BIOCOMPATIBLE HYBRID HYDROGELS BASED ON NATURAL POLYSACCHARIDES WITH LAPONITE® NANOFILLER

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Modern trends in the development of hydrogels for application in agriculture, ecology, pharmacology, and medicine are focused on the fulfilling conditions of their biosafety and biocompatibility. Natural biodegradable polymers such as polysaccharides (PS) are promising components for synthesizing such materials. This work aims to develop new hydrogel composite materials for sorption and prolonged release of bioactive components based on physically cross-linked natural polysaccharides. The natural polysaccharides, namely sodium alginate, kappa-carrageenan and chitosan were used for the synthesis. Nano-sized synthetic clay LaponiteRD was used as a filler to provide mechanical strength and improve functional properties of the hybrid hydrogels.

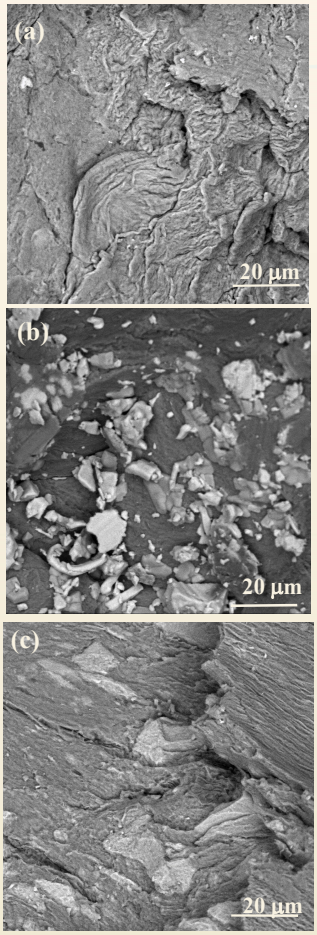

Fig.1. SEM images of PS-based nanocomposites with LaponiteRD filler: (a) N1, (b) N2, (c) N3.

Materials and synthesis

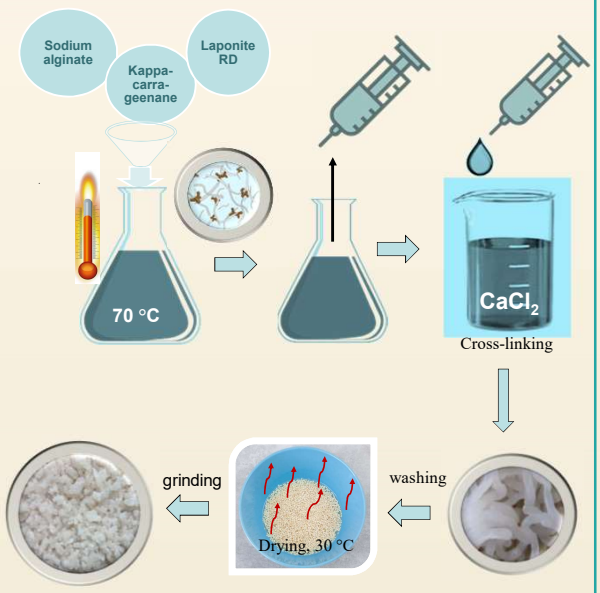

Table 1. Composition of hybrid hydrogels (content of components per 100 g of dry xerogel)

Component	N1	N2	N3
Sodium alginate, g/100g	50	44.4	44.4
Kappa-carrageenane, g/100g	-	11.1	11.1
LaponiteRD	50	44.4	44.4
Cross-linking agent	$CaCl_2$	$CaCl_2$, KCl	$CaCl_2$, Chitosan

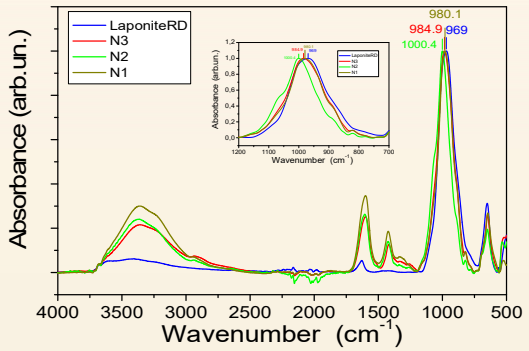

Fig.2. FTIR spectra of the hybrid hydrogels

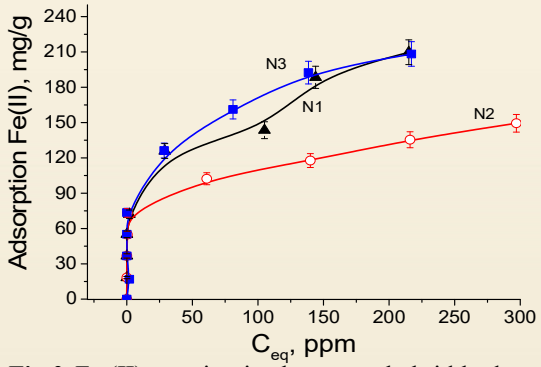

Fig.3. Fe (II) sorption isotherms on hybrid hydrogels filled with LaponiteRD

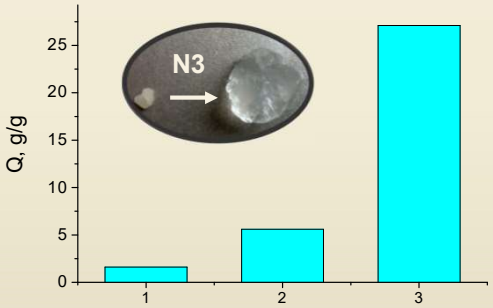

Fig.4. Swelling degree (Q) for hybrid hydrogels based on PS filled with LaponiteRD

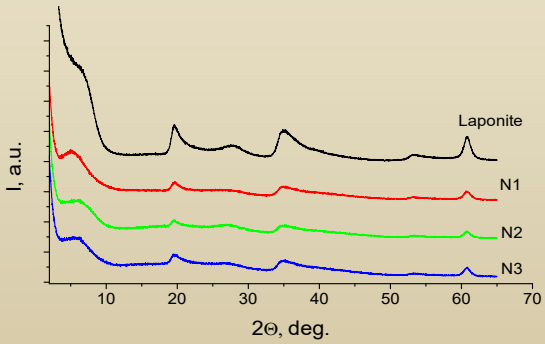

Fig.5. X-ray diffraction patterns of pristine LaponiteRD and hydrogels filled with LaponiteRD

Conclusions

- A series of sodium alginate/kappa-carrageenane/LaponiteRD hydrogels using different cross-linking agents was synthesized for their potential use as sorbents and soil conditioners.
- SEM images showed a homogeneous distribution and layered structure of composite hydrogels, which is provided with a high clay content.
- FTIR and XRD confirmed the intercalation structure of clay in hybrid hydrogels
- The swelling degree (Q) of hybrid hydrogels strongly depend on component ratio and cross-linking agent: Q is maximal for hydrogels crosslinked with $CaCl_2$/Chitosan.
- Sorption capacity of hybrid hydrogels towards Fe(II) was 150-205 mg/g
- Synthesized polysaccharide hybrid hydrogels have high absorption capacity, are safe and biodegradable, and also characterized by low mechanical strength.

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