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RESEARCH ARTICLE

ENHANCE BIOAVABILITY OF ALBENDAZOLE DRUG BY MESOPOROUS MATERIAL.

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Abstract

Mesoporous silica nanoparticles (MSN) have gained attention for potential as controlled release systems and vechicles for the delivery of chemotherapeutics due to high surface areas, large cavity volumes and ability to be fictionalized with biomolecules for the targeting of specific tissue by using Mesoporous material with Albendazole drug enhance Bioavability. Various Mesoporous silica structure incorporation of heteroatoms such as Cu, Zn, Al and Fe etc. into Mesoporous silica framework has been investigated .Mesoporous materials are used because of their ability of their desirable characteristics such as high surface area, large pore volume, and tunable Mesoporous channels with well defined pore size distribution, controllable wall composition as well as modification surface properties. According to the nomenclature by International Union of pure and applied chemistry (IUPAC). Albendazole is an antihelmintic drug whose solubility is low by Using Mesoporous material than Bioavability of Albendazole are Enhanced.

Introduction:-

In present Scenario with advancement in control drug delivery sytem.Multiple drugs are present in market 40 % are poorly water soluble whose bioavaibility is low. (Davis me et.al) Oral dosage forms, especially tablets are one of the most convenient formulation forms, as well in fabrication and administration. The production costs are very low compared to other dosage forms. Tablets have lots of advantages such as ease of transportation,easier delivery espically in elderly patients with low vision, patient compliance and accurate dosing (Sayari A *et.al*).

The tablet formulation of lot of potential hydrophobic and lipophilic drug molecules can be very problematic due to their poor pharmacokinetics/ADME parameters. These include a low solubility in the stability range of temperature and or a dissolution rate of the drug in the intestinal lumen, low permeation properties through the gastrointestinal (GI) wall and rapid intestinal wall metabolism or high hepatic first pass effect. The oral bioavailability of these molecules can be very low because the rate of absorption of the drug is restricted by the poor dissolution through out the GI tract (M. Hartmann *et.al*).

Recently, focus for oral drug delivery systems are the inorganic drug carriers, especially the porous carriers, "These are low density solids with open or closed pore structure and they provide large exposed surface area for drug loading'' (S Wang *et.al*).

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Mesoporous Material:-

Mesoporous material with regular geometries is generating a lot of attention owing to their great potential in practical application such as catalyzing, absorption, sensing, medical usage and nanotechnology (Monnier, A *et.al*).

Mobile corporation first introduced mobile crystalline material (MCM)-41,a large body of research has been devoted to developing novel mesoporous silica materials with controlled pore size and uniform pore structure (Hoffmana A *et.al*).

Recently, mesoporous silica nanoparticles (MSN) have gained attention for potential as controlled release systems and vechicles for the delivery of chemotherapeutics due to high surface areas ,large cavity volumes and ability to be fuctionalized with biomolecules for the targeting of specific tissue. Various Mesoporous silica structure incorporation of heteroatom's such as Cu, Zn, Al and Fe etc. into Mesoporous silica framework has been investigated. (Breck, D.W *et.al*). In recent years, Mesoporous materials, which have unique pore size, higher surface area and pore volume, have been used widely employed as carriers for drug delivery (Breck, D.W *et.al*).

Up to 40 % of new chemical entities (NCEs) discovered by pharmaceutical industry today are poorly soluble or lipophilic compounds. The solubility issues complicating the delivery of these new drugs also affect the delivery of many existing drugs. Low drug solubility often manifacts itself in a host of In vivo consequences, including decreased bioavailability ,increase chance of food effect more frequent incomplete release from the dosage form and higher interpatient variability (Alothman, Z.A *et.al*).

Poorly soluble compounds also present many in vitro formulation obstracles ,such as severely limited choices of delivery technologies and increasingly complex dissolution testing with limted or poor correlation to the in vivo absorption.

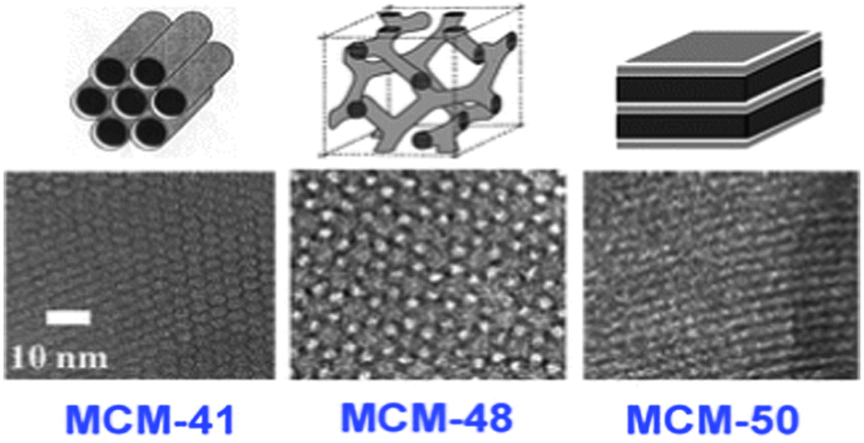


Fig 1:- Sizes of mesoparticals

In Vivo/ In Vitro correlations are often sufficiently formidable to development on many newly synthesized compounds due to solubility issues (HoffmanaA.*et.al*).

Developing strategies to overcome this handicap and to enable oral delivery of the new chemical entities now constitutes of the greatest challenges to us in pharmaceutical research. Although several formulation approaches including Solid dispersion, Emulsion based systems and nano sizing have led to promising in vitro results (Mc Bain *et.al*).

Ordered Mesoporous silica material have recently attracted much attention because of their emerging application in drug delivery, Since their first appearance in materials science in the 1990s these inorganic carriers have been successfully used in area such as catalysis, purification and adsorption (Davis, M.E *et.al*).

Meso, the Greek prefix, meaning-in between, has been adopted by IUPAC to define porous materials with pore sizes between 2.0 and 50.0 nm. Mesoporous are present in aerogels and pillared layered clays which show disordered pore systems with broad pore size distribution. A constant demand has been developed for larger pores with well defined

pore structure. The design and synthesis of organic, inorganic, and polymeric materials with controlled pore structure are important academic and industrial research projects, Many potential application require specific pore size, so that the control of pore dimensions to within a portion of an angstrom can be dividing line between success and failure. Zeolites and zeolite –like molecular sieves (zeotype) often fulfill the requirements of ideal porous materials such as narrow pore size distribution and a readily tunable pore size in a wide range (Alothman, Z.A *et.al*).

These new silicate materials possess extremely high surface areas and narrow pore size distribution .Rather than an individual molecular directing agent participating in the ordering of the reagents forming the porous materials, assembles of molecules, dictated by solution energetic, are responsible for the formation of these pore systems. This supramolecular directing concepts has led to a family of materials whose structure, composition, and pore size can be tailored during sysnthesis by variation of reactant stoichiometry, the nature of the surfactant molecules, the auxiliary chemicals, the reaction condition, or by the post-synthesis functionalization techniques.

The majority of ordered Mesoporous material have a two dimensionally ordered array of cylindrical pores of uniform size disposed parallel to each other and separated by the thin walls MCM-41 (Mobile composition of matter number forty one) and SBA-15 (Santa Barbara Amorphous number fifteen) are probably the most investigated materials (Asefa, T.*et.al*).

Recently, Mesoporous materials are used because of their ability of their desirable characteristics such as high surface area, large pore volume, and tunable Mesoporous channels with well defined pore size distribution, controllable wall composition as well as modification surface properties. According to the nomenclature by International Union of pure and applied chemistry (IUPAC) porous material defined in 3 category. Due to the distinct Mesoporous structure, mesoporous materials have demonstrated their unique advantage. (Davis, M.E *et,al*).

1. Mesoporous material have highly ordered and size controlled Mesoporous structure which enable the size selective adsorption of small molecules.
2. Mesoporous material have extremely high surface areas and large pore volumes which provide the sufficient capacity for the absorption.
3. Mesoporous material possess the performance in thermal stability, chemical stability, compositional controllability (Davis, M.E *et,al*).

Classification of porous materials:-

Micro porous material.

- Diameter < 2
- Zeolite,ALPO4

Meso porous material

- 2< Diameter<50
- HMS,MCM-41,SBA-15

Macro porous material

- Diameter >50
- Porous gel,porous glasses

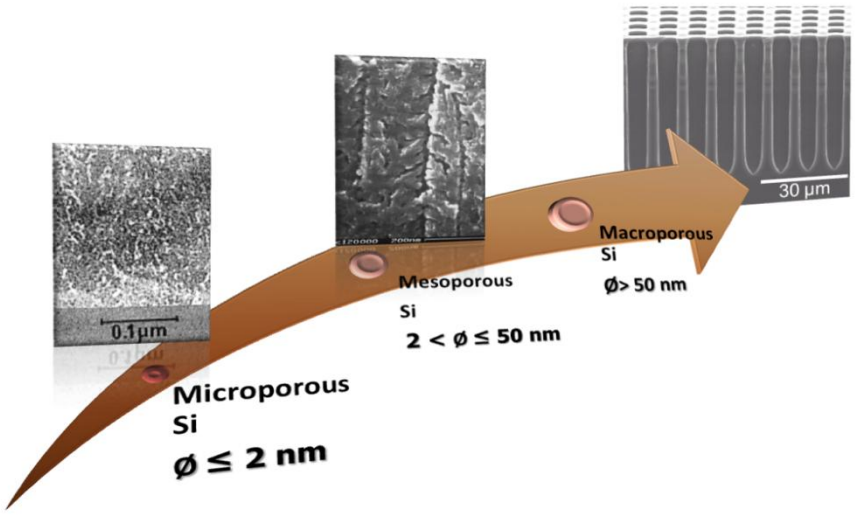


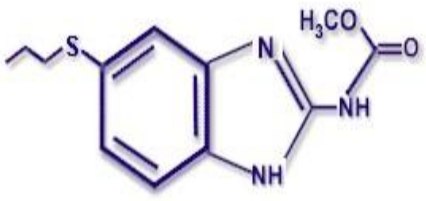
Fig 2:- Range of Mesoporous materials

Research Envisaged:-

1. The aim of my present study to formulate and evaluate of Albendazole tablet by using Mesoporous Material(Mag.allu.silicate) to improve entrapment of Albendazole and Enhance bioavailability with following Objectives.
2. To improve patient compliance with Mesoporous Formulation
3. To reduce Dose size.
4. To reduce Dose Frequency

Albendazole:- "Albendazole". *International Drug Price Indicator Guide*. Retrieved 18 August 2015.
Albendazole in treatment of human cystic echinococcosis: 12 years of experience

- **Drug : Albendazole**
- **IUPAC :** Methyl [5-(propylthio)-1*H*-benzoimidazol-2-yl]carbamate $C_{12}H_{15}N_3O_2S$



- Mol.weight : 265.34g/mole
- Physical state : Solid (solid crystalline powder)
- Colour : White to off White
- M.P : 209 ^{0}C (408.28 ^{0}F)
- Dose : 2400mg/kg (Rat)
  1500mg/kg (Mouse)

Marketed product.

- **Dahel**
- **Zental**

It is effective first-line of treatment against:

- Flatworms
- Flukes/trematodes
- Fasciolosis
- Tapeworm/cestodes
- Cysticercosis
- Echinococcosis

- **Nematodes**
- Enterobiasis (pinworm infection)
- Trichuriasis (whipworm infection)
- Toxocariasis
- Ascariasis
- Hookworm
- Cutaneous larva migrans (caused by *Ancylostoma*)

Development of porous materials:-
Zeolites and porous silicates take their place amoung the important porous material for their wide applications in separation and catalysis. Zeolite are members of a family crystalline Aluminosilicate.They were first discovered in 1756 by the Swedish Scientist Cronstedt when an unidentified silicate material was heat these minerals were found to bubble and froth ,releasing bursts of steams. (Davis, M.E *et,al*).

In 1949 and 1954 Breck and coworker were able to synthesize a number of new zeolites (types A,X and Y) which were produced in large scale to be used for the separation and purification of small molecule.The success synthesizing crystalline aluminiumsilicates in particular the emergence of the new family of alumino -phosphate and silico aluminophosphates (Dias, F *et.al*).

BCS classification (Biopharmaceutical):-
BCS is a direction for owing the intestinal drug absorption provided by USFDA.

Class I:-
Highly permeable and highly soluble drugs well absorbed and their absorption rate is greater than excretion. For those class I compounds formulated as immediate release products, dissolution rate generally exceeds gastric emptying. Therefore, nearly 100% absorption can be expressed if at least 85% of a product dissolves within 30 min of in vitro dissolution testing across a range at pH values eg. Metoprolol, Propranolol, verapamil, paracetamol, choloraquine etc.

Class II:-
Highly permeable and low soluble, limited bioavailability due to their salvation rate in vitro drug dissolution is then a rate limiting step for absorption except at a very high dose number. e.g Naproxen, Carbamezepine, phenytoin, Nifedipine.

Class III:-
Low permeable and high soluble,limited absorption by permeation rate but the drug is solvated fast .these drug exhibit a high variation in the rate and extent of drug absorption.Absoption is permeability-rate limited but dissolution will most likely occur very rapidly.
e.g Cimetidine, Ranitidine, Atenolol, Acyclovir, Captopril, Metformin, Albendazole.

Class IV:-
Low permeable and low soluble,those having poor bioavailability,usually not absorbed by the GI mucosa.These compounds are not only difficult to dissolve but once dissolved, often limited permeability across the GI mucosa.These drug tend to be very difficult to formulate and can exhibit very large inter subject and intra subject variability.
e.g Hydrochlorothiazide, furosemide, Taxol etc. (D M Brahmankar et al)

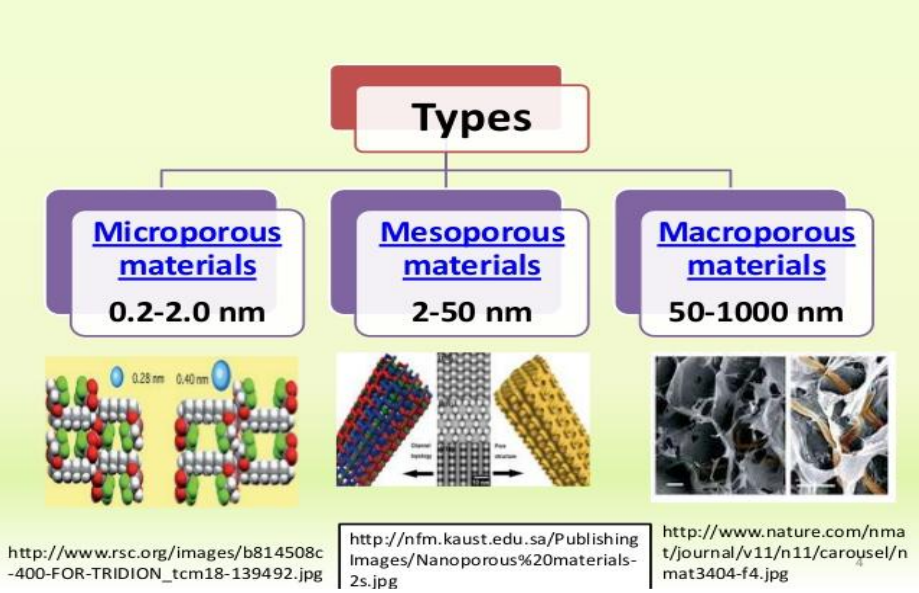


Fig 3:- Types of Mesoporous materials

Materials & Methods:-

Preformulation Studies:-

1) Angle of Repose (Θ):-

Angle of repose is defined as the maximum angle possible between the surface of a pile of the powder and horizontal plane. If more material is added to the pile, it slides down the sides until the mutual friction of the particles, producing a surface at an angle 0is in equilibrium with the gravitational force; the tangent of the angle of repose is equal to the coefficient of friction, μ, between the particles. The frictional force in a loose powder or granules can be measured by using this angle of repose.

$\tan 0 = h / r$

$0 = \tan^{-1} (h/r)$

Where, 0 is the angle of repose h is height of pile
r is radius of the base of pile

Different ranges of flow ability in terms of angle of repose are given in table no.8.4.1.1

Table: Relationship between Angle of Repose (0) and flow properties.

Table 1:- Flow Property Method.

S.no	Angle of Repose	Flow
1	< 25	Excellent
2	25-30	Good
3	30-40	Passable
4	>40	Very poor

A funnel was filled to the brim and the test sample was allowed to flow smoothly through the orifice under gravity. From the cone formed on a graph sheet was taken to measure the area of pile, thereby evaluating the flowability of the granules. Height of the pile was kept constant to 2cm measured.

Bulk Density:-

Bulk density is defined as the mass of a powder divided by the bulk volume. The bulk density of a powder depends primarily on particle size distribution, particle shape, and the tendency of the particles to adhere to one another. The bulk density of a powder depends on particle packing and changes as the powder consolidates. A consolidated powder is likely to have a greater arch strength then a less consolidated one and may therefore be more resistant to powder flow. The ease with which a powder consolidates can be used as an indirect method of quantifying powder flow.

Method:-
Both loose bulk density (LBD) and tapped bulk density (TBD) were determined by tap density tester. A quantity of accurately weighed powder from each formula, previously shaken to break any agglomerates formed was introduced into a measuring cylinder. After the initial volume was observed, the cylinder was allowed to fall under its own weight onto a hard surface from the height of 2.5 cm at 2 seconds interval. The taping was continued until no further change in volume was noted. LBD and TBD were calculated using following formula

LBD = *(M) / (VO)*
Where M is the weight of powder and VO is the volume after tapping.

TBD = $(M) / (V_f)$
Where M is the weight of powder and V_f is the final volume without tapping.

Table 2:- Flow property of Drug

S.no	Property	Value
1	Bulk Density	0.18 gm/ml
2	Tapped Density	0.24 gm/ml
3	Carr'S Index	25 gm/ml
4	Angle of Repose	43.18 ml
5	Melting Point	209-210
6	Flow Property	Very poor
7	Hausner Ratio	1.33

Solubility studies:-
Solubility of Albendazole is done in different solvents:-
Table 3:- Solubility of Albendazole.

S.no	Solvent	Solubility
1	Water	Poorly Soluble
2	Toluene	Poorly Soluble
3	Benzene	Poorly Soluble
4	Methanol	Insoluble
5	Methanolic Hydrochloric acid	Soluble

Melting Point Determination:-
Melting point of Albendazole was determined by open capillary method. Drug sample was filled in a capillary which was previously sealed at one end. The capillary was then placed into Thiel's tube, filled with liquid paraffin, along with a thermometer. The tube was heated and melting point was recorded.

UV Spectrophotometric Analysis Of Drug Sample:
100 mg of albendazole was taken in a 100 ml volumetric flask and volume was made upto the mark with methanol hydrochloric acid to produce a stock solution of 1000 µg/ml. From this solution, solution of 100µg/ml was prepared and sample was scanned between 200-400 nm on a double beam UV/Vis spectrophotometer.

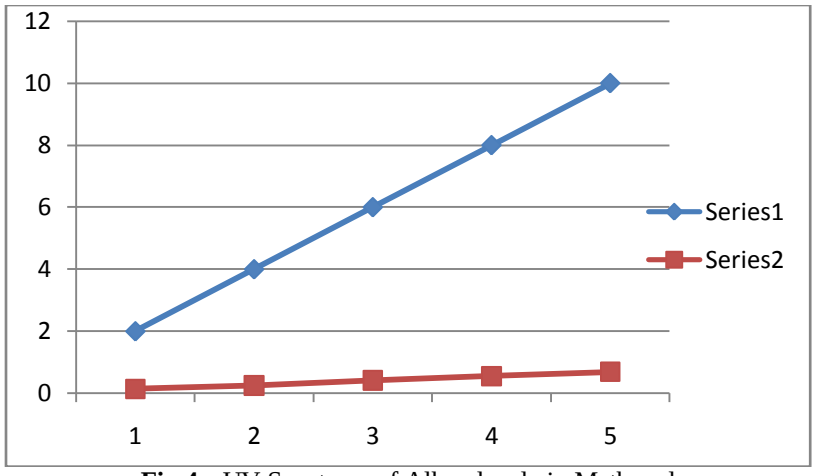


Fig.4:- UV Spectrum of Albendazole in Methanol
Y=0.07009x-0.00771
r2= 0.99731

Table 4:- Concentration of Albendazole.

S.no	Concentration	Absorbance
1	2	0.144
2	4	0.253
3	6	0.417
4	8	0.556
5	10	0.693

Ft-ir spectroscopy of albendazole drug sample:-
The flourier transform infrared (FT-IR) spectroscopy of the albendazole drug sample was performed using KBr pellets and the spectrum so obtained. IR spectrum of any compound gives information about the group present in particular compound. IR transmission spectra were obtained using infrared spectrophotometer. An infrared spectrum of drug was taken using KBr pellets. Small quantity of drug was used for IR analysis. The pellets were placed in holder and an infrared spectrum was taken. The scanning range was 400–4000 cm− 1; various peaks in infrared spectrum were interpreted for presence of different group in the structure of drug (Albendazole).

Table no. 5:- Stability of Drug with Excipients.

S. No.	Drug-Excipients Mixture	Initial Appearance	Storage conditions											
			Refrigerator (2-4ºC)				Room Temperature				At 40ºC			
			Weeks				Weeks				Weeks			
			1	2	3	4	1	2	3	4	1	2	3	4
1)	Albendazole	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
2)	Albendazole + Lactose	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
3)	Albendazole + Starch	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
4)	Albendazole + PVP	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
5)	Albendazole + SLS	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
6)	Albendazole + Sodium Starch Glycolate	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
7)	Albendazole+ MCC	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
8)	Albendazole + Sodium Saccharin	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
9)	Albendazole+ Magnesium Stearate	White Powder	N	N	N	N	N	N	N	N	N	N	N	N
10)	Albendazole	White	N	N	N	N	N	N	N	N	N	N	N	N

	+Magnesium Aluminium Silicate	Powder												
11)	Albendazole + Talc	White Powder	N	N	N	N	N	N	N	N	N	N	N	N

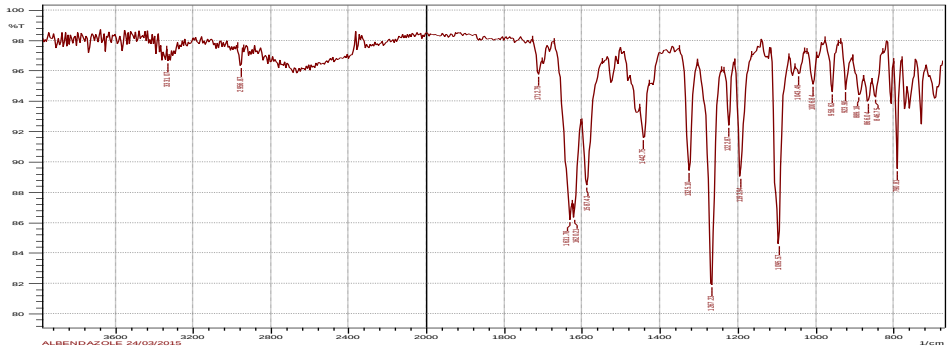


Fig 5:- FTIR Spectrum of Albendazole Drug Sample

Interpretations of Infrared Spectrum Bands of Albendazole sample:-

Table 6:- IR (Infra Red Value).

S.no	Functional group	IR Values
1	N-H Stretching	3331.07
2	C-H Stretching	2956.87
3	C=O Carboxy group	1712.79
4	C=C Bond	1631.78
5	C=N Bond	1620.21
6	CH3 Methyle group	1267.23
7	C-N Bond	1095.57

Table 7:- Optimization of Formulation.

S.no	Formula	F1	F2	F3	F4	F5	F6	F7
1)	Albendazole	4.00 gm	4.00gm	4.00gm	4.00gm	4.00gm	4.00gm	4.00gm
2)	Lactose	5.6 gm	5.6gm	5.6gm	5.6gm	5.6gm	5.6gm	5.6gm
3)	Starch	1.6 gm	1.6gm	1.6gm	1.6gm	1.6gm	1.6gm	1.6gm
4)	PVP	.200 mg	.200mg	.200mg	.200mg	.200mg	.200mg	.200mg
5)	SLS	.20 mg	.20 mg	.20mg	.600 mg	.20mg	.20mg	.20mg
6)	Sodium Starch Glycolate	.800 mg	1 gm	700mg	1.2gm	.900mg	1.4gm	1.6
7)	MCC	1.00 gm	.800 mg	1.2gm	1.4gm	1.6 gm	1.8gm	2gm
8)	Sodium Saccharin	2.0gm	2.0gm	2.0gm	2.0	2.0 gm	2.0gm	2.0gm
9)	Magnesium Stearate	.6 mg	.6 mg	.6mg	.6mg	.6mg	.6mg	.6mg
10	Magnesium Alluminium Silicate	-	50mg	100mg	125mg	150mg	200mg	250mg
11)	Talc	-	-	100mg	100mg	100mg	100 mg	100mg

Table 8:- Optimized Formula.

S.no	Formula	Quantity
1)	Albendazole	4.00 gm
2)	Lactose	5.6 gm
3)	Starch	1.6 gm
4)	PVP	.200gm
5)	SLS	.20mg
6)	Sodium Starch Glycolate	1.6gm
7)	MCC	2gm
8)	Sodium Saccharin	2gm
9)	Magnesium Stearate	.6mg
10	Magnesium Alluminium Silicate	250mg
11)	Talc	100 mg

Table 9:- Property of Albendazole Granule.

Sr.No.	Parameters	Paracetamol
1)	Bulk density	0.10
2)	Tapped density	0.20
3)	Carr's index	25
4)	Angle of repose	32.25
6)	Flow property	poor

Dissolution Profile:-

Amount of drug are taken in a 0.1N HCL in 1000ml Basket and dissolution carried out at different interval of time.

Table 10:- Drug Release.

S.No.	Time interval for sample collection	% drug release in 0.1 N HCl at 260nm
1)	15 min	4.48%
2)	30 min	8.99%
3)	1 hour	13.49%
4)	2 hour	18.55%
5)	3 hour	22.49%
6)	4 hour	27.7%
7)	6 hour	37.77%
8)	8 hour	68.55%
9)	12 hour	85.37%

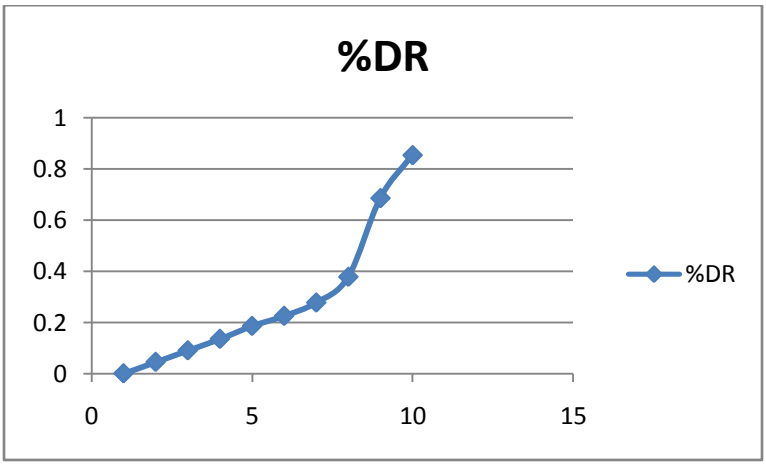


Fig 6:- Graph Percent Drug Release

Drug Content:-
100 mg crushed Albendazole Tablet taken and 100ml .1m HCL mixed to each other. Taken 1ml solution and diluted with .1m HCL upto 10 ml than Observed in UV Spectrophotometry.

Table 11:- Drug Content

S. No	sample	% of drug content in 0.1N HCl
1)	unknown	98.45%

Result and Discussion:-

Albendazole is one of the most effect API for management of an then disease in pediatric and geriatric patient but it was strumming with poor aqueous solubility profile which enhances the change of its tissue accumulation as well as life threating process. Out of the various solubility enhance alternate to counter act with percent solubility problem of APIs. Consideration the Above mention fact various batch with various concentration magnesium aluminum silicate as Mesoporous formulation prepared and evaluated out of the F8 was form to be most competition one. Since it effective overcome the solubility problem and further facilitate the bioavailability of API in the dissolution media.

The detailed result and dissolution of F8 formulation were as follows.
The tablets were found to be welled shape with while to off white appearance process a smooth surface texture. The diameter and thikness found to be 4.30mm with the help of screw gauge and it was compatible with prescribed parameter in Monograph. The hardness and weight variation test of tablet were performed with Pfizer the result ar4.4kg/cm^2.The hardness was found to be 4.4 ± kg/cm^2 which already indicate its compatibility nature to that of required sustained release.

The friability was performed with the help of Roche friability0.58The result clearly indicate that initial batches failure but in case of F8 batch when we take combination of magnesium aluminum silicate and PVP in large amount it provide good result.

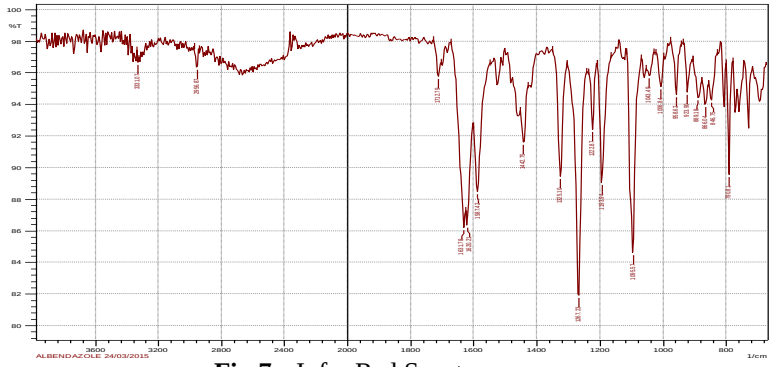


Fig 7:- Infra Red Spectroscopy

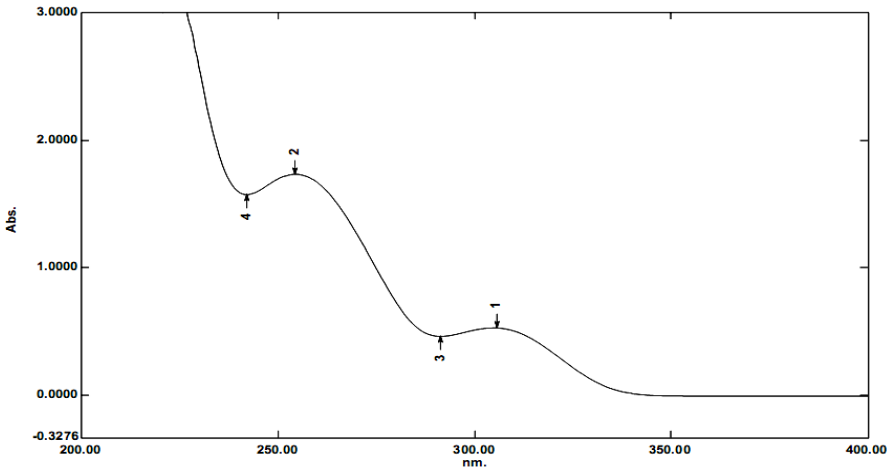
Table 11:- IR Spectroscopy Data.

S.No	Functional groups	IR values
1)	N-H Streching	3331.07
2)	C-H Streching	2956.87
3)	C=O Carboxy group	1712.79
4)	C=C Bond	1631.78
5)	C=N Bond	1620.21
6)	CH3Methyle group	1267.23
7)	C-N Bond	1095.57

Finally e perform the dissolution with the help of diisolution apparatus successive 3set of batch were evaluated by using .1N HCL PH 2-3 as a dissolution media which was suppose to mimic the stomach concentration and appearance was kept at themostate at 370 c ± 10C at regular the sample were with drug and analytically media it aliquates with the help of U.V Spectroscopy meter. Finally a drug release pattern was obtain between percent drug

release time which clearly show it's a sustained release behavior .About 40% drug is release which is sufficient elicited a therapeutic response in patient.

Finally on the basis optimization evaluated it can be consider as that mesoporous formulation is a better alteration for solubility enhance of Albendazole and can be employed effective Mesoporous material always remain a preferable choice for academic and industrial researcher for solubility as well as bioavailability enhancement of API in present thesis through they are successfully is achieve in a desired solubility profile but there is al lot to do regarding its solubility concert and its dosage form design in various formulation prospect. In the context to the above mention various form urgent need of its clinical evaluation which may possible to perform in near future.



Summary and Conclusion:-

The objective of the present research is Formulation and characterization of tablet "Albendazole". The sample of Albendazole procured for "Syncom pharmaceutical limited pithampur Indore" and was characterized by Melting point, IR analysis and UV analysis.

The results were similar to the one reported in the official compendia, hence the procured drug samples were considered as pure and used for further studies. In drug discovery, about 40% of new drug candidates display low solubility in water, which leads to poor bioavailability, and lack of dose proportionality. Therefore, producing suitable formulations is very important to improve the solubility and bioavailability of such drugs. One of the most popular and commercially viable formulation approaches for solving these problems is solubility. Albendazole tablet has proved batter action in compare to sustain release dose. In this study that mainly focus on the preparation and characterization of a Albendazole formulation in a systemic way, especially with respect to dosage form development and preparation techniques. In this present study, selection of each ingredient for Albendazole formulation based on following parameters; Sustain release Pre-formulation studies were performed to identify the desirable tablet region where it dissolve and to determine the dissolution factors Solubility study of drug, Drug-Excipient compatibility studies, Flow property of powder, Loss of drying, Bulk density, Melting point, Tapped density, Angle of repose, carr's Index, Haussener's ratio of powder.

Post-formulation studies were performed to find out Bulk density, Tapped density, Angle of repose, carr's Index, Haussener's ratio of granules. Formulation studies were performed Dissolution of tablet, Drug content, UV analysis, disintegration of tablet, Hardness of tablet, Friability, Weight variation of tablet.

Albendazole is one of the most effect API for management of an then disease in pediatric and Geriatric patient but it was strumming with poor aqueous solubility profile which enhance the change of its tissue accumulation as well as life treating process.

Out of the various solubility enhance alternate to counter act with percent solubility problem of APIs. Consideration the Above mention fact various batch with various concentration magnesium aluminum silicate as Mesoporous formulation prepared and Evaluated out of the F8 was form to be most competition one.Since it effective overcome

the solubility problem and further facilitate the bioavability of API in the dissolution media. Finally on the basis optimization evaluated it can be consider as that Mesoporous formulation is a better alteration for solubility enhance of Albendazole and can be employed effective.

Mesoporous material always remain a preferable choice for academic and industrial researcher for solubility as well as bioavability enhancement of API in present thesis through they are successfully is achieve in a desired solubility profile but there is al lot to do regarding its solubility concert and its dosage form design in various formulation prospect. In the context to the above mention various form urgent need of its clinical evaluation which may possible to perform in near future.

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