**Supplementary materials**

**Table S1.** The orthogonal factors of the modified urea-formaldehyde polymer (MUFP)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Polymer  number | Formaldehyde  (mL) | 0.0125mol/L NaOH  (mL) | Reaction temperature  (ºC) | Time  (h) | Group 1 | Group 2 |
| NH4Cl (g) | (NH4)2SO4 (g) |
| 1 | 12.16 | 4.00 | 60 | 2.5 | 0.5350 | 0.0132 |
| 2 | 12.16 | 5.00 | 65 | 3.0 | 1.0700 | 0.0198 |
| 3 | 12.16 | 6.00 | 70 | 3.5 | 1.6050 | 0.0264 |
| 4 | 12.16 | 7.00 | 75 | 4.0 | 2.1400 | 0.0330 |
| 5 | 16.22 | 5.00 | 70 | 4.0 | 0.5350 | 0.0132 |
| 6 | 16.22 | 4.00 | 75 | 3.5 | 1.0700 | 0.0198 |
| 7 | 16.22 | 7.00 | 60 | 3.0 | 1.6050 | 0.0264 |
| 8 | 16.22 | 6.00 | 65 | 2.5 | 2.1400 | 0.0330 |
| 9 | 20.27 | 6.00 | 75 | 3.0 | 0.5350 | 0.0132 |
| 10 | 20.27 | 7.00 | 70 | 2.5 | 1.0700 | 0.0198 |
| 11 | 20.27 | 4.00 | 65 | 4.0 | 1.6050 | 0.0264 |
| 12 | 20.27 | 5.00 | 60 | 3.5 | 2.1400 | 0.0330 |
| 13 | 24.31 | 7.00 | 65 | 3.5 | 0.5350 | 0.0132 |
| 14 | 24.31 | 6.00 | 60 | 4.0 | 1.0700 | 0.0198 |
| 15 | 24.31 | 5.00 | 75 | 2.5 | 1.6050 | 0.0264 |
| 16 | 24.31 | 4.00 | 70 | 3.0 | 2.1400 | 0.0330 |

Notes: (a) The urea content of each polymer was 3.00 g; (b) Group 1 used ammonium chloride as the modifier, while Group 2 used ammonium sulfate.

**Table S2.** The orthogonal factors of the modified melamine-formaldehyde polymer (MMFP)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Polymer  number | Formaldehyde  (mL) | 0.0125mol/L NaOH  (mL) | Reaction temperature  (ºC) | Time  (h) | Group 1 | Group 2 |
| NH4Cl (g) | (NH4)2SO4 (g) |
| 1 | 24.32 | 4.00 | 60 | 2.5 | 0.5350 | 0.0132 |
| 2 | 24.32 | 5.00 | 65 | 3.0 | 1.0700 | 0.0198 |
| 3 | 24.32 | 6.00 | 70 | 3.5 | 1.6050 | 0.0264 |
| 4 | 24.32 | 7.00 | 75 | 4.0 | 2.1400 | 0.0330 |
| 5 | 28.38 | 5.00 | 70 | 4.0 | 0.5350 | 0.0132 |
| 6 | 28.38 | 4.00 | 75 | 3.5 | 1.0700 | 0.0198 |
| 7 | 28.38 | 7.00 | 60 | 3.0 | 1.6050 | 0.0264 |
| 8 | 28.38 | 6.00 | 65 | 2.5 | 2.1400 | 0.0330 |
| 9 | 32.43 | 6.00 | 75 | 3.0 | 0.5350 | 0.0132 |
| 10 | 32.43 | 7.00 | 70 | 2.5 | 1.0700 | 0.0198 |
| 11 | 32.43 | 4.00 | 65 | 4.0 | 1.6050 | 0.0264 |
| 12 | 32.43 | 5.00 | 60 | 3.5 | 2.1400 | 0.0330 |
| 13 | 36.49 | 7.00 | 65 | 3.5 | 0.5350 | 0.0132 |
| 14 | 36.49 | 6.00 | 60 | 4.0 | 1.0700 | 0.0198 |
| 15 | 36.49 | 5.00 | 75 | 2.5 | 1.6050 | 0.0264 |
| 16 | 36.49 | 4.00 | 70 | 3.0 | 2.1400 | 0.0330 |

Notes: (a) The melamine content of each polymer was 2.52 g; (b) Group 1 used ammonium chloride as the modifier, while Group 2 used ammonium sulfate.

**Table S3.** The orthogonal factors of the modified dicyandiamide-formaldehyde polymer (MDFP)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Polymer  number | Formaldehyde  （mL） | Distilled water  （mL） | Reaction temperature  (ºC) | Time  (h) | Group 1 | Group 2 |
| NH4Cl (g) | (NH4)2SO4 (g) |
| 1 | 16.22 | 6.00 | 60 | 2.5 | 1.3375 | 0.6600 |
| 2 | 16.22 | 8.00 | 65 | 3.0 | 2.6750 | 1.3200 |
| 3 | 16.22 | 10.00 | 70 | 3.5 | 4.0125 | 1.9800 |
| 4 | 16.22 | 12.00 | 75 | 4.0 | 5.3500 | 2.6400 |
| 5 | 18.65 | 8.00 | 70 | 4.0 | 1.3375 | 0.6600 |
| 6 | 18.65 | 6.00 | 75 | 3.5 | 2.6750 | 1.3200 |
| 7 | 18.65 | 12.00 | 60 | 3.0 | 4.0125 | 1.9800 |
| 8 | 18.65 | 10.00 | 65 | 2.5 | 5.3500 | 2.6400 |
| 9 | 21.08 | 10.00 | 75 | 3.0 | 1.3375 | 0.6600 |
| 10 | 21.08 | 12.00 | 70 | 2.5 | 2.6750 | 1.3200 |
| 11 | 21.08 | 6.00 | 65 | 4.0 | 4.0125 | 1.9800 |
| 12 | 21.08 | 8.00 | 60 | 3.5 | 5.3500 | 2.6400 |
| 13 | 23.51 | 12.00 | 65 | 3.5 | 1.3375 | 0.6600 |
| 14 | 23.51 | 10.00 | 60 | 4.0 | 2.6750 | 1.3200 |
| 15 | 23.51 | 8.00 | 75 | 2.5 | 4.0125 | 1.9800 |
| 16 | 23.51 | 6.00 | 70 | 3.0 | 5.3500 | 2.6400 |

Notes: (a) The dicyandiamide content of each polymer was 8.40 g; (b) Group 1 used ammonium chloride as the modifier, while Group 2 used ammonium sulfate.

**Table S4.** Absorbency and turbidity of water treated by different polymers without modifiers

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Types of polymer | | Acid blue 47 | | Acid orange 10 | | Reactive red 13 | |
| Absorbency | Turbidity（NTU） | Absorbency | Turbidity（NTU） | Absorbency | Turbidity（NTU） |
| The raw water | | 0.115 | 0.67 | 0.130 | 0.57 | 0.060 | 0.90 |
| UFP | 0.112 | 0.32 | 0.128 | 0.31 | 0.059 | 0.76 |
| MFP | 0.104 | 1.18 | 0.120 | 0.51 | 0.058 | 1.20 |
| DFP | 0.102 | 0.96 | 0.124 | 0.43 | 0.056 | 1.05 |



**Fig. S1** Effect of pH on decolorization and turbidity removal for the three kinds of dyes. (a) MMFP-C16, (b) MDFP-C9, and (c) MDFP-S6. Dye initial concentration: 5 mg/L; the dosage of decolorizer: 0.1 mL/L; the dosage of PAC: 10 mg/L; measured wavelengths: λblue = 638 nm, λorange = 485 nm, λred = 540 nm.