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"Synthesis of mesoporous silica nanoparticles to improve the solubilityand release rate of nicardipine hydrochloride".

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ABSTRACT
Mesoporous silica nanoparticles (MSNs) are introduced as chemically and thermally stable nanomaterials with well-defined and controllable morphology and porosity. It is shown that these particles possess external and internal surfaces that can be selectively functionalized with multiple organic and inorganic groups. Silica nano-particles were synthesized by chemical methods from tetraethylorthosilicate (TEOS), methanol (CH3OH) and deionised water in the presence of sodium hydroxide as catalyst at 80°C temperature.
Keywords: Silica; cyclosporine;nanoparticle.

INTRODUCTION

oral drugdeliveryiswidelyacceptedforadministrationof drugintobody.
Oral drugdeliveryisconvenient administration routecomparedtootherroutebecauseof safety, non-invasiveandcomfort tothepatient.

Absorptionof drugisaratelimitingstepfordrug toreachsystemiccirculation.
But forbetterabsorption, drugmust berequiredin solutionform.

Amajorhurdletothedevelopment of oral solid dosageformsisthelowsolubilityof drugs, producing negativeeffect ondrugabsorptionandbioavailability.
Solubilityisaphenomenonof dissolutionof solute insolvent togiveahomogenoussystem, isoneof the important parametertoachievedesiredconcentration of druginsystemiccirculation.
Anydrugtobeabsorbedmust bepresent inthe formof solutionat thesiteof absorption.
BCSClassification

Highsolubility–highpermeability(clasI); low solubility–highpermeability(classII); highsolubility– lowpermeability(classIII); andlowsolubility–low permeability(classIV).

Differentt approachestoenhancement of DrugSolubility:
1.Micronization 2.Nanonization
SprayFreezingintoLiquidandLyophilisation
Co-Solvency
UseOf Surfactant
SolidDispersion
Hydrotrophy
LiquisolidSystem
Complexation
MesoporousSilsilidesandsilicananoparticles

(R. Narayanet al.,2018; Mudshingeet al., 2011)Originof mesoporoussilicananoparticle.

Needof work
Whenpoorlywater-solubledrugmoleculesarecontainedin mesoporoussilica, thespatial confinement withinthe mesoporescanreducethecrystallizationof thedrug

Whythisdrug?
Nicardipinehydrochlorideiscalciumchannel blockerused intreat hypertensionandanginapectoris.
Toimprovethesolubilityof BCSClassIIdrug(Nicardipine hydrochloride). Mesoporoussilicausedascarrierfor improvingsolubilityof poorlysolubledrug(NH). It haslarge surfacearea, highthermal stability, andtunableporesize
Aimandoobjective.. Aim-:

Synthesisof Mesoporoussilicananoparticles(MSN)to beusedascarrierforenhancingthesolubilityand releaserateof BCSClass–IIdrug(Nicardipine hydrochloride).

Objective-:
Toaccomplishtheaboveaimfollowingobjectiveswere set as:

TosynthesizemesoporoussilicabyCTACastemplate.

Tostudymorphologyof preparedmesoporoussilica.

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Tostudysolubilityprofileandpreliminarystudyof NH drug

Topreparedrugloadedmesoporoussilica nanoparticle. (massratio: 1:1, 1:2, 1:3)

LiteratureReview.

Selectionof methodsuitableforsynthesisof MSN.
Procurement of silicaprecursor&structuredirecting agent, otherexcipients.
Procurement of parteckSLC. Preparationof MSN.
Selectionof drugandorganicSolvent.
Solubilitystudy: selectionof suitablesolvent Studyof FTIR, PXRD.

Sunil Kumaret al (2017):

Inthispaper, historical backgroundof mesoporous silicamaterialsandmethodswhichareusedto synthesizethesematerialssuchassol-gel method, microwaveassistedtechnique, chemical etching technique, templatingapproacharediscussed.

JieLi et al (2018): Inthispaperinvestigatetheeffect of poresizeonanticancerefficacies. MSNwithdifferent poresizesbut similarparticlesize&surfacecharge weresynthesizedviamicroemulsionmethod.

Miaoet al (2009): Inthispaper, synthesizedordered mesoporoussilicabyusingpolystyrenemicroemulsio n astemplate. XRD, TEMandN2adsorption–sorption isothermsareusedtocharacterizethemesostructure

LiangHuet al 2015: usedacombinationof drugloaded MSNandthentheloadedMSNwererepeatedly encapsulatedbychitosanandacaciavialayer-by-layerself-assemblymethodtoestablishaoral sustaineddrugdeliverysystemforBCSclass-IIdrug Felodipine. Aftermultilayercoating, thedrugrelease

ratewaseffectivelycontrolled. Thestabilityand mucosaadhesiveabilityof preparednanoparticles werealsoexplored.

Yu-ShenLinet al.(2009): Astudyonsol-gel approach usingwater-in-oil microemulsionasatemplatefor synthesisof silicananospheres whichcan encapsulatedpreformedhydrophobic(Fe3O4) nanoparticlesthenexploredthesemultifunctional hollownanospheresincell-labellingapplication

SandyHartooet al.(2016): Investigatedtheeffect of particlesizeonthereleaseprofile, solubilityandoral bioavailabilityof curcumininmiceincludingamine functionalizedMSMandMSN.MSN-A-Curhadabetter releaseprofileandahighersolubilitycomparedto amineMSMA-Cur. Thebioavailabilityof MSN-A-Cur andMSM-A-Curwasconsiderablyhigherthanthat of ‘freecurcumin’.

Nicardipinehydrochlorideformulations

Variousformulationhavebeendevelopedforthe improvement of solubilityof NicardipinNicardipinee hydrochloride.
Michael Bet al (1994): studiedthesolubilitybehaviorof NicardipineHydrochloride, twotechniquesthat are knowntoimprovesolubility, complexationandsalt formation, wereexamined. Bothroutesprovide potential alternativesforthesolubilizationof Nicardipinehydrochloride.

AherS. et al (2018): Preparedfast dissolvingtablet of NicardipineHydrochloridebydirect compression methodandsolubilitycouldbeenhancedbypreparing soliddispersionof drugwithβ-cyclodextrinein variousratios. Theoptimizedsoliddispersionwas furtherkneadedwithsuitableproportionsof superdisintegrant andotheringredients. Thenstudied pre-compressionandpost-compressionparametersof tablet.

KKavithaet al.(2011): Developedandevaluatedmatrix- typetransdermal therapeuticsystemcontaining

Nicardipinehydrochloridewithdifferent ratiosof hydrophilicandhydrophobicpolymericcombinations bythesolvent evaporationtechnique. Thedeveloped transdermal patchesevaluatedforvariousparameter.

T. NagendraBabuet al.(2015): PreparedNicardipine hydrochloridesustainedreleasepelletswhich correlatesthestandardsof marketedproduct byusing HPMCandEthyl Celluloseaspolymers. Andcompare thein-vitrodissolutionprofilesof formulatedpellets withvariousconcentrationsof HPMCandEthyl cellulose.
HarekrishnaRoyet al. (2010): Thepurposeof thestudy wastoincreasethesolubilityof Nicardipine hydrochloridebycyclodextrininclusioncomplex technique. Amongdifferent complexes,

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acomplexwith 1:1 molarratioof drugandβ-CDshowedthehighest dissolutionrate. Matrixtableni JK. Drugsolubility: importanceandenhancement techniques. ISRN pharmaceutics. 2012; 2012.
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