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Formulation and Evaluation of Ethylcellulose Coated Microcapsules for Controlled Release of Paracetamol

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ABSTRACT

The objective of the study is to evaluate ethylcellulose as a coat for controlled release microcapsules of paracetamol. Ethylcellulose coated microcapsules were prepared by an emulsion-solvent evaporation method employing different proportions of core and coat and the microcapsules were evaluated for size, entrapment efficiency and drug release kinetics. The ethylcellulose coated microcapsules prepared were found to be discrete, spherical, and free flowing. Drug content was uniform. Diclofenac release from the ethylcellulose coated microcapsules was slow and depended on core: coat ratio, wall thickness and size of the microcapsules. Drug release from these microcapsules was by non-fickian diffusion. Microcapsules prepared employing cyclohexane as solvent exhibited good release rates. Ethylcellulose was found to be an efficient microencapsulating agent and the ethylcellulose microcapsules exhibited good controlled release characteristics and were found suitable for oral controlled release of paracetamol.

Key words: Paracetamol, Microcapsules, Ethylcellulose, Controlled Release etc.

INTRODUCTION

Controlled release drug delivery systems are aimed at controlling the rate of drug delivery, sustaining the duration of the activity and targeting the delivery of the drug to a tissue. Drug release from these systems should be at a desired rate, predictable and reproducible. Microencapsulation and microcapsules are widely accepted for controlled release. Polymers and release retarding materials used as coat play a vital role in controlling the drug release from the microcapsules. Microencapsulation by various polymers and their applications are described in standard text [1-3]. The objective of the present study is to evaluate ethylcellulose as microencapsulating agent and to prepare ethylcellulose coated microcapsules of paracetamol for controlled release. Ethylcellulose coated microcapsules containing paracetamol were prepared by an industrially feasible method of microencapsulation and the microcapsules were evaluated for controlled release of paracetamol. Controlled release drug delivery systems are aimed at controlling the rate of drug delivery, sustaining the duration of the activity and targeting the delivery of the drug to a tissue. Drug release from these systems should be at a desired rate, predictable and reproducible. Microencapsulation and microcapsules are widely accepted for controlled release. Polymers and release retarding materials used as coat play a vital role in controlling the drug release from the microcapsules. Microencapsulation by various polymers and their applications are described in standard text [1-3]. The objective of the present study is to evaluate ethylcellulose as microencapsulating agent and to prepare ethylcellulose coated microcapsules of Paracetamol for controlled release. Ethylcellulose coated microcapsules containing Paracetamol were prepared by an industrially feasible method of microencapsulation and the microcapsules were evaluated for controlled release of Paracetamol. Paracetamol chemically named N-acetyl-p aminophenol is a widely used over the counter analgesic (pain reliever) and antipyretic (fever reducer). It is commonly used for the relief of headaches and other minor aches and pains and is a major ingredient in numerous cold and flu remedies. In combination with opioid analgesic, paracetamol can also be used in the management of more severe pain such as post-surgical pain and providing palliative care in advanced cancer patients. The onset of analgesia is approximately 11 minutes after oral administration of paracetamol, and its half-life is 1–4 hours. Though acetaminophen is used to treat inflammatory pain, it is not generally classified as an NSAID because it exhibits only weak anti-inflammatory activity.

MATERIAL AND METHOD

MATERIAL:

Paracetamol, Cyclohexane, Ethyl cellulose, Potassium Hydrogen Phthalate, Distilled Water, Whatman Filter Paper, Microfilter(0.45 μ), Glasswares, Dissolution Rate Test Apparatus (Lab India, Disso 2000), Optical microscope, U.V. Spectroscopy.

METHOD^[9]

Ethyl cellulose was dispersed in cyclohexane to yield a polymer concentration of 2% by weight. The mixture was heated to form a homogenous polymer solution. The core material was dispersed in the solution with stirring at a coating to core material. Allowed the mixture to cool with continuous stirring effect phase separation/coagulation of ethyl cellulose and micro encapsulation of core solidification of coating the microencapsulated product was collected from the cyclohexane by filtration, decantation or centrifugation technique.

Characterization of microcapsules

Size analysis^[9]

Particle size was measured by the optical microscope by using stage and ocular lenses.

Drug Entrapment efficiency

About 50mg microcapsules were crushed and then kept for 48 hours in 250ml phosphate buffer (pH-7.4) with occasional shaking for drug extraction. The polymeric debris was removed by filtering through whatman filter paper. The filtrate followed suitable dilution was analysed spectrophotometrically.

Drug release study^[9]

Drug release from the microcapsules was studied using an eight station dissolution rate test apparatus (Lab India, Disso 2000) in phosphate solution of pH 7.4 (900 ml). The paddle speed at 50 rpm and bath temperature at 37 \pm 0.50c were maintained throughout the experiment. A sample of microcapsules equivalent to 100 mg Paracetamol

was used in each test. Aliquot equal to 5ml of dissolution medium was withdrawn at different time intervals through a filter (0.45 μ) and assayed at 257 nm.

RESULT AND DISCUSSION

The particle size of drug polymer ratio 1:1, 1:2 and 2:1 were found to be 4.3 μ m, 4.4 μ m and 2.8 μ m respectively shown in Table; 1. The lowest entrapment efficiency of Paracetamol was observed in drug polymer ratio 1:1 and the highest entrapment efficiency was obtained in drug polymer ratio 2:1 formulation. It was due to the degree of crosslinking. The release pattern of Paracetamol was performed in 0.1N Phosphate buffer (pH-7.4) to stimulate the stomach and intestinal condition. The release concentration was increased in 2:1 ratio formulation but drug release concentration was decreased in 1:1 ratio formulation.

Table1: Particle size and Entrapment Efficiency

S.N.	Drug:Polymer Concentration	particle size	Entrapment Efficiency
1	1:1	4.3 μ m	18%
2	1:2	4.4 μ m	19%
3	2:1	2.8 μ m	22%

Table2: Drug release

SN	Drug: Polymer Ratio	CONCENTRATION (μ g/ml)				
		0.1	0.2	0.3	0.4	0.5
1	1:1	0.217	0.428	0.625	0.720	1.234
2	1:2	1.566	2.959	4.352	5.745	7.138
3	2:1	1.175	2.339	2.503	4.667	5.531

CONCLUSION

The result of study revealed that ethyl cellulose was used as coating material for the encapsulation of paracetamol; therefore it might be possible novel polymer for fabrication of sustained device, due to its flexible and nonflexible substituted polysaccharide chain and ionic group.

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