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## Abstract

Alginate hydrogels are biomaterials that have found numerous applications in medical science and engineering. Due to their properties such as biocompatibility and biodegradability, alginate hydrogels are widely used as drug delivery systems. In this paper the controlled release of active substance, ketoprofen, from Ca<sup>2+</sup> cross linked alginate hydrogels was investigated. Different mass concentration of alginate acid (1%, 1.5%, 2% and 2.5%), acidic, neutral and basic media were analyzed. The pH values of the acidic and basic media were adjusted to 5.0 and 9.0 using CH<sub>3</sub>COONa/CH<sub>3</sub>COOH and Tris-HCl buffers. Ketoprofen quantities released from studied samples, depending from the pH of the environment and the mass concentration of alginate acid can be observed as controlled release mechanisms.

**Keywords:** alginate hydrogels, controlled release, pH, alginate acid, ketoprofen.

## Introduction:

Alginate hydrogels are biomaterials that have found numerous applications in biomedical science and engineering, due to their properties such as biocompatibility and biodegradability. In biomedicine alginate hydrogels are widely used as drug delivery, wound healing and tissue engineering applications [1].

Stability of these alginate hydrogels in physiological environments and controlled release of active substances are the main properties, that affect the use of these hydrogels for medical purposes.

When alginate hydrogels come in contacts with physiological environments with different pH, their reaction in these environments goes with controlled release of active substance, loaded inside the gel. Controlled release from alginate hydrogels is more efficient because these biopolymers will react only with the environment where the substance has to be delivered[2].

## Experimental:

Controlled release of active substance has been investigated for samples with different mass concentration of alginate acid 1%, 1.5%, 2% and 2.5%, loaded with same concentration of active substance, 0.05g/L ketoprofen. Controlled release from these samples has been followed in three environments with different pH at an interval of 200 min.

From the measured absorbance is calculated the amount of ketoprofen, released from alginate hydrogels. The relation between released amount of ketoprofen with time is presented graphically as follows.

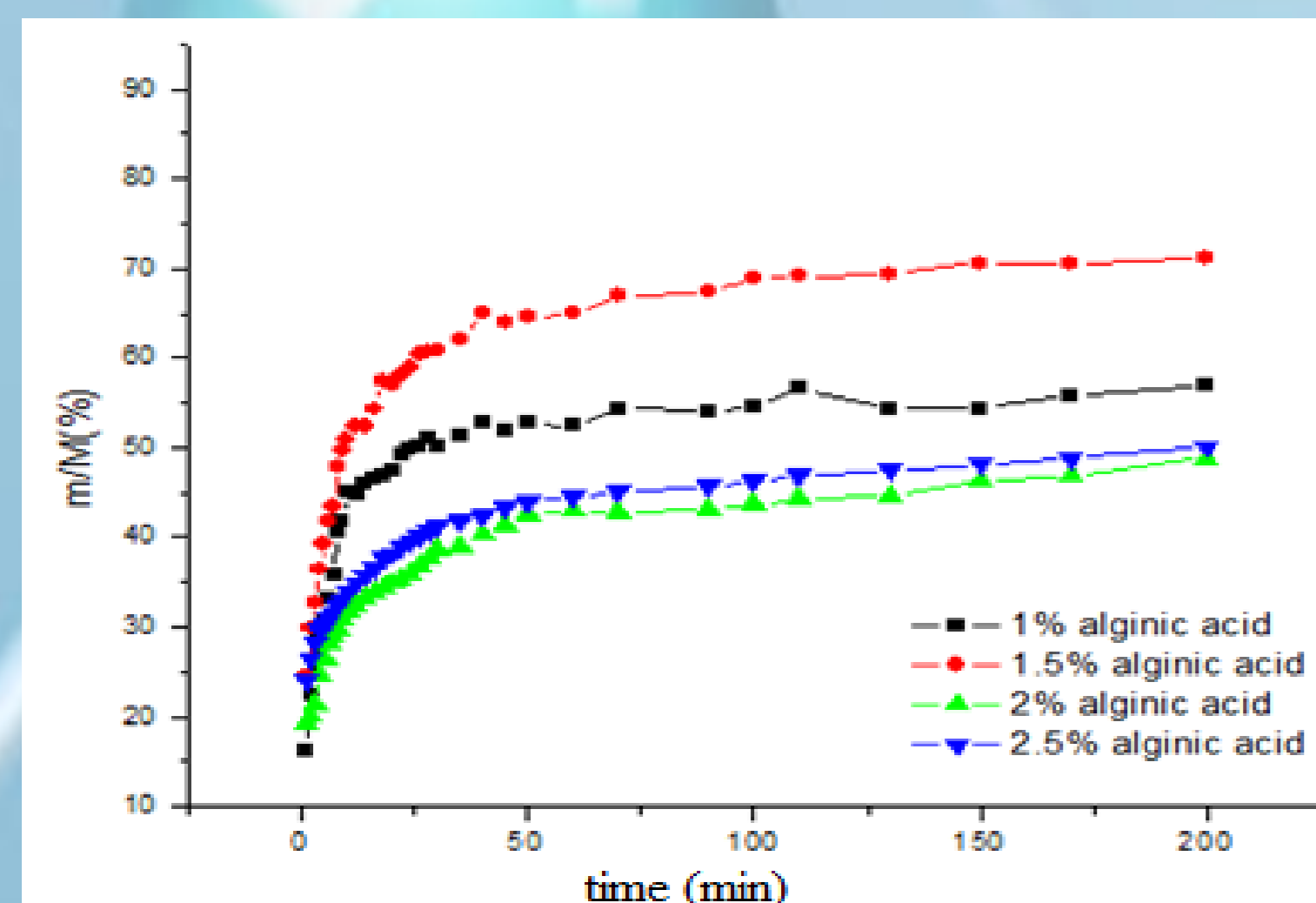


Fig 1. Controlled release of ketoprofen in acidic environment with pH=5.0 from alginate hydrogels with 1%, 1.5%, 2%, 2.5% mass concentration of alginate acid.

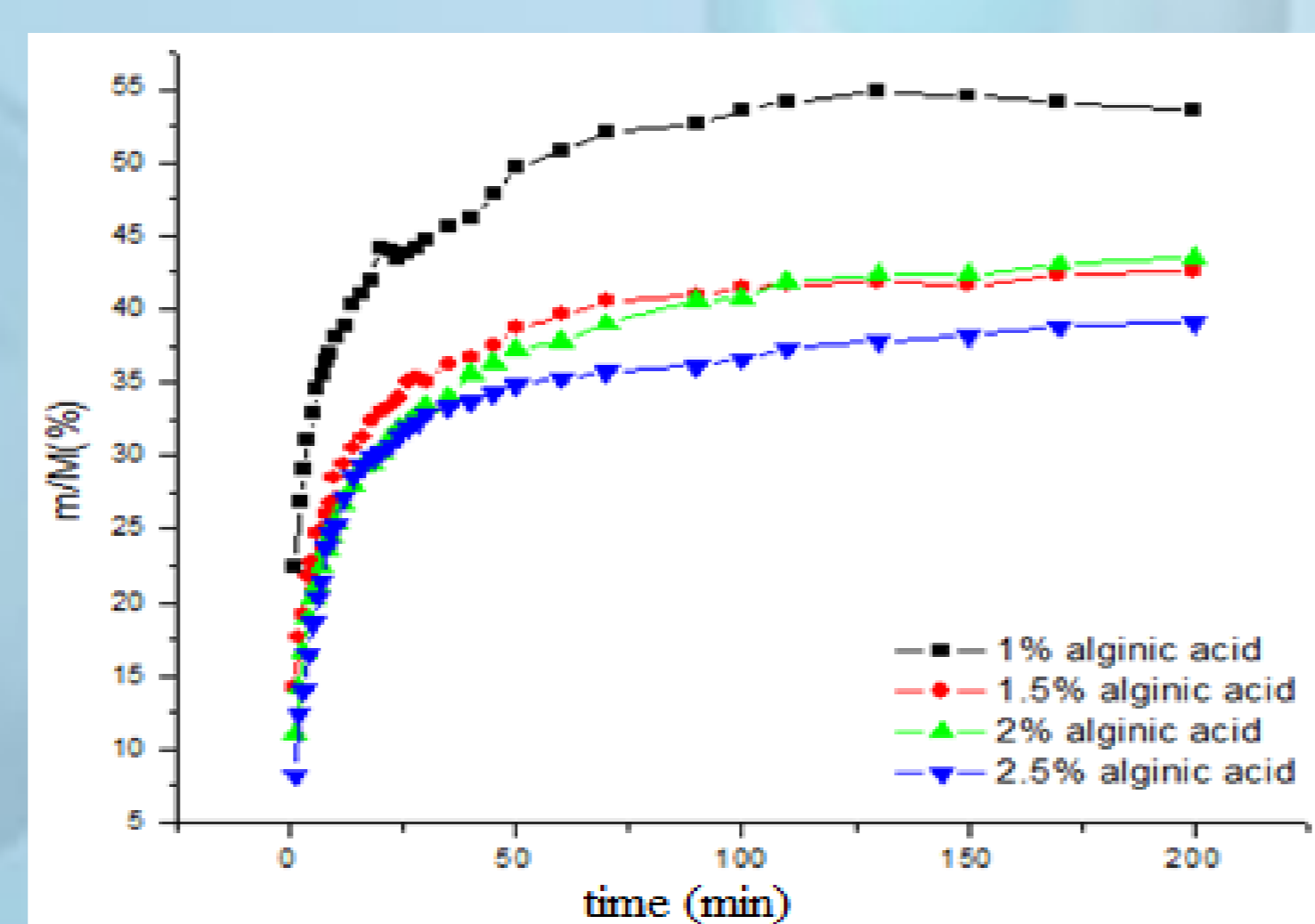


Fig 3. Controlled release of ketoprofen in basic environment with pH=9.0 from alginate hydrogels with 1%, 1.5%, 2%, 2.5% mass concentration of alginate acid.

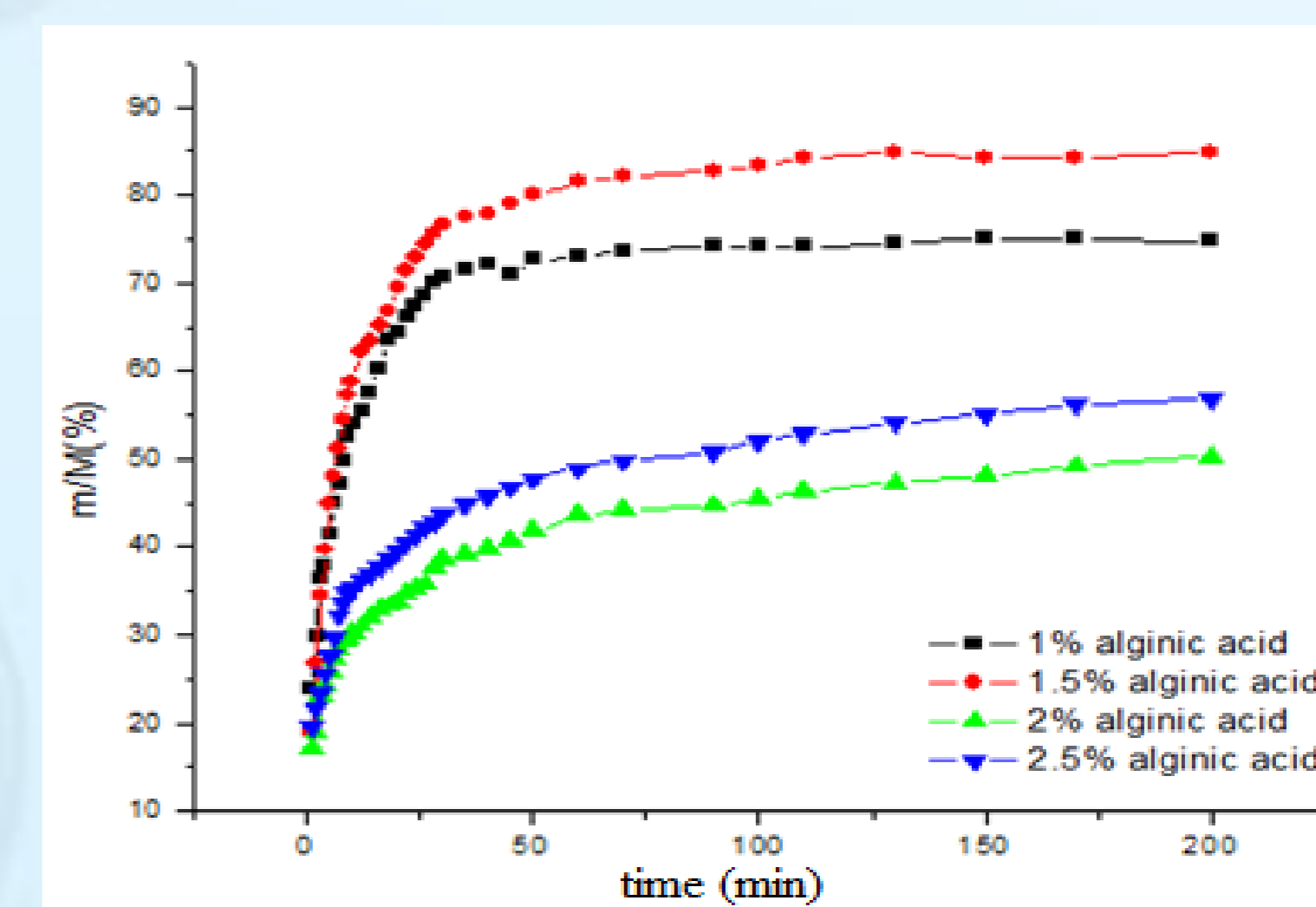


Fig 2. Controlled release of ketoprofen in neutral environment with pH=6.9 from alginate hydrogels with 1%, 1.5%, 2%, 2.5% mass concentration of alginate acid.

## Results and discussion

The controlled release of ketoprofen from alginate hydrogels directly depends on the mass concentration of alginate acid in hydrogels. Hydrogels with lower mass concentration of alginate acid, have released larger amounts of active substance for the same time, compared to others with higher mass concentration of alginate acid. The rapid release of the active substance from hydrogels with lower alginate concentration comes due to the fact that these gels are less dense and degrade faster than hydrogels with higher concentrations of alginate acid.

Controlled release from alginate hydrogels is also affected by the environment in which the hydrogels are placed. The graphs shows that larger amount of active substance is released in basic and in neutral environment, while the hydrogels placed in acidic environment tend to have smaller release for the same time. This difference is due to the fact that alginate hydrogels have greater stability in acidic environment than in basic and neutral environment.

## Conclusion

The research on the controlled release of active substance ketoprofen shows that alginate hydrogels are a suitable choice for incorporating this drug into the structure of hydrogels. These hydrogels show rapid release of ketoprofen, especially in the first hour of investigation, enabling that on further uses this drug reaches relatively quickly to the damaged tissue. The pH of the environment as well as the selected composition can serve as mechanisms for the controlled release of ketoprofen from alginate hydrogels.

## References:

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