

Evaluation and optimization of Combined gum mixture as matrix former biomaterial in Drug Delivery

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ABSTRACT

In the present investigation, two novel gum mixtures were evaluated as controlled release polymer. The ghatti gum obtained from *Anogeissus latifolia* and Konjac glucomannan from *Amorphophallus konjac* was evaluated as base polymer for controlled delivery of model drug diclofenac sodium. The prepared synergistically acting gums were evaluated for compatibility study using FT-IR. The diclofenac sodium tablets were evaluated for hardness, friability, weight variation and drug content. The in vitro dissolution study confirmed that the controlled release behavior is mainly due to konjac glucomannan proportion and optimum concentration ratio for ghatti: konjac glucomannan was 30:70.

Key Words: Ghatti gum, Konjac glucomannan, Diclofenac sodium, FT-IR

INTRODUCTION

In recent times, naturally occurring biomaterials have been paid utmost attention in controlled drug delivery as these polymers are non-toxic, safe, hydrophilic and biodegradable. Gums from natural resources hydrate and swell on contact with water and these have been used for the preparation of single unit dosage form. Konjac glucomannan (KGM) is a natural neutral polysaccharide obtained from *Amorphophallus konjac* commonly used as gelling agent in the food industry[1]. Recent studies on KGM have demonstrated its potential for the controlled release of hormones and other bio-molecules. Ghatti gum (GG) is commonly known as Indian gum and obtained from *Anogeissus latifolia*. Gum ghatti is an extremely complex polysaccharide that occurs in nature as mixed calcium and magnesium salts of uronic acid and/or ghattic acids[2].

In the present investigation, combination of two natural gums was evaluated for controlled delivery of diclofenac sodium.

MATERIAL AND METHODS

Konjac glucomannan was kindly donated by C.E. Roeper, Germany. Gum Ghatti Extra pure and Diclofenac sodium was purchased Loba Chemie and Yarrow Chem respectively. All other chemicals used were of AR grade.

Preparation of Gum Mixture:

The KGM and GG mixtures were physically mixed in different proportions (1:9, 3:7, 5:5 and vice versa).

FT-IR study of mixed Gums:

The powder of KGM, GG and the mixtures of the polysaccharide were dispersed in water, and then dried at 60°C to make sample films. The films were blended with potassium bromide and laminated, and their IR spectra were studied by Bruker FT-IR spectrophotometer (Bruker, Germany).

Preparation of Diclofenac Sodium Matrix Tablet

Diclofenac matrix tablets of 400±5mg (Total weight) were prepared by wet granulation method. Drug and gum mixture ratio was kept constant at 1:2. Lactose was used as diluent and a mixture of talc and magnesium stearate (1:1) was used as lubricant. KGM and GG were included in the formulations at various proportions which are shown in Table-1.

Physical Evaluation of Tablets

The prepared tablets were evaluated for different physical parameters such as hardness, friability, drug content and weight variation.

In vitro Drug release Study

The prepared tablets were evaluated for *in vitro* dissolution which was carried out in USP type-II dissolution apparatus (Model type: TDT 08L, Eletrolab, India) using 0.1 N HCl as dissolution medium, paddle rotating with a speed of 50 rpm and maintained at 37±0.5°C. The 5 mL sample was withdrawn at every one minute and all the spectrophotometer analysis was carried out using UV-Vis spectrophotometer (UV-1700 Pharmaspec, Shimadzu, Japan) at 276nm in 0.1 N HCl dissolution medium [3]. The dissolution study was further evaluated for zero, first and Higuchi model to know the release mechanism.

RESULTS AND DISCUSSION

The gum mixtures are physically blended and added some amount of water and finally prepared a gel mass, then the prepared gel mass was dried in hot air oven at 60°C for 8 hrs to form a dry hard cake. The prepared cake was grinded in a mechanical grinder to form a powder. The powder was then passed through sieve no 100 and stored in a desiccator's till further use. Figure-1 showed FT-IR spectra of KGM, GG and gum mixture. The gum mixture showed more hydrogen bonding exhibiting strong absorption peak at 3453 and 1637 cm⁻¹.

The diclofenac sodium matrix tablets were prepared by wet granulation method and in all the formulations the drug: gum ration was kept constant at a level of 1:2. The prepared tablets were evaluated for physical characteristics such as hardness using Monsanto hardness tester. The average hardness came in the range of 5.2-6.0 kg/cm² which is acceptable as per USP. All the tablets passed the friability test and lowest value is observed for formulation F2. The weight variation and drug content results were came with in the official range for all the formulations (shown in Table-2). The *in vitro* dissolution study was done and outcome data's were evaluated for kinetics parameter. Release behaviors of all the formulation is presented in Figure-2. Formulations with high proportion of KGM showed more sustained behavior than

with GG this could be due to their high gel forming strength [4]. Due to highly matrix gel formation drug diffusion from the gel layer is sustained as shown by formulation F4 & F5. Similarly GG forms less viscous gel as compared to KGM, this is the reason why the drugs are more easily diffused from the gel pores and high concentration of drug was achieved in dissolution study[5]. After comparing all the formulations nearly all the formulations followed Higuchi release kinetic model, and in all the formulation F2 having gum ratio [KGM(30%):GG(70%)] showed best sustained release behavior.

CONCLUSION

From the foregoing results, it can be concluded that synergistically acting gum mixture of KGM and GG could be used as sustained release polymer in pharmaceutical formulation development.

REFERENCES

- [1] Zhang Y., Xie B. and Gan X. (2006). "Advances in the application of Konjac glucomannan and its derivative". *Carbohydrate Polymers*, 60;27-31.
- [2] Singh A., Singh A.V., Nath L.K. and Ghosh T.K. (2010). "Anogeissus latifolia: A recent update on its chemistry and pharmacological application". *Pharmacologyonline*,2;446-449.
- [3] Sylvania A., Bravo,Maria.C. and Lamas,Claudio, J.(2002). "In vitro studies of diclofenac sodium controlled release from biopolymeric hydrophilic matrices". *Journal of Pharmacy and Pharmaceutical Sciences* , 5(3),213-219.
- [4] Fang J., Wang K., Liu M. and He Z. (2008). "In vitro evaluations of konjac glucomannan and xanthan gum mixture as sustained release material of matrix tablet". *Carbohydrate Polymers*, 73,241-247.
- [5] Munday D.L. and Cox P.J. (2000). "Compressed xanthan gum matrices: hydration,erosion and drug release mechanism". *International Journal of Pharmaceutics*,203,179-192.

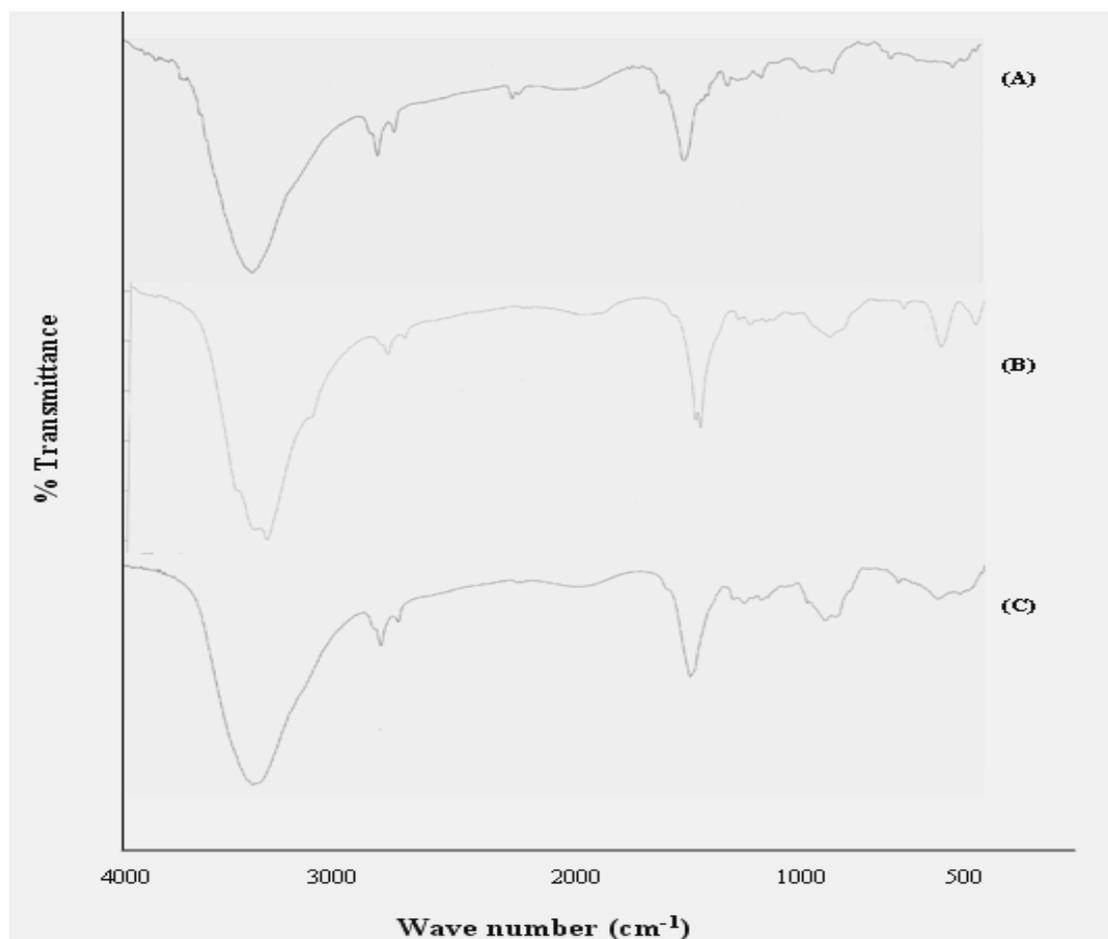


Fig.1: FT-IR spectra of KGM (A), GG (B) and gum mixture (C).

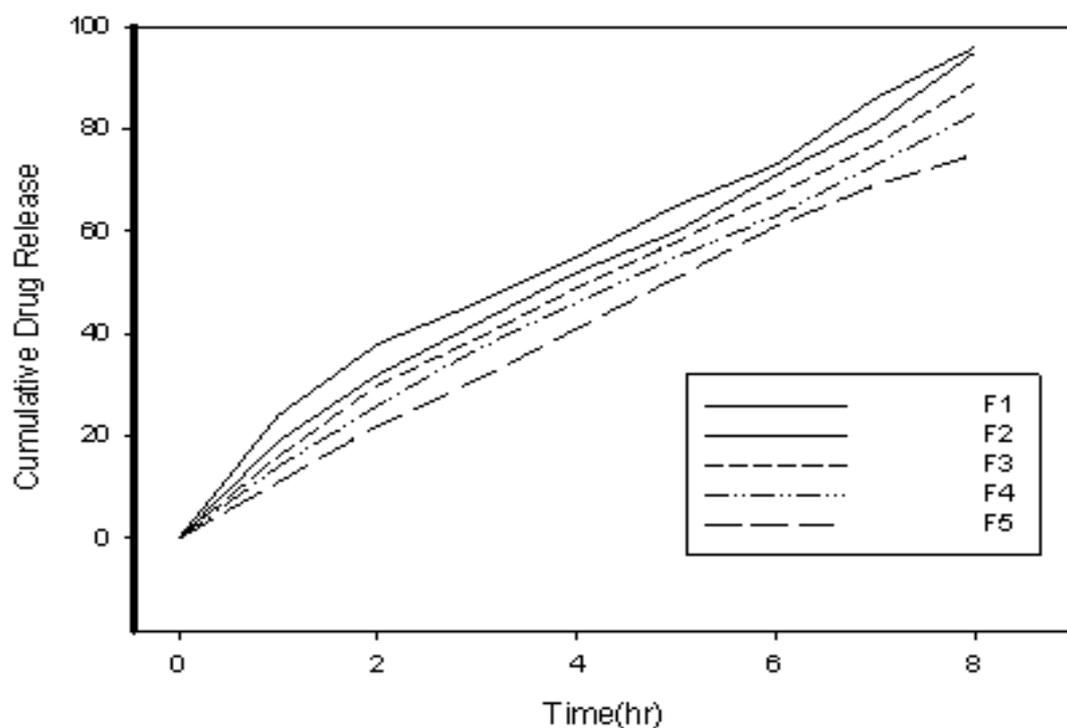


Fig.2: Dissolution behavior of all the formulation

Table-1: Proportions of the KGM and GG in the mixture of the formulation

Formulation Code	F1	F2	F3	F4	F5
KGM (%)	10	30	50	70	90
GG (%)	90	70	50	30	10

Table.2 Physical parameter of the prepared tablets.

Batch	Hardness (Kg/cm²)	Friability (%)	Drug Content (%)	Weight deviation (%)
F1	5.7±0.24	0.45±0.16	97.65±0.15	2.3±0.18
F2	5.6±0.32	0.23±0.25	98.96±0.20	4.0±0.28
F3	5.2±0.16	0.24±0.31	99.43±0.21	1.5±0.20
F4	6.0±0.21	0.33±0.20	98.23±0.26	2.7±0.15
F5	5.9±0.15	0.34±0.25	98.43±0.13	3.1±0.35