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A Review on Preparation and Evaluation of Sodium Alginate Beads with Metformin

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Abstract

This present study an attempt was made to formulate beads of Metformin Hcl by using Sodium alginate in combination of HPMC , Carbopol ,Pectin and sodium caroxy methy cellulose. Beads of metformin Hcl were successfully prepared by Ionotropic Gelation Method .The prepared beads evaluated for various parameters lke encapsulation efficacy, swelling index, loading capacity and in vitro release. The yields were varies from 78-101.99% and encapsulation efficacy varie from 81.10 to 81.6 % which encourage the investigation depends upon the combination of sodium alginate with various polymers. The various parameters of model equation of beads containing Metformin Hcl in vitro kinetic release were thoroughly investigated and it was seen that the statistically significant confined to Zero-order, Higuchi and Korsmeyer-Peppas model. To establish the release kinetic, Korsmeyer-Peppas model shows the prominent release characteristics.

INTRODUCTION

Oral drug delivery is the most desirable and preferred method of administering therapeutic agents for their systemic effects. In addition, the oral medication is generally considered as the first avenue investigated in the discovery and development of new drug entities and pharmaceutical formulations, mainly because of patient acceptance, convenience, and cost effective manufacturing process. For many drug substances, conventional immediate release formulations provide clinically effective therapy while maintaining the required balance of pharmacokinetic and pharmacodynamic profiles with acceptable level of safety to the patient in-recent years a wide variety of newer oral drug delivery systems like sustained/controlled release dosage forms are designed and evaluated in order to overcome the limitations of conventional therapy. These products are able to maintain steady drug plasma levels for extended periods of time as a result the variations of the drug levels in the blood are prevented and drug related side effects are minimized. Spherical microbeads are able to prolong the release of metformin hydrochloride and were prepared by ionotropic gelation method, using sodium alginate as the hydrophilic carrier in combination with HPMC, chitosan and pectin polymers as drug release modifiers in proportions to overcome the drug related adverse effects, improve drug bioavailability in different GI tract conditions.

Sodium alginate a water soluble salt of alginic acid is a natural polysaccharide extracted from marine brown algae. It consists of 2 uronic acids β – d – mannuronic acid (M) and α – 1 – glucoronic acid (G) and is

composed of homopolymeric blocks and alternating blocks that are MM/GG and MG.

Sodium alginate has been used as a matrix for entrapment of drugs and macro molecules. It forms hydrophilic gels by interaction with bi-valent metal ions.

Metformin is a biguanide derivative and its chemical structure is related to guanidine. It is a first line oral therapy in the recent guidelines of the American Diabetes Association. It is most widely prescribed drug to treathyperglycemia, at least 120 million user worldwide .It is an insulin sensitizer.

It decreases hepatic glucose production through a mild inhibition of the mitochondrial respiratory-chain complex 1.It also decreases intestinal absorption of glucose.

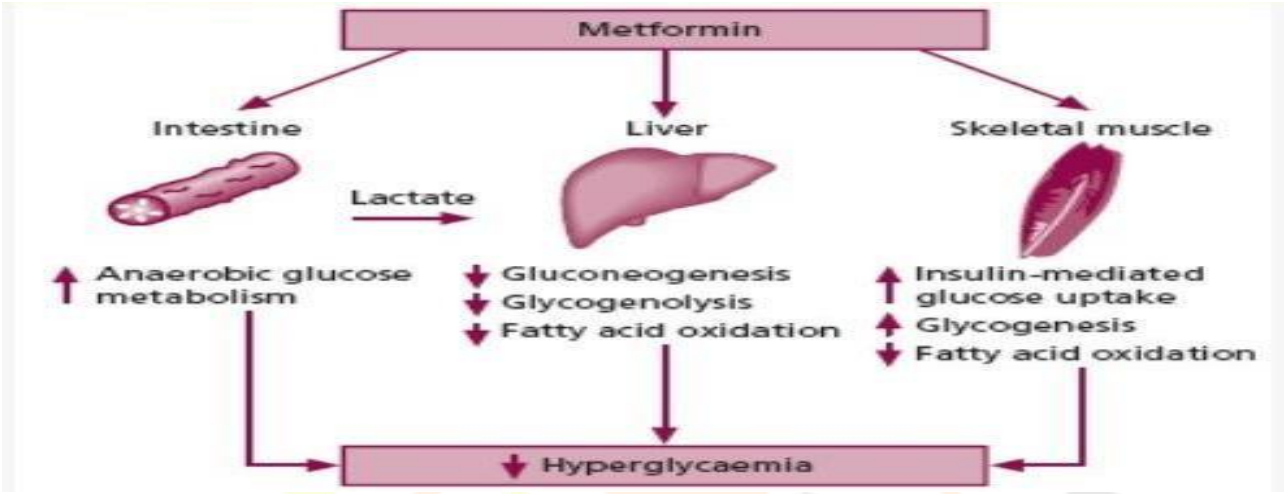

Fig no. 1

Spherical micro beads are able to prolong the release of metformin hydrochloride and were prepared by ionotropic gelation method using sodium alginate as the hydrophilic carrier in the combination with HPMC, chitosan and pectin polymers as drug release modifiers in various proportions to overcome the drug related adverse effects, improve drug bioavailability in different GI tract conditions.

Sodium alginate is a water soluble salt of alginic acid, is a natural polysaccharide extracted from marine brown algae. It consists of 2 uronic acids β – d – mannuronic acid (M) and α – 1 – glucoronic acid (G) and is composed of homopolymeric blocks and alternating blocks that is MM/GG and MG. Description of sodium alginate include,

- ✓ COLOUR: Yellowish white, cream coloured, buff coloured.
- ✓ ODOUR: odourless
- ✓ SOLUBILITY: Insoluble in alcohol, ether, chloroform and strong acids, freely soluble in water.
- ✓ VISCOSITY: A 1% (W/V) aqueous solution at 20 ˚c may show a viscosity ranging between 20-400centipoises.

Sodium alginate has been used as a matrix for entrapment of drugs and macro molecules. It forms hydrophilicgels by interaction with bi-valent metal ions.

METHOD OF PREPARATION

PREPARATION OF SODIUM ALGINATE BEADS:

- ✓ Required weight (500 mg) of sodium alginate was dissolved by heating in 30 ml of 2% polymer solutionwith constant stirring.
- ✓ Then 500 mg of metformin drug was added and kept aside for 30 minutes and taken into syringe.
- ✓ Add the solution from syringe drop wise into a (100 ml) 2% calcium chloride solution on magneticstirrer.
- ✓ The beads were formed and filtered.
- ✓ The filtered beads should be washed 2-4 times with water and dried.

EVALUATION OF SODIUM ALGINATE BEADS:

DETERMINATION OF ENTRAPMENT EFFICIENCY:

50 mg of beads were taken in a 50 ml of buffer and kept aside until transparent, then centrifuged at 300 rpm for 15 minutes, supernatant was collected and absorbance was checked using UV spectrophotometer at 233 nm.

IN-VITRO DRUG RELEASE / DISSOLUTION STUDIES:

The release profile of metformin hydrochloride from beads was examined in simulated intestinal fluid (pH 6.8) by using USP XXII rotating paddle apparatus. The beads were taken into muslin cloth and were tied to the rotating paddle, then rotate the paddle was rotated at constant speed of 100 rpm in 900 ml of dissolution medium thermostated at 37±0.5˚C.

At scheduled time intervals the samples were withdrawn and replaced with fresh medium. The samples were diluted, filtered and the drug content was determined spectrophotometrically at 233 nm.

To know the mechanism of drug release from the formulation, the data obtained from in-vitro dissolution studies of formulation was fitted to zero order, first order, Higuchi and Korsmeyer peppas equations.

The in-vitro release profile of drug shows good linearity in higuchi kinetics clearly indicating that the drug release mechanism was predominantly diffusion method.

From the regression coefficient, the in-vitro drug release from the formulation was best explained by first order kinetics (0.789) as first order plot showed highest linearity when compared to zero order plots.

To confirm the exact, mechanism of drug release from the formulation, the data were fitted to Korsmeyer peppas equation. The diffusion exponent value (n) obtained for formulation was 0.2 indicating that metformin hydrochloride drug release from the formulation follows Fickian diffusion.

CONCLUSION

In conclusion, ionotropic gelation technique can be successfully used for preparation of metformin hydrochloride microbeads using sodium alginate and with coating polymer solution as a drug release modifiers. Various formulation variables such as polymer concentration, calcium chloride concentration, stirring speed, and coating polymer concentration were used, which are influenced to the drug entrapment efficiency. Metformin hydrochloride microbeads are promising pharmaceutical dosage forms by providing sustained release and avoiding the dose related side effects in the entire physiological region. All the formulations showed good rate of release. YZ values are derived from the release kinetics and n values are obtained from korsmeyer peppas equation and from these n values it was found that the transport mechanism of all these formulations are of anomalous type. Process parameters such as the polymer concentration, polymer/drug ratio, and the amount of hardening agent were analyzed for their influences on the bead properties.

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