PVA, SLS, and IBU-PVA-SLS are shown in Figure 2. The IBU-PVA-SLS pattern spectrum was visible in the FTIR spectrum and was similar to the untreated IBU, PVA, and SLS.The para C-H in untreated IBU causes a peak to appear about 860–830 cm-1, and the carboxylic C=O group causes a strong band to appear at 1700 cm-1. PVA displays a peak between 3334 and 3299 cm-1 because of the O-H group. SLS displays a peak at 1219 and 1214 cm-1 because of sulphate covalent. IBU-PVA-SLS exhibits the same peaks with untreated IBU, PVA, and SLS in the same location. The IBU-PVA-SLS XRD pattern is in concordance with the FTIR spectrum, which shows the presence of untreated IBU, PVA, and SLS. Due to intermolecular hydrogen bonding, the carboxylic C=O group in IBU-PVA-SLS exhibits a shift to a higher wavenumber. The O-H group which was exhibited by IBU-PVA-SLS have a different transmitance according to concentration of PVA. Lower concentration of PVA in IBU caused lower transmittance intensity of O-H group. The transmittance values of O-H group peak for IBU-PVA-SLS (2:1:2; 2:2:2; 2:3:2) were 79.08, 59.92, and 49.56%, respectively [32]

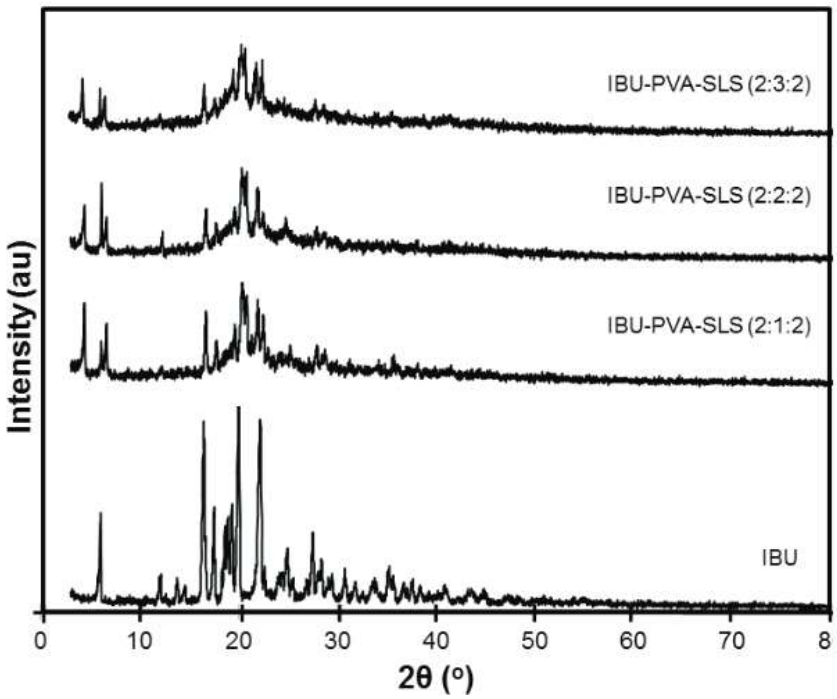
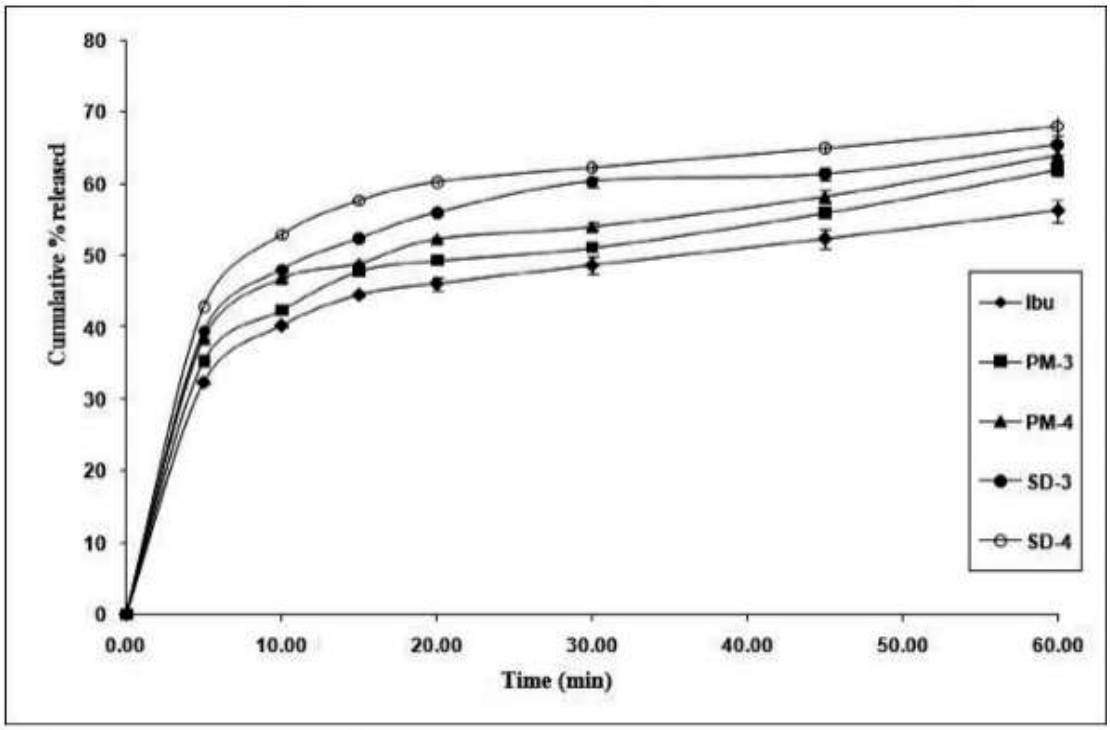


Figure 1. X-ray diffraction pattern of IBU-PVA-SLS 2:1:2, IBU-PVA-SLS 2:2:2, IBU-PVA-SLS 2:3:2, and untreated IBU.

Solubility and dissolution enhancement of ibuprofen by solid dispersion technique using peg 6000-pvp k 30 combination carrier:-

A drug's solubility and/or dissolution rate affect a drug's oral bioavailability, and dissolution may be the step that determines how quickly therapeutic activity begins. Because of this, medications that are weakly aqueous soluble are typically characterised by a low bioavail- ability due to poorer absorption, which is a serious concern for pharmaceutical firms all over the world. Micronization (Gupta et al., 2003), the creation of inclusion complexes with cyclodextrins (Cavallari et al., 2002), the creation of amorphous drugs (Corrigan, 1995), and the creation of solid dispersions of drugs using various hydrophilic carriers are some of the different methods available to improve drug solubility as well as drug dissolution of poorly aqueous soluble drugs.

(Ambike et al., 2004; Paradkar et al., 2004; Das et al., 2011). Among these, solid dispersion technique has garnered a lot of attention as an effective way to increase the dissolution rate and bioavailability of a variety of medications that are poorly water soluble. (Chiou & Rielman, 1971; Leuner & Dressman, 2000; Dhirendra et al., 2009). Due to the drug's increased wettability and dispersibility, the fact that it exists in amorphous form with better solubility, and the absence of drug particle aggregation utilising various hydrophilic carriers, fast and prompt drug dissolution from solid dispersions has been observed. (Zerrouk et al., 2001; Tashtoush, et al., 2004; Van der Mooter, 2006; Kalaiselvan et al., 2006; Vinaya Kumar & Mishra, 2006; Shah et al., 2007; Batra et al., 2008; Mehta et al., 2009; Das et al, 2011).



Various ibuprofen solid dispersions were prepared using PEG 6000 and PVP K 30 in combination and individually, as carriers by solvent evaporation technique to increase the solubility as well as dissolution of poorly aqueous soluble drug ibuprofen.

Solubility Enhancement of Ibuprofen by Adsorption onto Spherical Porous Calcium Silicate:-

A significant portion of medications now on the market are poorly water-soluble. Additionally, poorly water-soluble medicines are included in more than 40% of oral medication items on the pharmaceutical market [1–3]. Nearly 70% of novel drug candidates have low water solubility, which has progressively increased in recent years as the number of drug candidates in drug discovery has increased [4]. These medications are taken by mouth. Therefore, increasing their bioavailability is crucial. (BA).The Biopharmaceutics Classification System (BCS), one of the indexes used to categorise BA, is based on solubility and permeability and contains Classes I through IV. For Class II medications, the dissolution rate limits absorption in formulation studies; consequently, improving solubility is a key concern when creating oral dosage forms. Amorphization, nanoparticles, co-crystals, liposomes, microemulsions, self-emulsifying drug delivery systems, and drug-cyclodextrin inclusion compounds are just a few methods that have been reported to increase the solubility of poorly water-soluble drugs.One of the most common and easy ways to increase solubility is amorphization, which includes spray drying, freeze-drying, and ball mill grinding with a water-soluble polymer [24-29].

However, there are benefits and drawbacks related to their physicochemical features. Liposomes, microemulsions, and self-emulsifying systems are reasonably simple to create, but because they are liquid formulations, stability is frequently a problem. Manufacturing processes specific to solid dispersions and nanocrystalline formulations are required. Their physicochemical stability is also thought to be inadequate.

Adsorption of IBU onto Drug Carriers:-

EV Method The IBU was dissolved in ethanol and poured, along with PS300, into an eggplant flask. Then, the IBU was adsorbed onto the PS300 by evaporating and removing the ethanol with a rotary evaporator. The resulting white powder was an evaporated mixture (EVM). The EVM was dried further in a vacuum desiccator at 25 ◦C for 6 h. It was then stored in a desiccator under a definite relative humidity (RH 22%) until further use.

SH Method

Various PMs were placed into 20 mL vacuum reaction tubes (Thermo Fisher Scientific Inc., Waltham, MA, USA) and heated under reduced pressure (−96 kPa) using a vacuum pump for 6 h. The sealed and heated mixture (SHM) was obtained by heating at 70 ◦C. The obtained SHM was then stored in a desiccator under a definite relative humidity (RH 22%) until further use.

Percentage Increases In the Solubility Of Ibuprofen In Various Solid Dispersion:-

Solid dispersions (drug:carrier)	Nature of the product	Solubility* (mg/ml)	% increase in solubility*
IBP(Pure drug)	White crystalline powder	20.5±0.5	-
PHYSICAL MIXTURE OF IBP WITH EXCIPIENTS (1:1)			
IBP+PEG 6000	White powder	20.7±0.3	ϕ
IBP+MCC	White crystalline powder	20.6±0.2	ϕ
IBP+PVP	White powder	21.0±0.7	ϕ
IBP+Sucrose	White crystalline powder	20.9±0.9	ϕ
IBP+Mannitol	White crystalline powder	20.6±0.5	ϕ
IBP+ Dextrose	White crystalline powder	20.8±0.9	ϕ
IBP+Lactose	White crystalline powder	20.6±0.4	ϕ
IBP+Sorbitol	White crystalline powder	21.6±0.8	ϕ
DISPERSIONS BY FUSION METHOD			
IBP:PEG-6000 (1:2)	White sticky granules	20.9±0.3	2.0±1.5
IBP:PEG-6000 (1:3)	White sticky granules	22.9±0.2	12.0±0.9
DISPERSIONS BY SOLVENT EVAPORATION METHOD			
IBP:Sucrose (1:2)	Free flowing powder	20.2±0.3	12.0±0.9
IBP:Sucrose (1:3)	Free flowing powder	19.9±0.3	ϕ
IBP:Sucrose (1:4)	Free flowing powder	19.8±0.5	ϕ
IBP:Mannitol (1:2)	White powder	22.6±0.2	10.0±0.7
IBP:Mannitol (1:3)	White powder	21.6±0.2	5.0±1.0
IBP:Mannitol (1:4)	White powder	21.8±0.2	6.0±1.0
IBP:Dextrose (1:2)	White powder	23.0±0.3	12.0±1.4
IBP:Dextrose (1:3)	White powder	22.6±0.2	10.0±0.8
IBP:Lactose (1:2)	White powder	25.2±0.1	23.0±0.4
IBP:Lactose (1:3)	White powder	24.3±0.1	18.0±0.5
IBP:Sorbitol (1:2)	Free flowing powder	35.9±0.2	75.0±0.7
IBP:Sorbitol (1:3)	Free flowing powder	34.1±0.2	66.0±0.7
IBP:PVP:MCC(1:1:2)	Free flowing granules	24.3±0.1	19.0±0.6
IBP:PVP:MCC(1:1:3)	Free flowing granules	23.5±0.2	15.0±0.9
DISPERSIONS BY FUSION-SOLVENT METHOD			
IBP:PVP:PEG-6000 (1:0.5:2)	Free flowing granules	24.0±0.4	17.0±2.0
IBP:PVP:PEG-6000 (1:1: 2)	Free flowing granules	24.3±0.3	18.0±1.5

Results and discussion:-

To improve the solubility as well as dissolution of the poorly water soluble medication ibuprofen, several ibuprofen solid dispersions were created utilising PEG 6000 and PVP K 30 both singly and in combination as carriers.The range of ibuprofen solid dispersions' percent yields was 88.76 2.04% to 94.88 3.32%. (Table 1). According to a publication in, the percentage drug content in several ibuprofen solid dispersions was between 96.33 3.05% and 98.61 2.92%. This demonstrated that ibuprofen was evenly dispersed throughout all of these manufactured solid dispersions, even those made with PEG 6000 and PVP K 30. (SD-5, and SD-6). In phosphate buffer, pH 7.2, the saturation solubility of pure ibuprofen, several ibuprofen solid dispersions made with PEG 6000 and PVP K 30 acting as carriers and their respective physical mixes were measured. According to Ghosh et al. (1998), the solubility of this medication is pH dependant. The results of the solubility measurement from the ibuprofen solid dispersion may therefore be hampered by the pH shift. So, phosphate buffer with a pH of 7.2 was employed to keep the pH constant. Ibuprofen in its purest form had a saturation solubility of 2.56 0.22 mg/ml. Ibuprofen was more soluble in all samples, including physical mixtures and solid dispersions of the medication. In comparison to pure ibuprofen, all physical combinations displayed increased saturation solubility. The saturation solubility of ibuprofen solid dispersions was higher than that of the corresponding physical mixes of the drug and carrier, once more. This may be due to the hydrophilic polymeric carriers' improved wetting of drug particles and localised solubilization. Solid dispersions utilising PEG 6000 and PVP K 30 in combination demonstrated better saturation solubility than solid dispersions using PEG 6000 and PVP K 30 individually among diverse ibuprofen solid dispersions.

Conclusion:-

Utilizing a PEG 6000-PVP K 30 combination carrier, ibuprofen solid dispersions were created utilising a solvent evaporation approach. Ibuprofen solid dispersions using a PEG 6000-PVP K 30 combination were shown to convert crystalline ibuprofen (in pure medication) to amorphous ibuprofen, according to XRD and DSC investigations. These new ibuprofen solid dispersions demonstrated a notable improvement in solubility as well as drug dissolution over those of ibuprofen solid dispersions using these carriers (PEG 6000 and PVP K 30) separately, according to saturation solubility and in vitro dissolution experiments. It was discovered that the Hixson-Crowell model was followed in the in vitro dissolution of ibuprofen from these solid dispersions. These PEG 6000-PVP K 30 solid dispersions were sufficiently stable over the course of the investigation, according to stability studies. According to the study's findings, the increased solubility and drug dissolution of these newly created ibuprofen solid dispersions using PEG 6000-PVP K 30 combination carrier may be attributed to the increased wettability and decreased drug crystallinity, which can be controlled by the proper level of hydrophilic carriers.

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