**Supplementary information**



Figure S1: Three reproducible reference particle series (A, B, and C). Particle sizes were measured by DLS of colloidal suspensions synthesized without the addition of patent blue. The vertical bars show the standard deviation of the size distribution.

Table S1: Encapsulation efficiency (EE), pH after precipitation, particle diameters measured by DLS, and zeta potential for each ratio zein to dye (patent blue). Particles were synthesized while keeping the initial zein solution weight percentage at 10wt%.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Zein(wt%) | Ratio Z:D | pH after precipitation | Particle diameter(nm) | Standard deviation of particle distribution(nm) | ζ-potential after dialysis(mV) | EE(%) |
| 10 | 0 | 4.2 | 74.13  | 32.07 | 46.3 ± 7.37 | - |
| 10 | 0.0025 | 4.4 | 76.85  | 35.01 | 49.4 ± 7.75 | 99.9 |
| 10 | 0.003 | 4.3 | 81.12  | 35.67 | 49.1 ± 7.36 | 99.9 |
| 10 | 0.004 | 4.3 | 96.78  | 38.22 | 49.0 ± 7.46 | 99.7 |
| 10 | 0.005 | 4.2 | 89.19  | 37.48 | 50.6 ± 8.22 | 99.6 |
| 10 | 0.007 | 4.5 | 95.62  | 39.83 | 41.3 ± 7.21 | 98.6 |
| 10 | 0.007 | 4.5 | 95.47  | 37.10 | 42.3 ± 7.63 | 99.8 |
| 10 | 0.008 | 4.3 | 100.3  | 42.02 | 39.6 ± 6.67 | 99.4 |
| 10 | 0.008 | 4.4 | 78.05  | 39.69 | 42.2 ± 6.95 | 99.7 |
| 10 | 0.009 | 4.3 | 93.27  | 41.89 | 37.9 ± 5.77 | 99.2 |
| 10 | 0.009 | 4.4 | 86.62  | 48.03 | 40.3 ± 6.87 | 99.8 |
| 10 | 0.010 | 4.2 | 90.34  | 47.42 | 50.3 ± 7.71 | 99.8 |
| 10 | 0.010 | 4.3 | 101.8  | 41.47 | 39.2 ± 5.99 | 99.7 |
| 10 | 0.014 | 4.6 | 124.8  | 49.56 | 39.2 ± 6.23 | 99.1 |
| 10 | 0.016 | 4.4 | 131.6  | 52.75 | 42.1 ± 6.68 | 99.0 |
| 10 | 0.018 | 4.4 | 99.60  | 79.13 | 39.0 ± 6.32 | 98.1 |
| 10 | 0.020 | 4.6 | 130.7  | 56.49 | 44.9 ± 6.00 | 97.7 |

Table S2: Different concentrations of dye were used in post-addition. The amount of adsorbed dye was determined and the dye concentration inside of the particles was calculated.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Zein(wt%) | Ratio Z:D | Particle diameter(nm) | Standard deviation of particle distribution(nm) | ζ-potential(mV) | Adsorption(%) |
| reference | 0.0000 | 74.13  | 32.07 | 46.3 ± 7.37 | **-** |
| A | 0.0005 | 73.62  | 33.26 | 44.5 ± 6.88 | **95.8** |
| B | 0.0019 | 71.98  | 31.96 | 45.9 ± 7.40 | **98.8** |
| C | 0.0048 | 75.10  | 33.02 | 44.1 ± 7.00 | **99.3** |
| D | 0.0096 | 72.03  | 31.50 | 44.3 ± 6.53 | **99.3** |
| E | 0.0156 | 70.75  | 31.49 | 41.9 ± 6.84 | **99.2** |
| F | 0.0209 | 73.80  | 33.60 | 38.1 ± 6.43 | **99.3** |
| G | 0.0313 | 67.71  | 32.64 | 39.2 ± 7.46 | **99.0** |
| H | 0.0417 | 71.46  | 35.23 | 36.3 ± 7.10 | **98.9** |