pharm nano
Pharmaceutical Nanotechnology Conference 2018

50TH BEYOND 50 YEARS
Dedication, Respect, and Consistency
UNIVERSITAS SURABAYA

THE EFFECT OF COMPOSITE COMPOSITION RATIO TO THE PHYSICAL CHARACTERISTICS AND THE RELEASE OF CIPROFLOXACIN FROM BOVINE HYDROXYAPATITE-CHITOSAN-CIPROFLOXACIN IMPLANT

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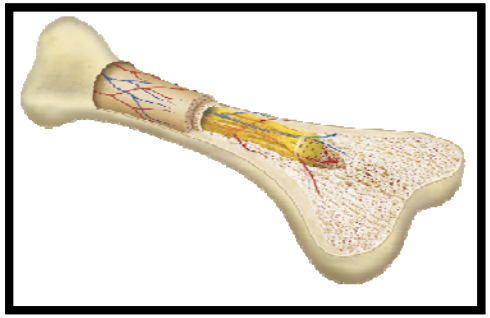
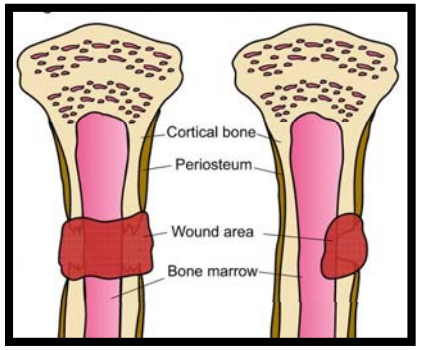
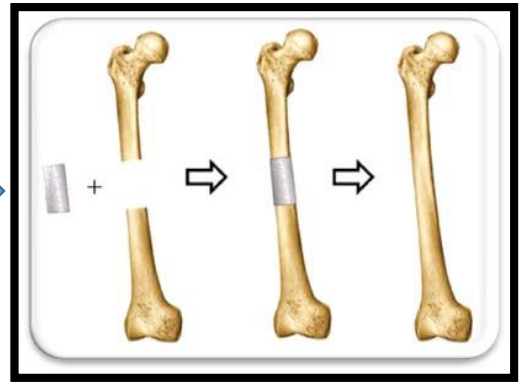
RESEARCH BACKGROUND



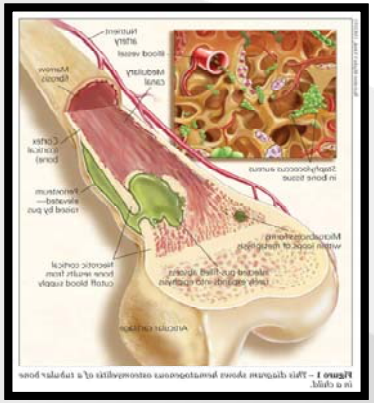
Bone is a complex of organic-inorganic materials



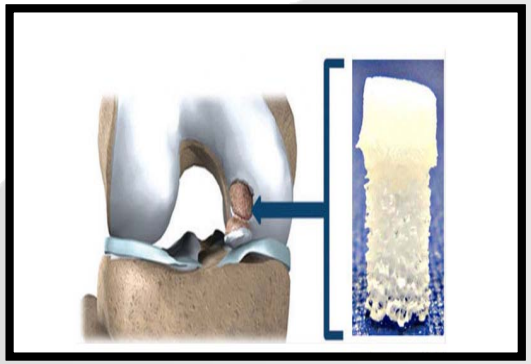
Bone defects



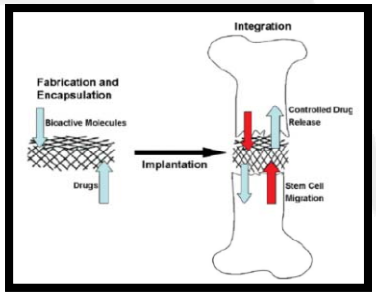
Reconstruction



Risk of Infection

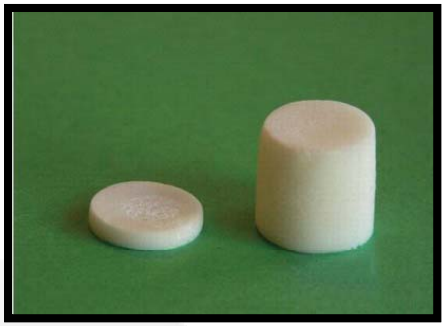


Functional bone implant



Bone implant to fill the defects and drug delivery system

RESEARCH BACKGROUND



Design of Bone implant using biocompatible and biodegradable materials

Combination of inorganic materials and polymer (Composite)

Bovine Hydroxyapatite (BHA)

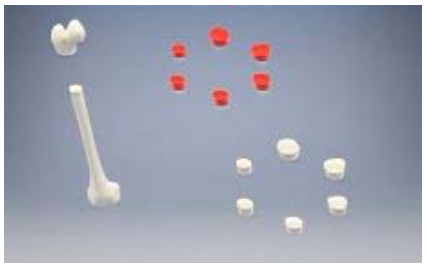
+

Chitosan

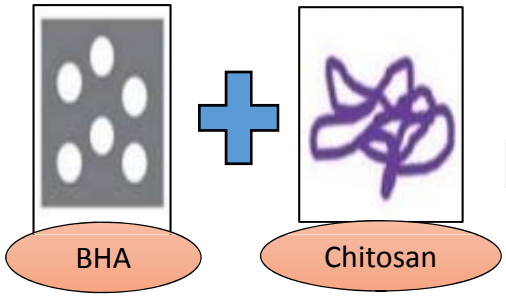
Antibiotic to prevent the postoperative infection

Ciprofloxacin HCL

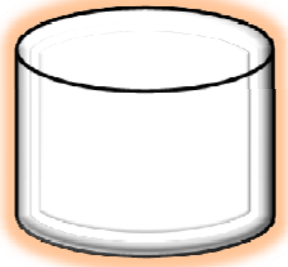
RESEARCH BACKGROUND



Bone implant consist of BHA-Chitosan composite and ciprofloxacin



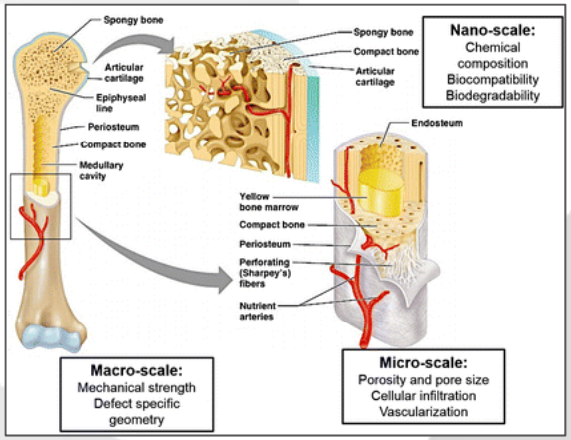
BHA-Chitosan ratio



- Physical characteristics of the implant
- The release of the drugs

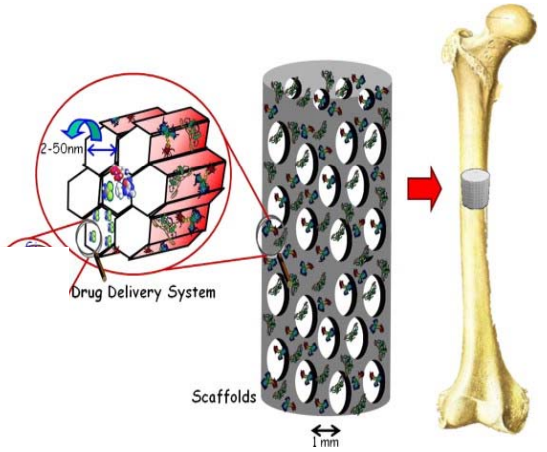
Composite composition ratio

1. BHA-Chitosan (20:80) → Formula 1
2. BHA-Chitosan (30:70) → Formula 2
3. BHA-Chitosan (40:60) → Formula 3
4. BHA-Chitosan (60:40) → Formula 4



RESEARCH OBJECTIVES

The general objective of this research was to develop Bovine Hydroxyapatite-Chitosan-Ciprofoxacin implant which function as bone filler and drug delivery vehicle.



The specific objective of this research was to determine the effect of composite composition ratio to physical characteristics and the release of ciprofloxacin from Bovine Hydroxyapatite- chitosan-ciprofloxacin implant.

METHOD

Preparation of chitosan powder

Preparation of granules mas (BHA,chitosan, ciprofloxacin) by wet granulation method

Milling of granule mass

Drying process of granules

Weighing of dry granule mass

Compression process into bone pellet/beads as bone implant

Evaluation of physical characteristics and the release of ciprofloxacin from the implant

METHOD

PREPARATION OF CHITOSAN POWDER

Chitosan flakes were dissolved in acetic acid solution 1% (v/v)

Chitosan solution with 2% (w/v) concentration

Chitosan soluition was added by 1 M NaOH solution until netral (pH= 7)

Chitosan gels

Dried in tray dryer at 40 °C for 24 hours

Chitosan powder

METHOD

PREPARATION OF BHA-CHITOSAN-CIPROFLOXACIN IMPLANT

Ciprofloxacin HCL were dissolved in aquabidestilata

BHA and the solution of ciprofloxacin HCL were mixed

Chitosan powder were added and mixed

Sieving process

METHOD

Physical Characteristics

- Porosity, density, water absorption, and swelling ratio
- Disintegration test
- Compressive strength
- Test of functional group change using FT-IR
- Evaluation of implant surface morphology (SEM)
- X-ray difraction

Assay of Ciprofloxacin

- Determination of ciprofloxacin concentration in implant

Drug Release Evaluation

- In vitro release of ciprofloxacin from implant

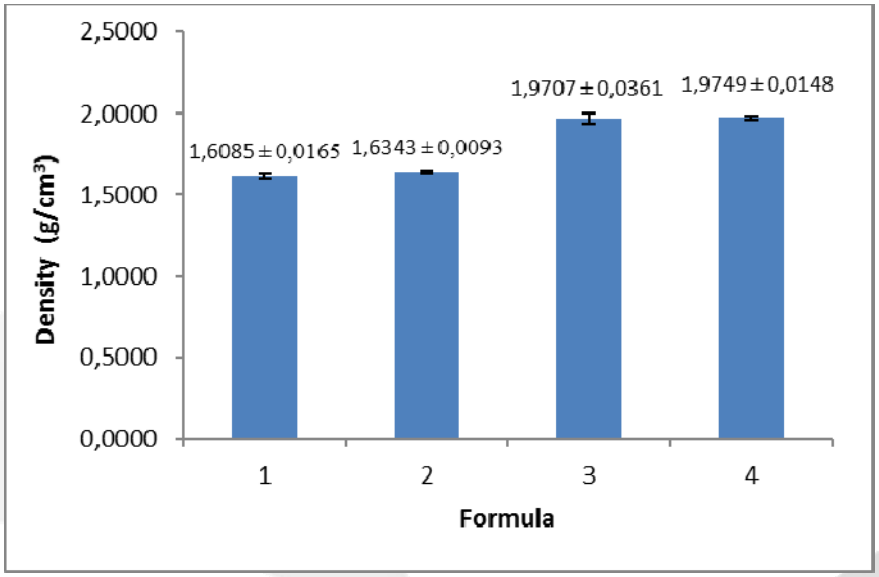
RESULT AND DISCUSSION

Dried granules of BHA-chitosan-ciprofloxacin

BHA-chitosan-ciprofloxacin implant

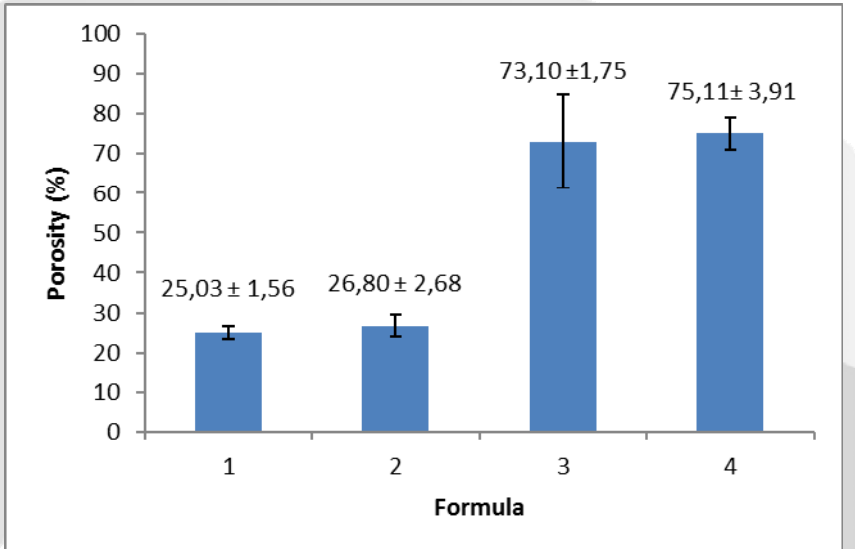
RESULT AND DISCUSSION

Density and porosity of the implant



- BHA will be dispersed in the chitosan matrix cause the structure of the implant became denser
- The higher BHA proportion, the higher density of bone implant will be obtained

- The increased of BHA proportion led the pore wall became thinner and the structure of the pore became weaker, meanwhile the porosity of the implants are increased



RESULT AND DISCUSSION

Disintegration Test

Formula 1

Formula 2

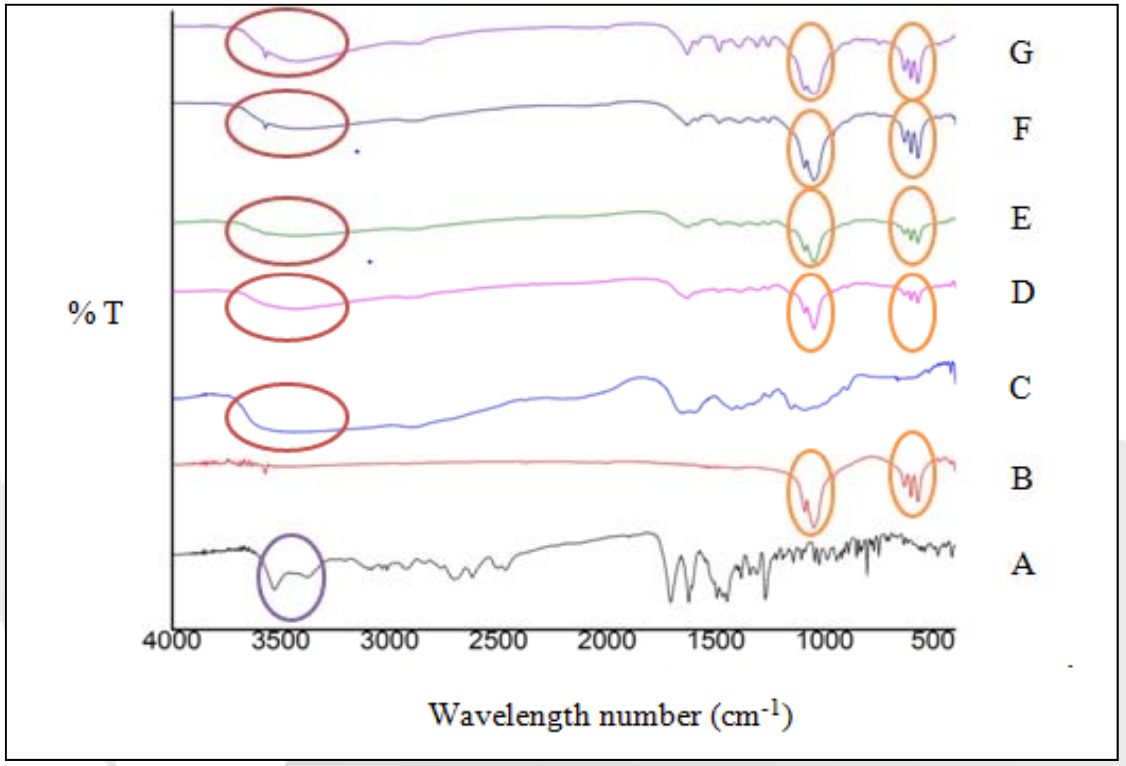
Formula 3

Formula 4

- Disintegration test was conducted to evaluate the ability of the implant to have enlarged pore size when applicated in body fluid. Enlargement of the pore size can facilitate cell attachment and bone tissue growth
- Formula 4 showed the faster disintegration rate among four formulas

RESULT AND DISCUSSION

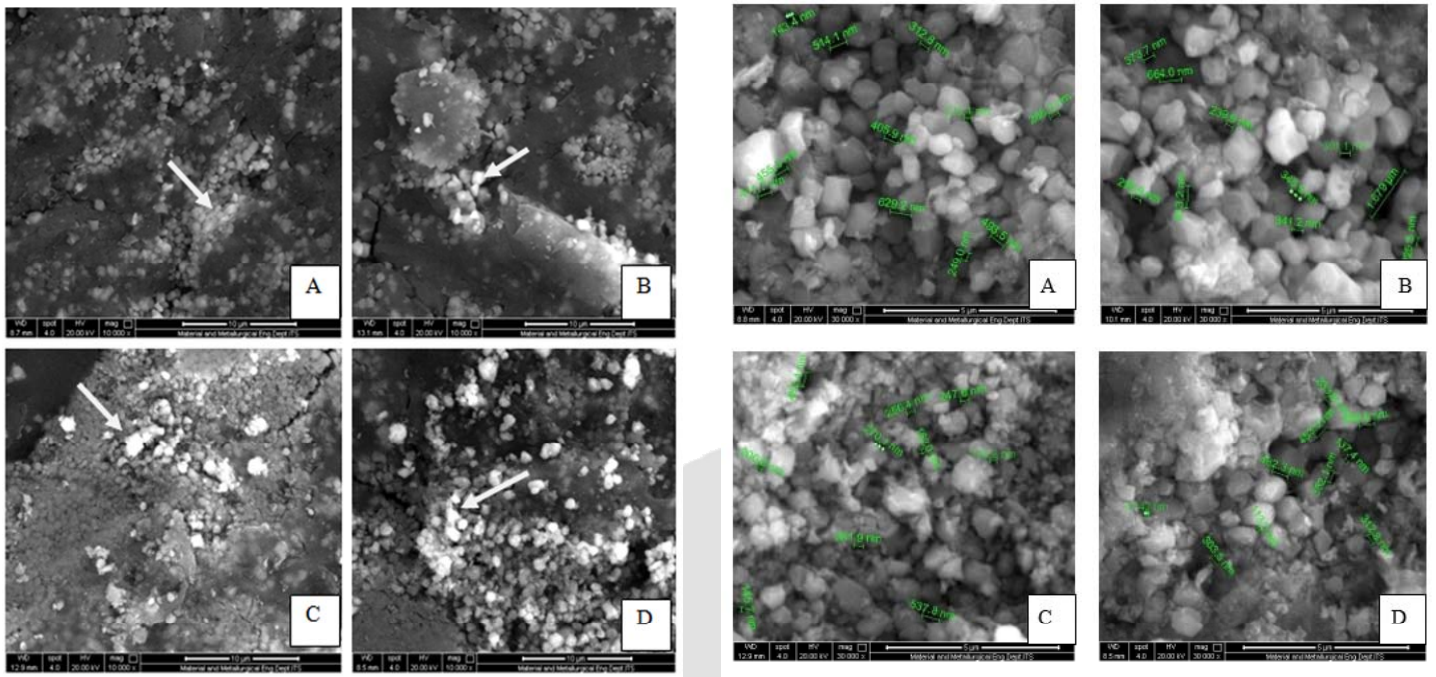
Fourier transformed infrared spectroscopy (FT-IR) Spectrum



FT-IR spectrum of, (A): Ciprofloxacin; (B): Bovine Hydroxyapatite; (C): Chitosan; (D): Formula 1; (E): Formula 2; (F): Formula 3; (G): Formula 4

RESULT AND DISCUSSION

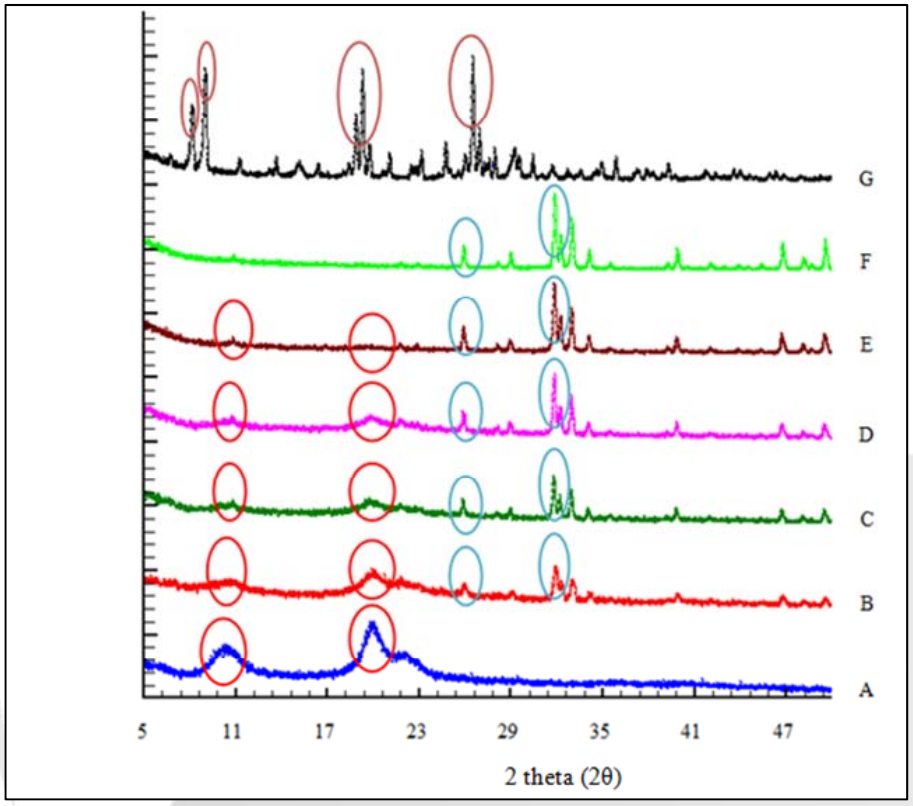
Scanning Electron Microscope (SEM) Images of The Implants



SEM micrograph of the implants, A): F1 (BHA-chitosan = 20:80), B): F2 (BHA-chitosan = 30:70), C): F3 (BHA-chitosan = 40:60), D): F4 (BHA-chitosan = 70:30)

RESULT AND DISCUSSION

X-Ray Diffraction Spectrum of The Implants



X-ray diffraction spectrum of (A): Chitosan; (B): Formula 1; (C): Formula 2; (D): Formula 3; (E): Formula 4; (F): Bovine Hydroxyapatite; (G): Ciprofloxacin

RESULT AND DISCUSSION

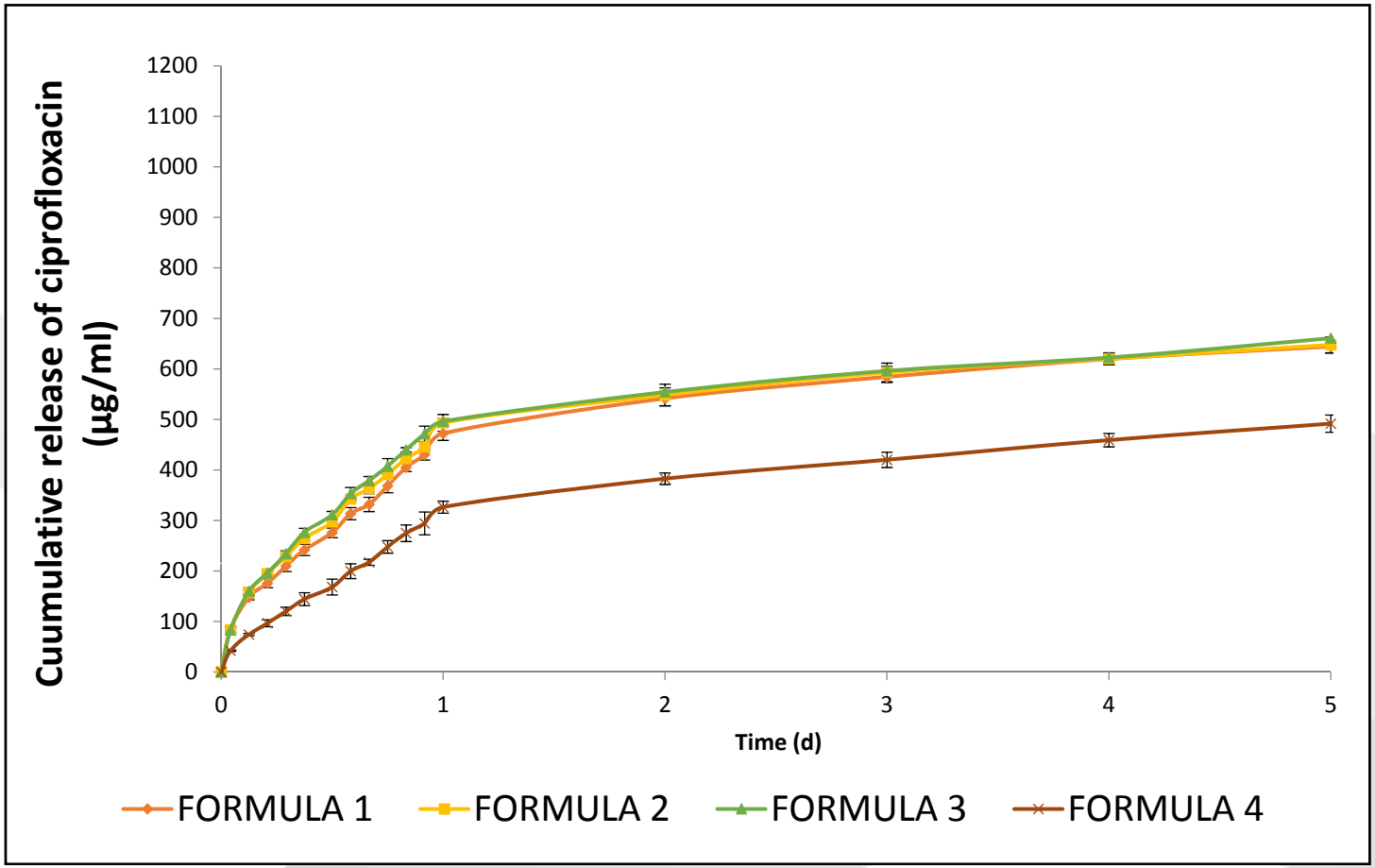
Drug Content

- Drug content of all formulations was determined by UV spectrophotometer
- All the implants revealed uniform distribution of ciprofloxacin

Formulation	Drug content (%)
Formula 1	93.84 ± 1.05
Formula 2	94.62 ± 2.06
Formula 3	96.10 ± 0.96
Formula 4	99.81 ± 3.37

RESULT AND DISCUSSION

Cummulative Release Profile of Ciprofloxacin



CONCLUSION

- Based on the results of physical characteristics evaluation and in vitro drug release study, it can be concluded that formula 4 (Bovine Hydroxyapatite:chitosan = 70:30) fulfilled the requirement of ideal bone implant.
- The release rate of ciprofloxacin from formula 4 maintained in the in vitro therapeutic level (2-50 µg/ml), however in the intial period the release of ciprofloxacin exceed the in vitro therapeutic level.

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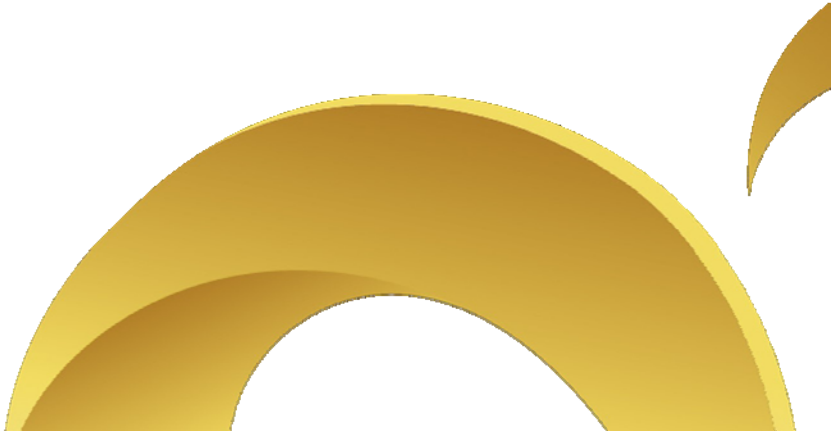
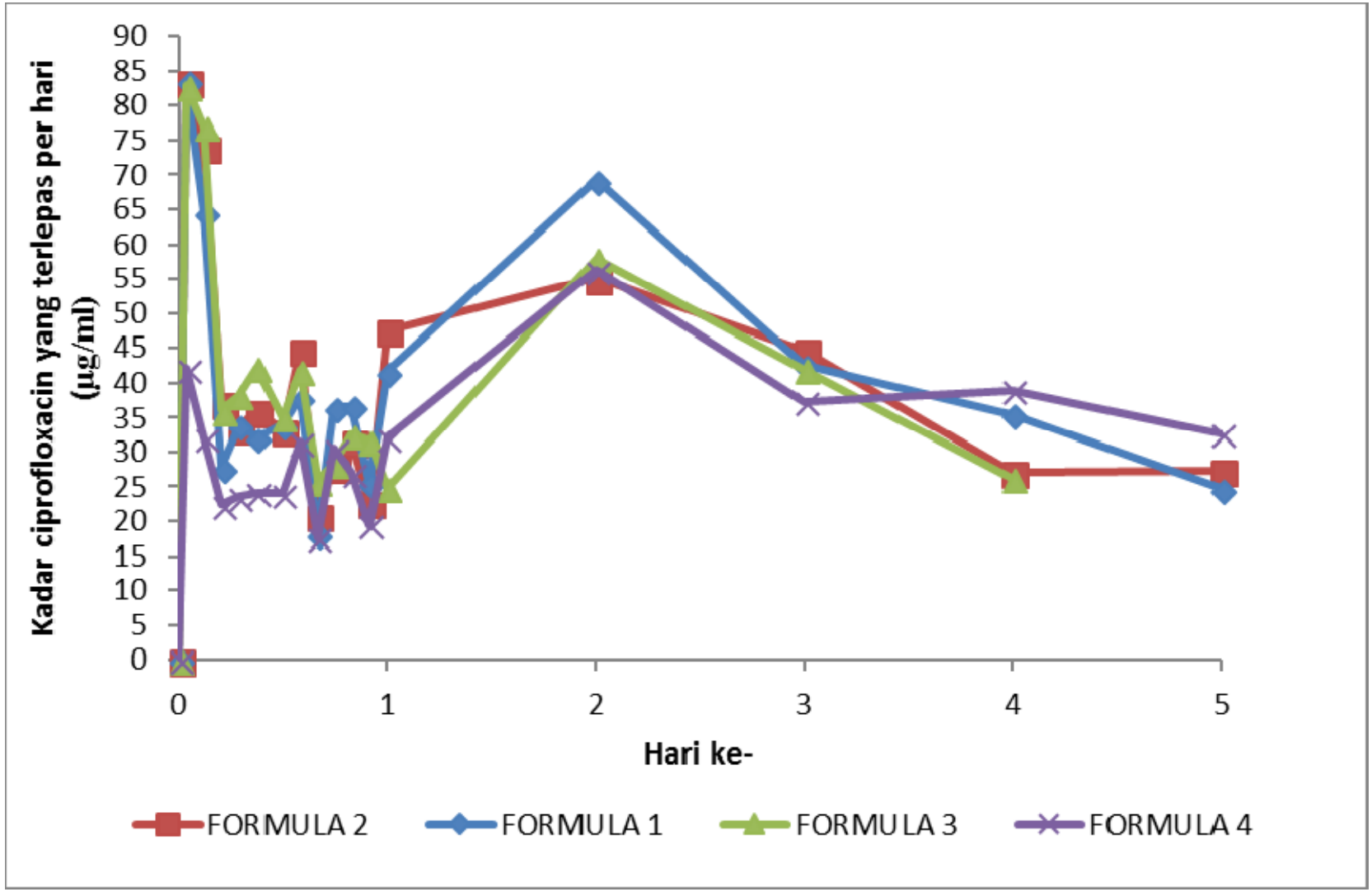
THANK YOU




Kadar ciprofloxacin yang terlepas per hari (µg/ml)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
Hari ke-
FORMULA 2
FORMULA 1
FORMULA 3
FORMULA 4