

Electrochemical degradation of *Reactive Black 5* using PbO_2 and graphite carbon nitride modified steel electrodes

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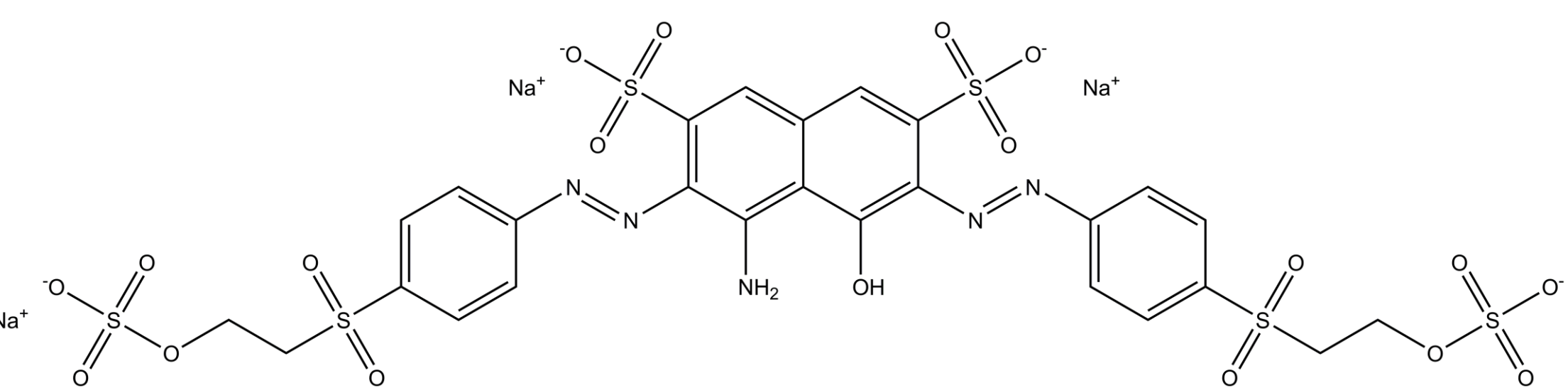


Fig. 1. Reactive Black 5

Electrodes modified by PbO_2 and graphite carbon nitride (GCN) composite were used for electrochemical degradation of *Reactive Black 5* textile dye (fig. 1).

Modified steel electrodes were used as the anode, while a pure steel electrode was used as the cathode. The influence of the structure PbO_2 on electrocatalytic properties of the electrodes was investigated.

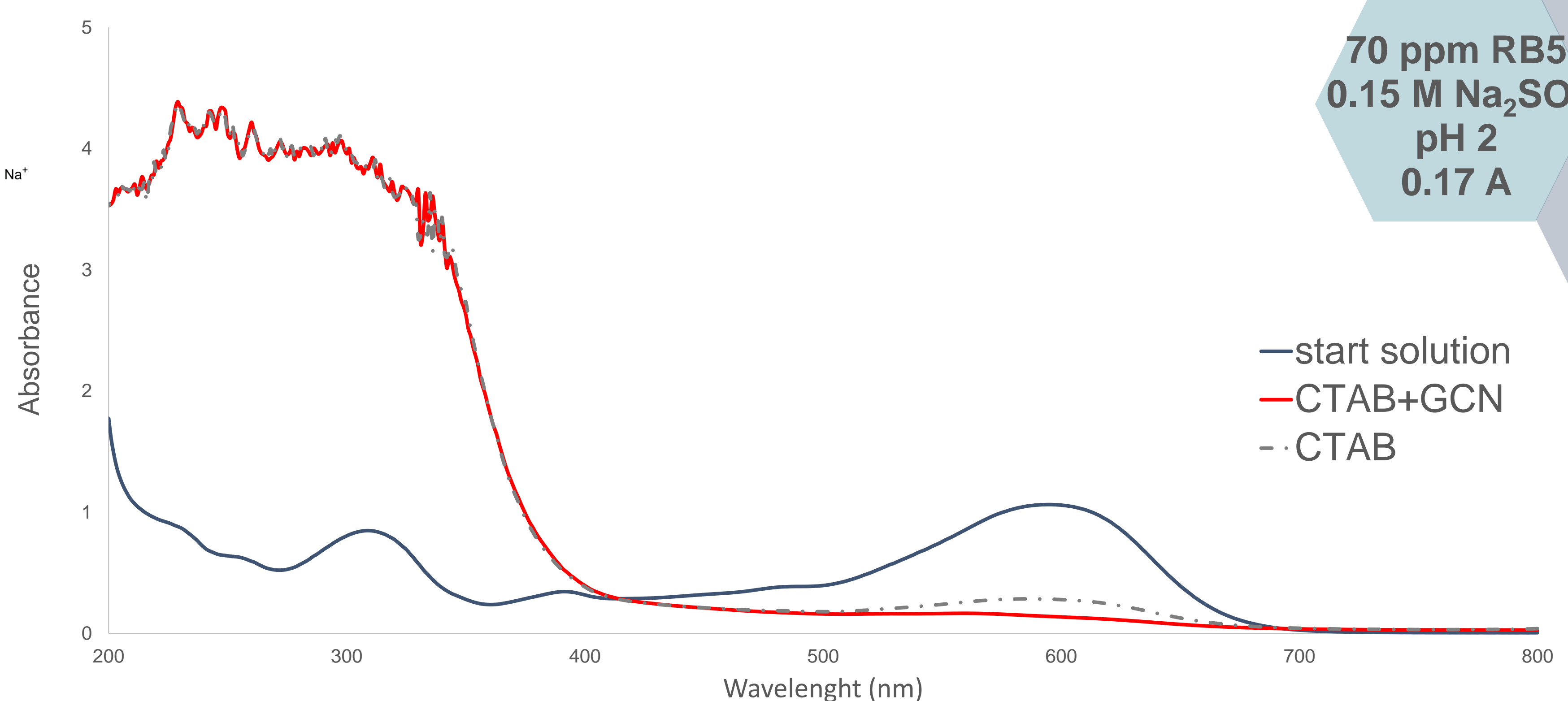


Fig. 3. UV-Vis spectrum of Reactive Black 5 solution degraded using two templates (CTAB and CTAB-GCN) for PbO_2 synthesis

METHODS

Cetyltrimethylammonium bromide (CTAB), with and without graphite carbon nitride (GCN), was used as a template for the synthesis of PbO_2 nanoparticles, which resulted in two PbO_2 modified steel electrodes.

The morphology of materials was examined by SEM and TEM, while its electrochemical properties were analyzed by means of CV and EIS measurements.

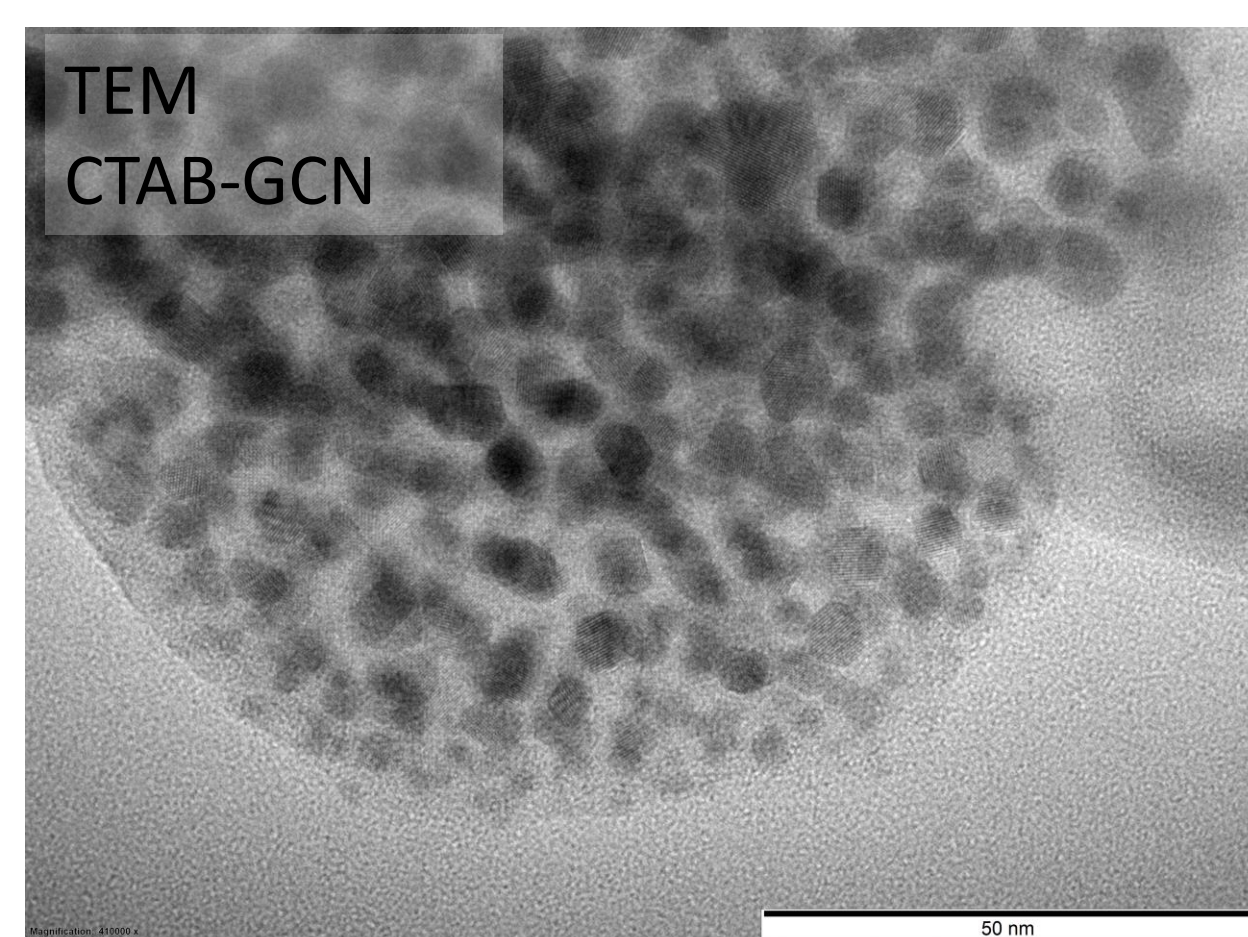
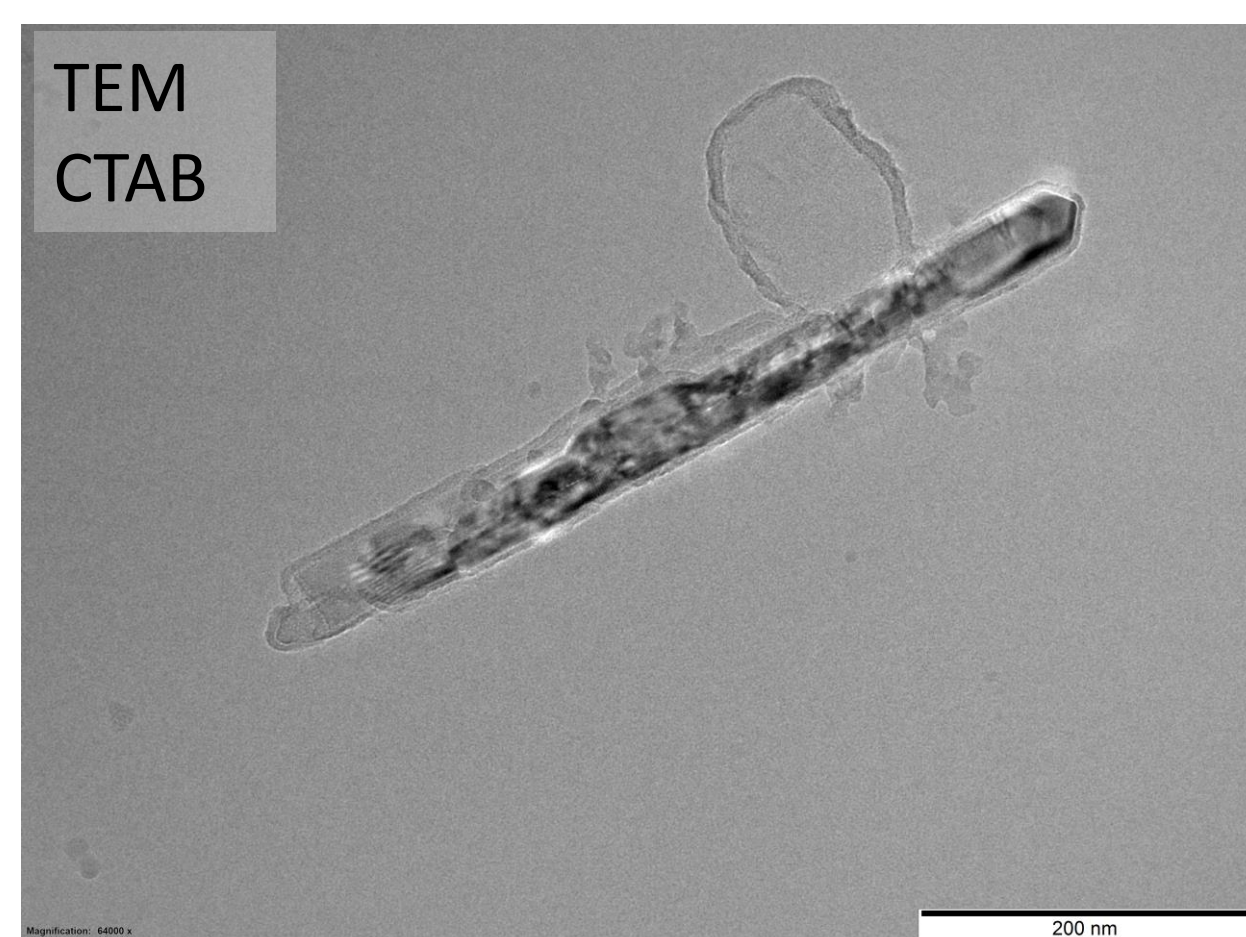
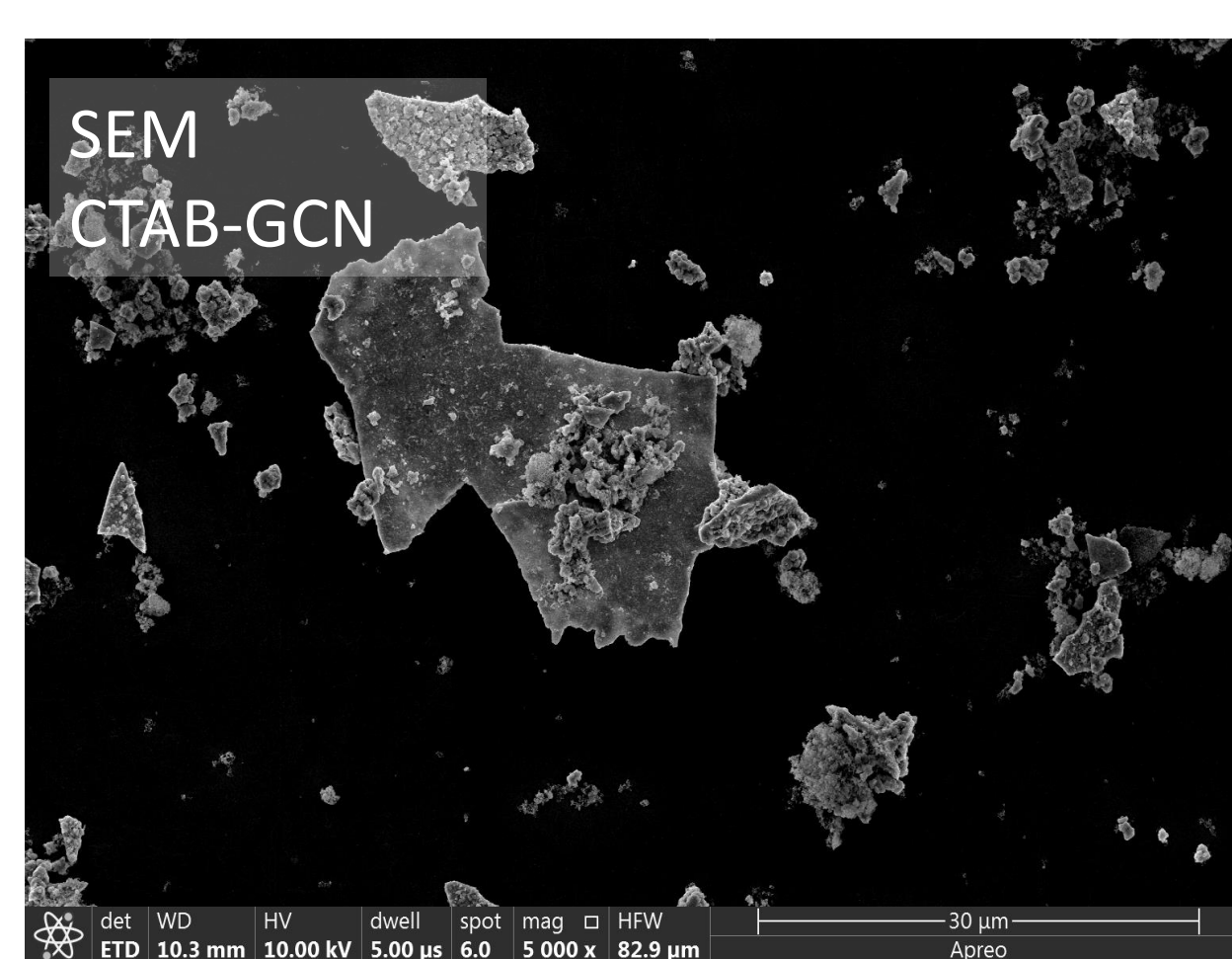
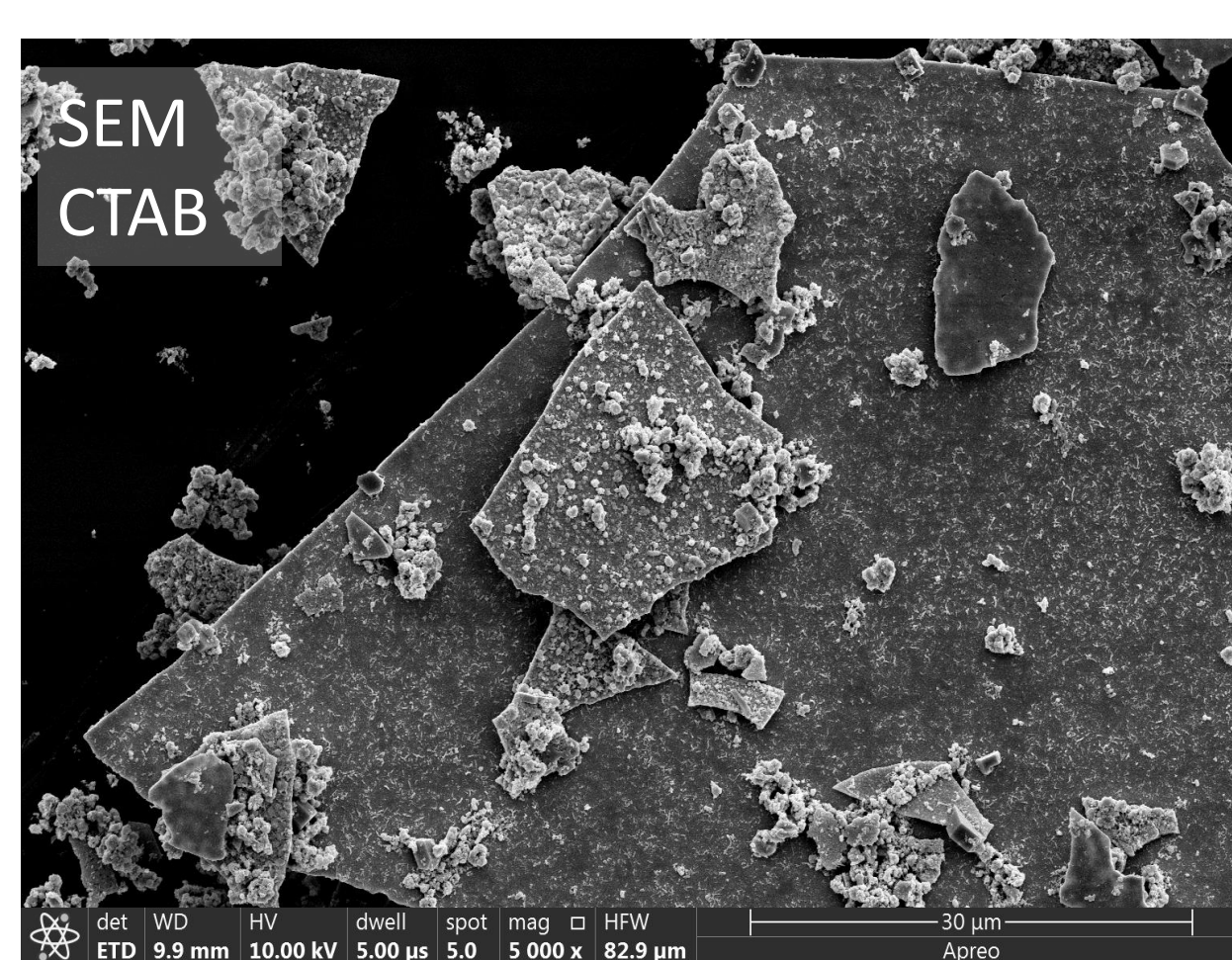


Fig. 2. Materials under SEM and TEM – CTAB with and without GCN for PbO_2 template-based synthesis

RESULTS

Different morphologies of PbO_2 synthesized using two templates (CTAB and CTAB-GCN) was confirmed by SEM and TEM (fig. 2).

pH, the concentration of Na_2SO_4 supporting electrolyte, current (fig. 4) and the template content were varied (fig. 3) during the treatment to find optimal conditions.

DISCUSSION

Optimized parameters were found to be: pH 2, 0.15 M Na_2SO_4 , and 0.17 A (fig. 4).

The CTAB template-synthesized PbO_2 on GCN composite gave smaller nanoparticles which resulted in a more effective decolorization of *Reactive Black 5* (almost 90% compared to over 70% when only CTAB was used as a template, fig. 3).

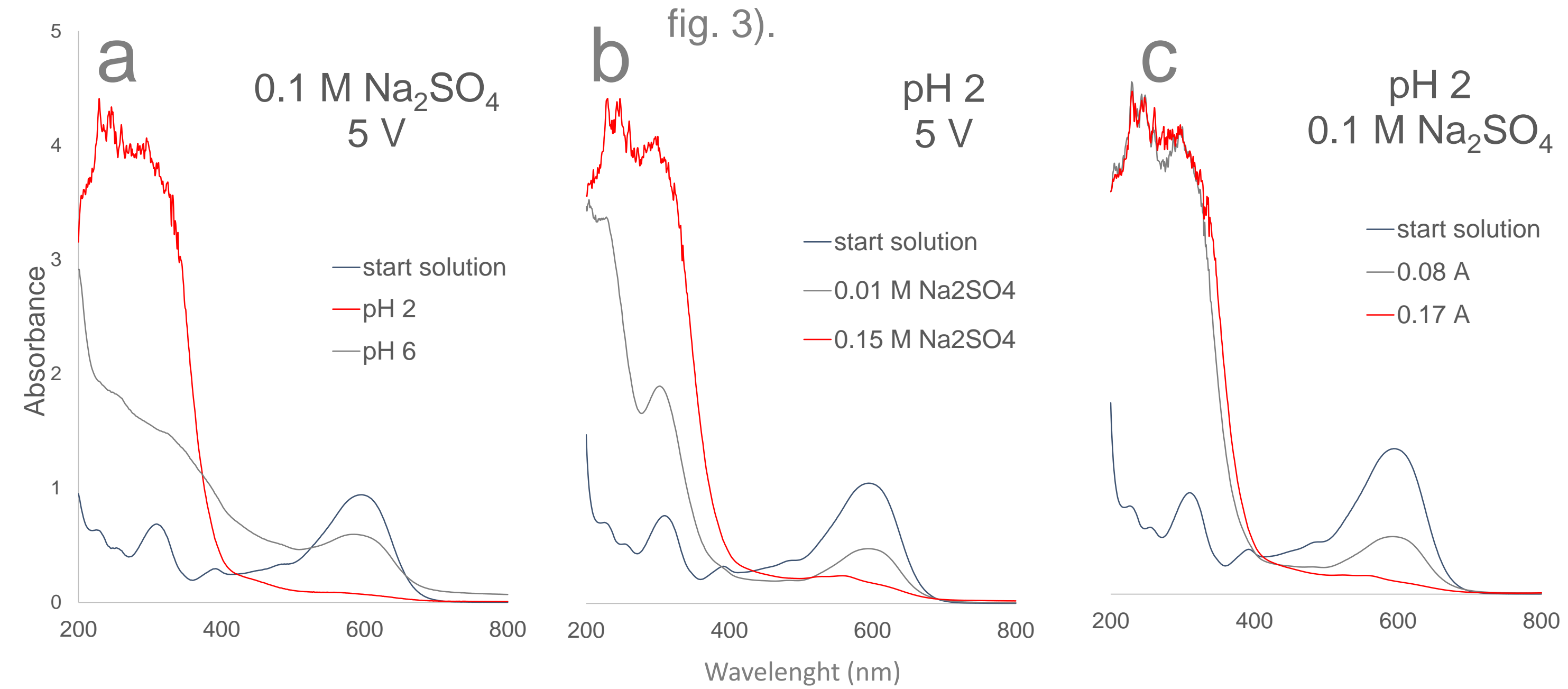


Fig. 4. UV-Vis spectra of Reactive Black 5 (70 ppm) in different pH environments (a), concentrations of the supporting electrolyte (b), and current strength (c), with the rest of parameters kept constant

CONCLUSION

Steel electrodes modified by PbO_2 nanoparticles and graphite carbon nitride (GCN) composite have led to successful electrochemical degradation of *Reactive Black 5* textile dye (90% decolorization after 60 minutes of treatment), with optimized values of pH, supporting electrolyte concentration and current strength.