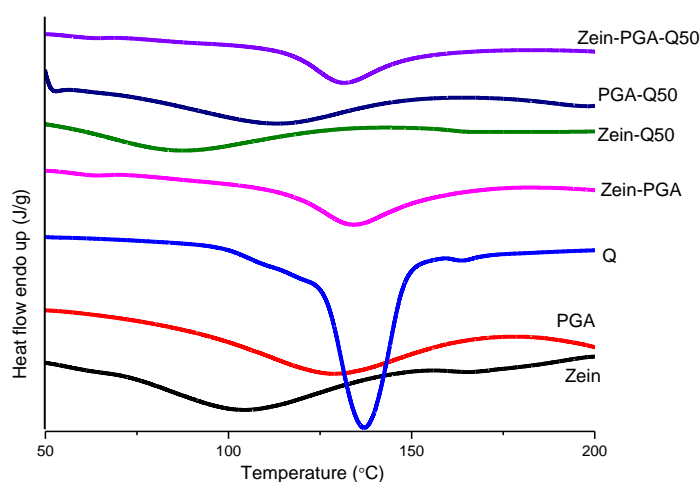


Differential scanning calorimetry (DSC)

DSC measurements were conducted by a Perkin-Elmer DSC60 instrument in a nitrogen atmosphere. Approximately 10 mg samples were sealed in an aluminum pan for the measurements. The samples were heated from 30 to 300 °C at a rate of 10 °C/min.



SI Figure 1 DSC thermograms of freeze-dried samples

DSC thermograms of freeze-dried samples were shown in SI Figure 1. Zein and PGA presented broad endothermic peaks at around 104.2 and 128.4 °C, respectively. These characteristic endotherms could be associated with the evaporation of bound water from the polymer and were termed as a dehydration temperature (T_d).^{1,2,3} For the samples of Zein-PGA binary complex and Q-loaded Zein-PGA composite, the T_d shifted towards higher temperatures. The increased temperature may be attributed to the intermolecular interactions between zein and PGA, resulting in the formation of Zein-PGA complex which had a higher affinity with water due to the fact that the

presence of hydrophilic groups of PGA could improve the binding capacity of water molecules to the binary polymer network and consequently increase the content of bound water, leading to the high endothermic peak temperature.⁴ There was a sharp endothermic peak around 137.3 °C attributed to the melting of crystalline structure of Q. However, this melting peak was not appeared in the curves of samples for Zein-Q, PGA-Q, and Q-loaded Zein-PGA binary complex, indicating that Q was well dispersed in the polymeric matrix as testified by the result of XRD (Figure 3A). Similar findings have been pointed by Luo et al.⁵ and Patel et al.⁶. The presence of Q induced lower T_d of binary complexes (Zein-Q and PGA-Q), which may be ascribed to the fact that the embedded Q destroyed the natural compact structure of zein or PGA, leading to the formation of loose structure with a large particle size.⁷

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