THE EFFECT OF PVA/AQUADES/Fe$_3$O$_4$ RATIO, FREEZING-THAWING CYCLES AND DURATION ON STABILITY OF MAGNETO-ELASTIC PROPERTIES OF FERROGEL

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ABSTRACT

Ferrogel, a type of hydrogel, has attracted much attention for its wide potential application. In the application, problem often occurs due to limited stability of ferrogel to persist at room temperature. Therefore, fabrication of Fe$_3$O$_4$ nanoparticle-based ferrogel is necessary to explore. In this work, the effect of polymer-aquades ratio, content of Fe$_3$O$_4$ nanoparticles, number of cycles and duration of freezing-thawing are comprehensive studied. The PVA : aquades ratio varying at 13: 100, 18: 100, 23: 100, 28: 100 and 33: 100. The Fe$_3$O$_4$ content was varied from 5 to 12.5wt%. The variation of cycle duration of freezing-thawing were 30-30, 60-30, 90-30, 120-30, and 150-30 minutes with 4, 8, and 12 cycles. Furthermore, magneto-elastic properties in terms of elongation and deflection responses to external magnetic field were also observed as well as their elastic moduli. Time-dependent of the magneto-elastic behavior of ferrogel were examined by conducting measurement at 1$^{st}$, 2$^{nd}$, 3$^{rd}$, 4$^{th}$ and 5$^{th}$ days after the preparation. Ferrogel with PVA : aquades ratio 23: 100, 10 wt% Fe$_3$O$_4$, fabricated via 4 cycles of freezing-thawing (duration 30 min-30 min) showed stable elongation and deflection. Ferrogel with PVA : aquades ratio 23: 100, 10 wt% Fe$_3$O$_4$, fabricated via 4 cycles of freezing-thawing (duration 90 min-30 min) showed a more stable on deflection, but not in elongation. The same result was also found for the sample with PVA : aquades ratio 23: 100, 12.5 wt% Fe$_3$O$_4$, fabricated via 4 cycles of freezing-thawing (duration 30 min-30 min).

Keywords: Fe$_3$O$_4$, magneto-elastic, PVA, ferrogel