

# [Berberine two different materials with wide range](https://assignbuster.com/berberine-two-different-materials-with-wide-range/)

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Berberine has long been used as atraditional medicine because of  itspotential activity  against Bacterial, fungal, viral diseases. Berberine have a complex and diverse chemical structure provide a base for differentbiological targets. The present study deals with the novel encapsulation ofbiopolymer called Collagen1 with berberine by Electrospinning method  in different compositions, parameters, andmethod for preparation. By electrospinning not only  we get desired mechanical and biologicalproperties of encapsulation studies, but also used to combine these twodifferent materials with wide range of drug delivery science and tissueengineering  properties to produceelectrospun nanofibres at different compositions. The physical and thermalproperties of electro spun nanofibres interaction and  were examines under FE-SEM.

resultantstudies  may be used in variety ofapplications including Chemical, Genetical, Immunological  and industrial purposes Introduction         Encapsulation studies were mainlyuseful for tissue engineering and meeting a wide range of applications inBiotechnology, Environmental, and Medicine fields. Mainly these studies madepossible in nano particles engineering, which enhances the site  specific drug delivery system and improvesthe pharmaco kinetics properties to drug. There are many methods to performencapsulation studies, in this study we discuss abut electrospinning method. Electro spinning is a method which uses electrical energy as a source  and fabricate fibres in different diameterranges from  microns to nano meters.        Berberine is a plant alkaloid with manybiological activities. Preclinical in vitro and in vivo studiescarry diverse pharmacological actions of berberine that could be potentiallyhelpful in the management of infectious, anti-bacterial anti-inflamatory and metabolicdiseases. To study more about we conducted the study in nanotechnology byinfusing berberine in collagen for drug delivery experiments for that we willget to know about encapsulation  nature ofdrug. The purpose of this study is to identify the potential of drug by usingelectrospinning at  differentcompositions  of berberine infusedcollagen.

Materialsand Methods   Collagen crosslinking: The collagen 1was cross-linked by dealing with glutaraldehyde vapor, soaked with 20%glutaraldehyde solution at room temperature for different time period, followedby treatment with 0. 2M glycine aqueous solution to lump un reacted Amino acids. Preparationof solutions: collagentype I is extracted  from rat tail calfskin, the proteins were dissolved in HCL for 8 hours at room temperature. Whereas the berberine solution was prepared by dissolving  50 mg of berberine in 2ml of methanol andthen the emulsify it with 1% Pva solution and run in  cyclo mixture for 2 hours to homogenise thesolution. The mixture of   berberine andcollagen solutions were prepared in the weight ratio of 1: 2, 1: 1, 2: 1 forencapsulation  Parametres:   Theelectrospinnig instrument can be used for various solutions, but every solutionhas its own properties. To prepare  theencapsulation mainly we need , Drum rotation speed, Syringe translation speed, Solution flow rate, Voltage required the following table has listed the parameterswe used for encapsulation Preliminary experiments revealed that, independent ofthe conditions used, continuous fibres could not be spun from acidic aqueoussolutions of pure collagen. It is known that by addition of sodium chloride tothe solution, formation of fibres by electrospinning becomes possible due tothe increase in solution conductivity . Moreover, the presence of NaCl caninduce hydrophobic interactions in or between the protein molecules and thuscontribute to the production of continuous fibres The higher net chargeincreases the force exerted on the jet and at a concentration of 42.

5mM NaCland spinning voltages between 10 and 25 kV, fibre formation was observed. However, continuous jets could not be produced and only short beaded fibreswere obtained. This latter phenomenon is known to be favoured by the presenceof a high electric field, which leads to capillary breakup of theelectrospinning jet  Increasingthe viscosity of the spinning solution is a way to overcome the formation ofbeads and a suitable polymer for this purpose we use PVA. Addition of thispolymer to the protein solution, which also contained 42.

5mM NaCl, allowed amuch better control over fibre formation. The voltages necessary to obtain acontinuous fibre were dependent on the weight ratio of collagen to Berberine. Collagen and berberine solutions (2% w/v) containing 42. 5mM sodium chloride, having a collagen and berberine weight ratio of 1: 2 and spun at 21 kV, affordedthe formation of a continuous jet. However, the collected fibres were notcompletely dry and resulted in meshes of highly fused fibres. Increasing theweight ratio between collagen and Berberine to 1: 1 or 2: 1 required higherpotentials of 22 and 23. 5 kV, respectively.

However, at a collagen and berberineweight ratio of 1: 2, beaded and highly fused fibres were obtained. Obviously, under these conditions the water evaporation from the fibres was not complete. Dry fibres entirely devoid of beads and with a narrow diameter distribution(average fibre diameter ¼ 0. 4070. 05 mm) were produced at a weight ratio ofcollagen and berberine equal to 1: 1. Electrospinning: Theelectrospinning method consists a syringe needle, electrode, stainless sheetpaper on drum and electric supply.

5ml syringe filled with polymer  solution which is linked to syringe pump. Solutionswill be hard pressed through tube on a rotating drum which is covered by stainlesssteel paper. The  needle( distancebetween needle and rotate drum should be 6cm to collect the fibres) wasassociated to high voltage supply (Maximum volts 40 kv and the experiment hasto be carried at room temperature ). The solution will get a positive voltagewhich is 30 kv and the fibres were collected on steel paper with the speed of0. 5 ml/hour SEM  The resultantMicroscopic images of different composition of polymer encapsulation has viewedunder FESEM-EXT-501 microscope. Results  Differentcompositions of Berberien and collagen mixtures(2: 2, 1: 1, 1: 2)  were performed to produce fibres from solubleberberine.

As with collagen solutions, addition of NaCl at a concentration of42. 5mM and PVA at a concentration of 1% w/v were necessary to obtain acontinuous fibres., it was possible to spin fibres at a voltage of 10 kV and aflow rate of 50 ml/ min. These fibres had an average thickness of 0. 5 mm, Thefibres have a rough surface and appear to be composed of 5–10nm wide filaments, oriented parallel to their longitudinal axis similarly to native elastin fibresAs with collagen, the Berberine appear to preserve the ability to self organizeinto the native structure during fibre formation in the electrospinningprocess. The fibres were easily produced, but difficult to collect because ofsubstantial splaying. Splaying occurs when the radial forces derived from theelectrical charges carried by the jet, overcome the cohesive forces in the jetitself. The single jet divides into many charged jets before reaching thecollecting plate.

Splaying thus yields unusual small diameter fibres In thearterial wall, collagen and elastin are both present and constitute togetherwith the extracellular matrix and the cells, a fibre-reinforced compositestructure of which the mechanical properties are mainly determined by thefibrous network. The presence of both proteins is necessary to confer thevessel its strength but also its elasticity Inthe arterial wall, collagen and Berberine are both present and constitutetogether with the extracellular matrix and the cells, a fibre-reinforcedcomposite structure of which the mechanical properties are mainly determined bythe fibrous network. The presence of Both mixture concentrations is necessaryto confer the vessel its strength but also its elasticity  Aqueous solutions comprising collagen, Berberine (weight ratios are, 2: 1, 1: 1, 1: 2) and  Thedegree of cross linking was estimated by determining both the denaturationtemperature and the residual amount of free amine groups of (non-)cross linkedsamples. Formation of crosslinks in the collagen/ Berberine spun matricesincreased the denaturation temperature of the samples. As a consequence ofcrosslinking, the amount of free amino groups present in the samples decreasedIndependent of the weight ratio of collagen to Berberine, the relativepercentage of free amino groups left after cross linking of the fibres wasdecreased to approximately 30% of the original value. These results arecomparable with those obtained by performing the same reaction withfreeze-dried scaffolds of insoluble collagen and elastin In the DSC thermogramsof dry uncrosslinked fibres.

Moreover, by means of SEM, it was verified that noNaCl crystals were present at the surface of the fibres after EDC/NHScrosslinking.. Crosslinked collagen/berberine scaffolds with different weightratios (2: 1, 1: 1, 1: 2, ) of the two solutions were formed. In all cases, theformation of a confluent multi-layer of SMC, growing on top of each other wasobserved by means of histology The possibility to electrospin collagen andberberine solutions into fibres composed of a homogeneous blend of the twosolutions can lead to the production of scaffolds with extraordinaryproperties, completely different from those observed in analogous mixtures ofSolutions , for which the separate contributions can always be welldistinguished. Evaluation of the specific interactions occurring in or betweensoluble collagen and soluble berberine and theoretically resulting in formationof collagenous fibrillar structures and aggregation of collagen and berberine mightresult in a better understanding of the potential of the application ofcollagen/berberine electrospun scaffolds in different fields, like tissueengineering. Further investigations are actually being performed in thisdirection. Conclusion: Electrospinningwas used as a successful technique to produce non-woven meshes from aqueoussolutions of collagen type I and Berberine. In all cases, the addition of NaClwas necessary to spin homogeneous and continuous fibres.

Composition of thesolution, net charge density and applied electric field were parametersinfluencing the morphology of the obtained fibres. Spinning collagen/elastinsolutions yielded meshes composed of fibres with diameters ranging from 220 to600nm. Stable scaffolds were prepared by cross linking with EDC/NHS. Aftercross linking, scaffolds completely devoid of NaCl were obtained. SMCs weresuccessfully cultured on cross linked scaffolds and a confluent layer of cellswas observed after 14 days on the surface of the different meshes. One of theadvantages of electrospinning aqueous solution of collagen and Berberine is theformation of scaffolds with high porosity and surface area, two essentialrequisites for tissue engineering.

Electrospinning solutions of the twosolutions separately from each other can also give the possibility to producemultilayered scaffolds with controlled morphology and/or mechanical properties. Moreover, in this study, it has been shown that fibres, in which the two solutionscannot be distinguished, can be electrospun from a mixture of collagen andBerberine. This may result in fibres with extraordinary mechanical properties, different from those observed in analogous mixtures of the insoluble solutions. Further investigations are currently being done in this direction. Acknowledgement:  I wish my sincere thanks towards the SRMUniversity, Chennai for providing us the SEM Images