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Supplementary Information

Enhanced Mechanical Stability and Sensitive Swelling Performance of Chitosan/yeast Hybrid Hydrogel Beads

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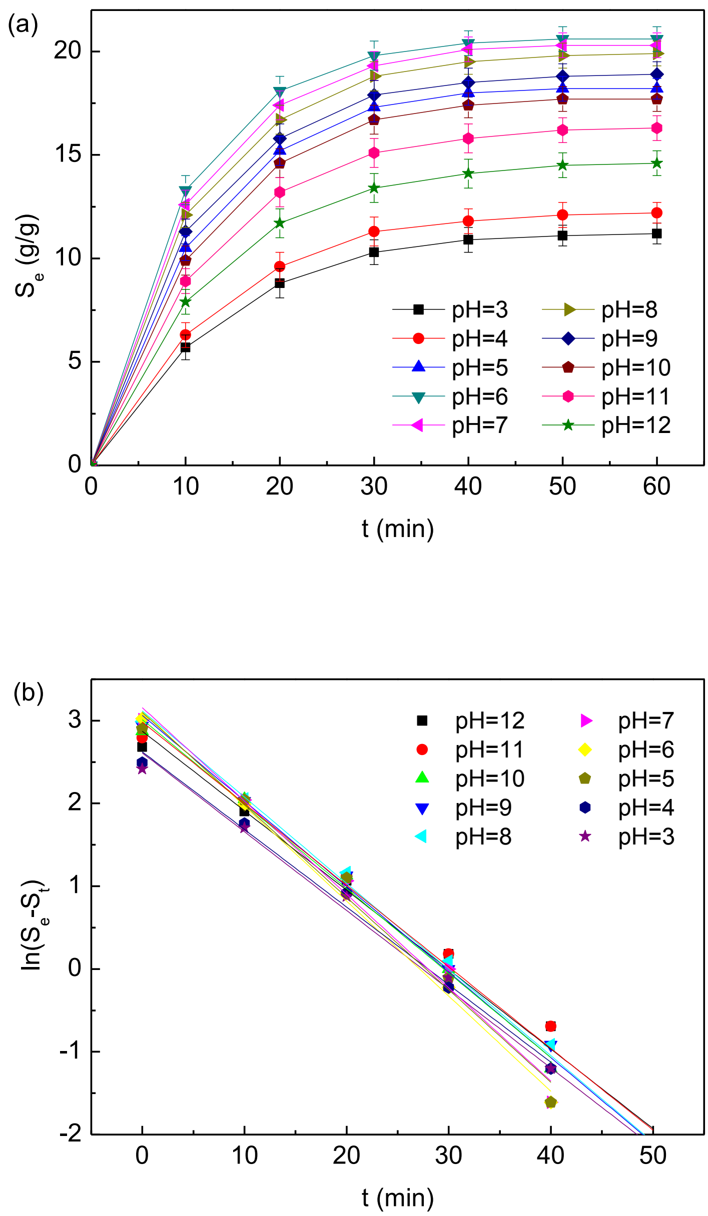
The time-dependent swelling behaviours of chitosan/yeast hybrid hydrogel beads with 40 wt% yeast content were further investigated by a sequential pH variation (3~12) to discuss the mechanism. The experimental data were fitted by pseudo-first-order and pseudo-second-order kinetic models, and the results are exhibited in Figure S1 and Table S1.



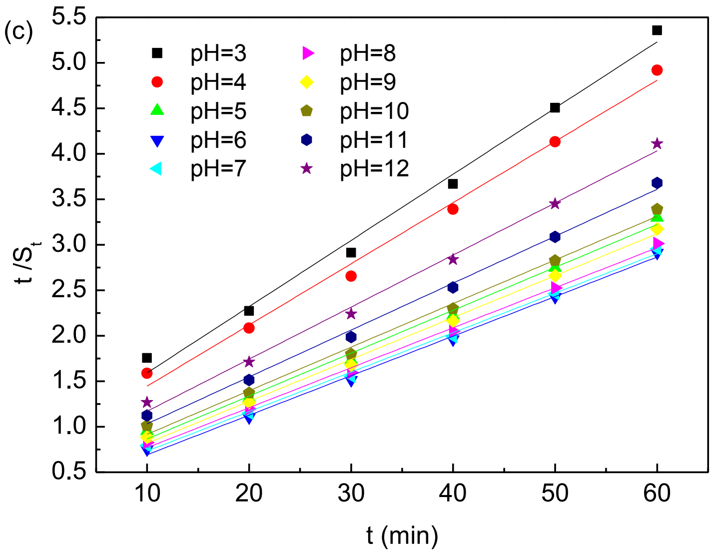


Figure S1. (a) Swelling behaviors of chitosan/yeast hybrid hydrogel beads with 40 wt% yeast contents in pH 3-12 solutions, (b) pseudo-first-order kinetic model, (c) pseudo-second-order kinetic model.

As can be seen, the time-dependent swelling behaviour of chitosan/yeast hybrid hydrogel beads with 40 wt% yeast content observed in pH 3-12 solutions is similar to that in distilled water presented in Figure 4. Specifically, a steep increase of S_e was observed in the first 30 min, and then followed a gentle stage until reached an equilibrium state. In comparison, the values of the correlation coefficient (R^2) of pseudo-second-order kinetic model are much closer to 1.0, and the values of chi square or the residual sum of squares (χ^2) are much closer to 0 than pseudo-first-order kinetic model. It seemed that the swelling process of chitosan/yeast hybrid hydrogel beads obeyed pseudo-second-order kinetic model better than pseudo-first-order kinetic model. Furthermore, the swelling kinetics is dependent on the pH values of swelling medium. With altering the pH values of swelling medium, the S_e values obtained in the range of 6~7 were higher than any other pH values. This was due to the quaternisation of $–NH_2$ groups derived from chitosan after the external pH value exceeding its pK_a (approximately 6.3), and thus the electronic repulsion between $–NH_3^+$ groups contributed the network of chitosan/yeast hybrid hydrogel beads to relaxing more.

Table S1. Kinetic parameters for the water absorbency of chitosan/yeast hybrid hydrogel beads (40 wt%) in various pH media.

pH	$S_{e,exp}$ (g/g)	Pseudo-first-order kinetic model				Pseudo-second-order kinetic model			
		$S_{e,cal}$ (g/g)	K_1 (min^{-1})	R^2	χ^2	$S_{e,cal}$ (g/g)	K_2 (g/g·min)	R^2	χ^2
3	11.2	13.5887	0.0951	0.9912	0.1117	13.7438	0.0061	0.9901	0.0739
4	12.2	13.7786	0.0937	0.9913	0.0575	14.8721	0.0058	0.9910	0.0572
5	18.2	22.1746	0.1117	0.9814	0.1764	21.2089	0.0056	0.9929	0.0223
6	20.6	22.5440	0.1148	0.9953	0.0467	23.0044	0.0073	0.9964	0.0097
7	20.3	23.5162	0.1128	0.9830	0.1646	23.0468	0.0063	0.9959	0.0110
8	19.9	22.5860	0.1041	0.9930	0.1062	22.7531	0.0058	0.9964	0.0098
9	18.9	21.4085	0.1034	0.9935	0.0982	21.7202	0.0059	0.9957	0.0129
10	17.7	20.3455	0.1021	0.9912	0.0692	20.8768	0.0052	0.9924	0.0247
11	16.3	19.7440	0.0986	0.9802	0.2742	19.3949	0.0051	0.9939	0.0226
12	14.6	17.6621	0.0960	0.9771	0.3014	17.4703	0.0054	0.9946	0.0247