## Abstract

### Introduction

Polyvinyl alcohol is a biocompatible, biodegradable, and cheap polymer. Despite the mentioned positive characteristics, the use of polyvinyl alcohol-based hydrogels has been limited due to insufficient strength; therefore, suitable cross-linkers are used in various studies to improve mechanical properties. In this study, triazine two-dimensional polymer is used to improve the mechanical and rheological properties of polyvinyl alcohol-based hydrogel. In addition to creating antibacterial properties, the two-dimensional triazine polymer will improve the mechanical properties of the resulting hydrogel due to the presence of oxygen and nitrogen active functional groups and the creation of hydrogen bonds with hydroxyl groups in the structure of polyvinyl alcohol.

### Materials and Methods

Four types of hydrogels with different concentrations of 2DP (Two-Dimensional Polymer) were made and the initial water content, swelling percentage, water holding capacity, biodegradability percentage, porosity and pore morphology, mechanical strength and rheological properties were evaluated. Then the optimal concentration of 2DP was selected and the tests of Fourier transform infrared (FTIR), Thermogravimetric analysis (TGA) and X-ray Diffraction (XRD) were performed for the resulting hydrogels and their raw materials. The antibacterial effects of the hydrogel were evaluated.

### Results

By changing the concentration of 2DP, the physicochemical properties of the hydrogel can be easily changed. The results of infrared spectroscopy, Thermogravimetric analysis and X-ray diffraction tests confirmed the formation of hydrogel. mechanical strength and rheology tests showed a significant improvement in the mechanical properties in the optimal hydrogel. The resulting hydrogel also showed antibacterial ability.

### Discussion and Conclusions

By using triazine two-dimensional polymer, in addition to creating antibacterial properties, with the help of creating cross-connections and creating hydrogen bonds with polyvinyl alcohol polymer, it is possible to see the improvement of water retention capacity, swelling ability, improvement of mechanical and rheological properties

compared to PVA-based hydrogel.

**Key words:** Improved hydrogel, pH sensitive, 2D polymer, Swelling, Mechanical strength, Antibacterial