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Preparation, characterization and antibacterial activity of a novel chitosan polymer dye

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As we all know, chitosan which is one of the most abundant natural amino polysaccharide has many special properties, such as biodegradability, nontoxicity, renewability and antibacteriality and so on. However, its low solubility in water restricts the application in wood, food and other industries. To improve the water solubility of chitosan, the carboxymethyl group was introduced. Acid red GR is commonly used in wood dyeing for its bright colors and easily penetrating in wood fiber. However, the small dye molecules run off easily from wood which is love by bacterial. Hence, a newly synthesized biopolymer dye with acid dye and anti-bacterial chitosan would have a huge market and broad prospects in wood industry for special situation like hospital, etc. Therefore, a new and novel antimicrobial biopolymer dye was synthesized by reaction of o-carboxymethyl chitosan and acid red GR. The synthesized products were characterized by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Thermogravimetric (TGA), solubility test and antimicrobial test. Results show that the antimicrobial biopolymer dye was combined by NH3+ of chitosan and sulfonic group of acid red GR under acidic conditions. Water solubility of chitosan biopolymer dye was increased. Moreover, the antibacterial property of the new synthesized dye was excellent, whose antibacterial rates of S. aureus and *E. coil* were both bigger than 99%. These results may provide new perspectives on improving the decorative properties and antimicrobial properties in wood industry.

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Evaluation of a modified TiO_2 (GO–B–TiO_2) photo catalyst for degradation of 4-nitrophenol in petrochemical wastewater by response surface methodology based on the central composite design

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In this study, a novel boron–graphene oxide–TiO_2 (B–GO–TiO_2) was synthesized by sol–gel method. The structure and properties of nano particles were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier transform infrared (FT-IR) spectroscopy. The analysis of the process was performed by varying four significant independent variables, including four numerical factors (concentration of 4-NP, dosage of photo catalyst, initial pH and reaction time). The experiments were conducted based on a central composite design (CCD) and analyzed using response surface methodology (RSM). The photo catalytic activity of samples was monitored by UV–vis absorption measurements and chemical oxygen demand (COD) test. The results showed that degradation of 4-NP in acidic pH is more favored than in neutral and basic pH. The modified modes reduced recombination of photo generated electron and holes, and extended the absorption of TiO_2 into the visible light. The photo catalytic properties of B–GO–TiO_2 is more effective than those of pure TiO_2 and other modified TiO_2. The removal efficiency of 4-NP for B–GO–TiO_2, B–TiO_2 and GO–TiO_2 was about 100, 85 and 80%, respectively, and also removal efficiency of COD was about 85, 70 and 65%, respectively, under visible light irradiation and optimum condition (4-NP concentration=25 mg/l, concentration of photo catalyst = 1 g/l, amounts of COD= 300 mg/l and pH of 3 after 180 min).

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