SUPPLEMENTAL MATERIAL

Decolorization of Organic Dyes by Gold Nanoflowers Prepared on Reduced Graphene Oxide by Tea Polyphenols

M. Šimšíková[1]✉, M. Bartoš[1,2], J. Čechal[2], T. Šikola[1,2]

[1] CEITEC BUT, Brno University of Technology, Technická 10, 616 69 Brno, Czech Republic

[2] Institute of Physical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic

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1. Degradation of dyes by rGO – UV-Vis measurements
2. Degradation of dyes by $NaBH_4$ in the presence of rGO - UV-Vis measurements
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4. Degradation of dyes by $NaBH_4$ without catalyst – PL measurements
5. Degradation of dyes by rGO-AuNFs – UV-Vis measurements

✉ Dr. Michaela Šimšíková, CEITEC BUT, Brno University of Technology, Technická 10, 616 69 Brno, Czech Republic
E-mail: michaela.simsikova@ceitec.vutbr.cz, Telephone number: +420 54114 2810

1. Degradation of dyes by rGO – UV-Vis measurements. There was almost no degradation of the absorbance intensities of safranin T and congo red in the presence of rGO as a catalyst. Only 8.12 % of safranin T and 8.13 % of congo red was decolorized at the time when the whole appropriate dye was degradated by $NaBH_4$ in the presence of rGO-AuNFs. The rate of eosin reduction upon the addition of rGO was very slow and took 57 min for the complete degradation.

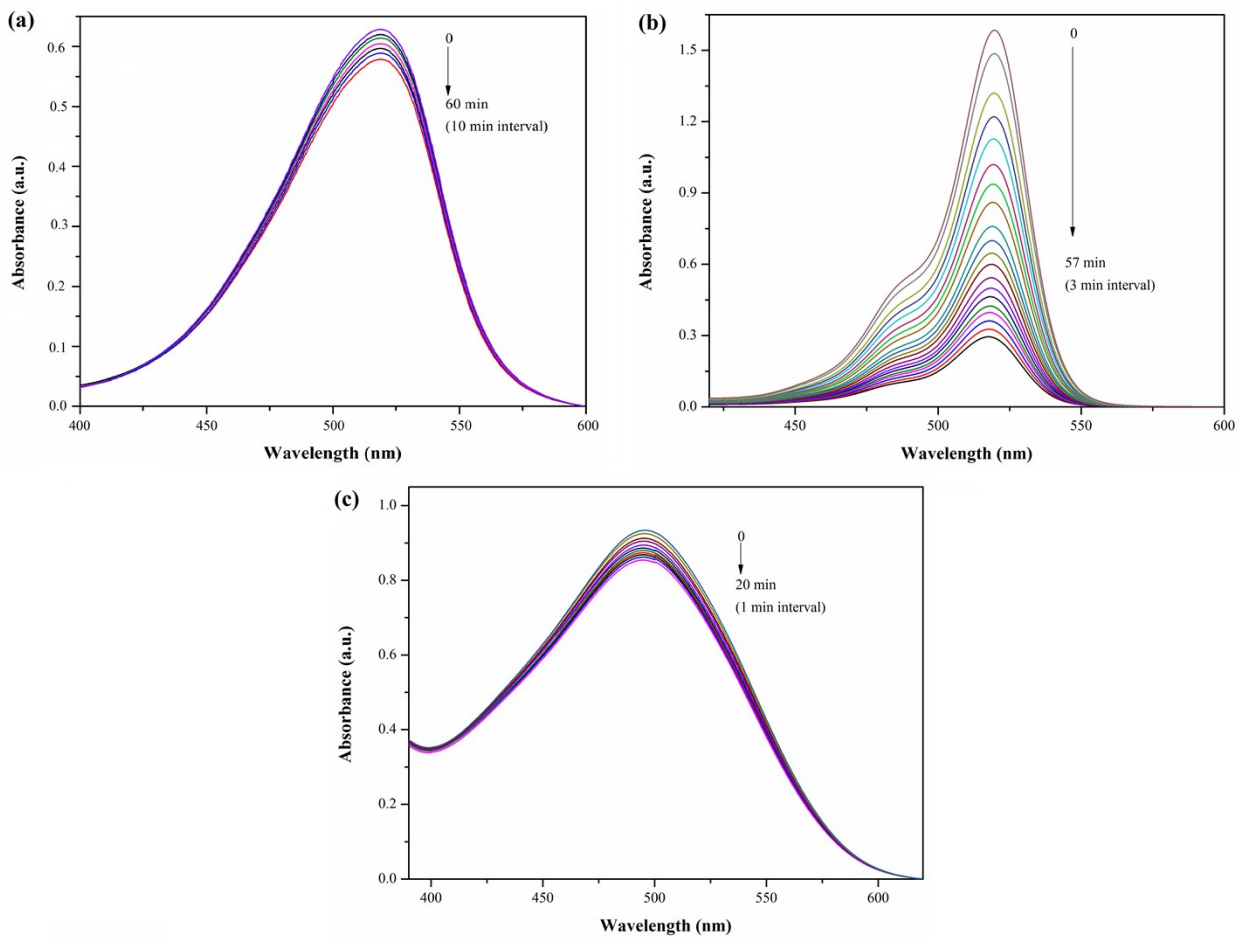

Figure S1 UV-Vis absorption spectra of decolorization of safranin T (**a**), eosin Y (**b**), and congo red (**c**) in the presence of rGO.

2. **Degradation of dyes by rGO in the presence of $NaBH_4$ – UV-Vis measurements.** The absorption spectra of safranin T were changed very little upon the addition of rGO and $NaBH_4$. The absorption intensity of dye was decreased by about 10.2% in the 60 min. Eosin Y was successfully decolorized in the presence of reductant and rGO as a catalyst. The whole process was completed in approximately 51 min. The intensity of congo red decreased approximately 12.2% in 20 min.

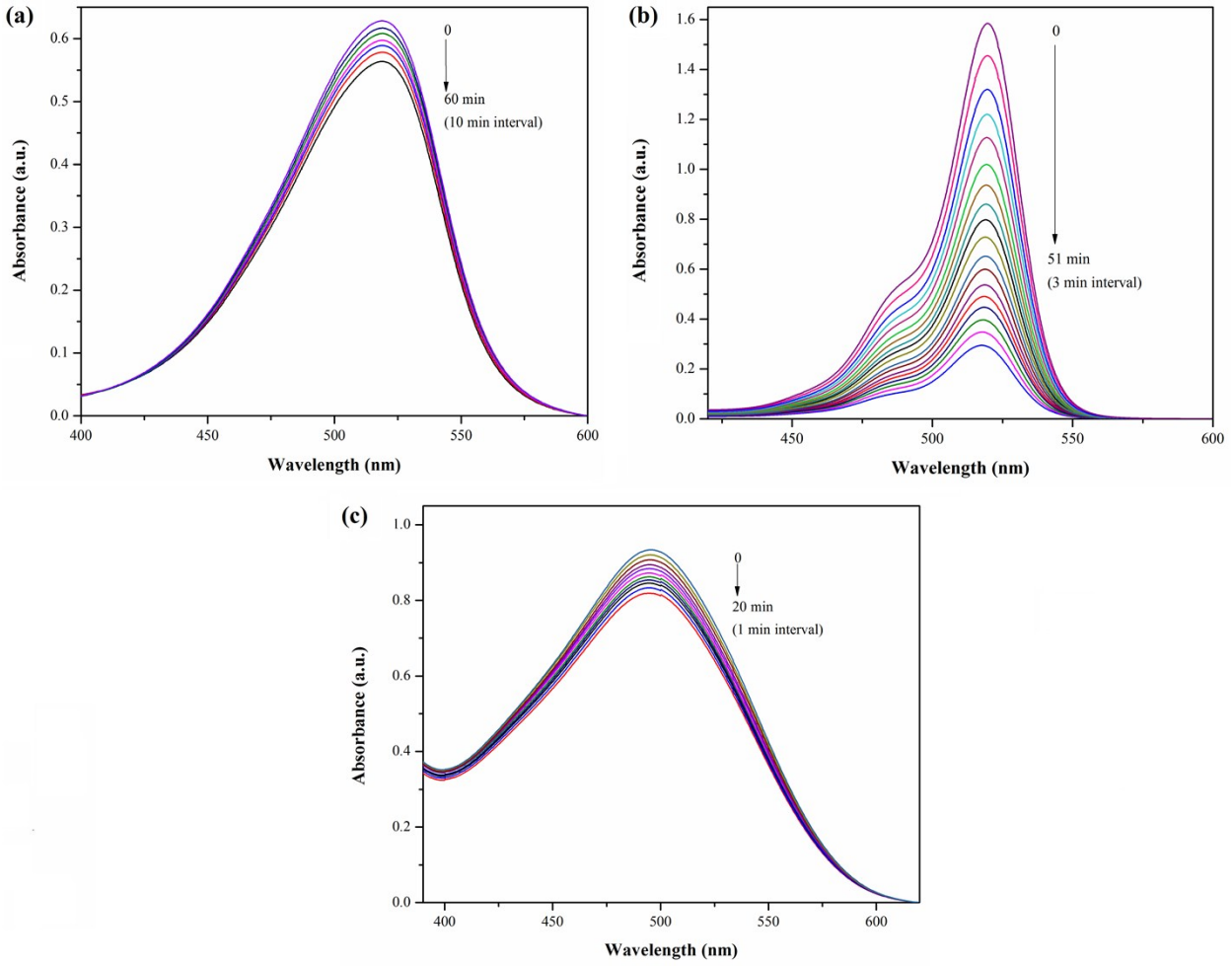

Figure S2 UV-Vis absorption spectra of the borohydride reduction of safranin T (**a**), eosin Y (**b**), and congo red (**c**) in the presence of rGO.

3. Degradation of dyes by $NaBH_4$ without catalyst – UV-Vis measurements. In the absence of catalyst, almost no degradation of safranin T took place which can be attributed to the extremely slow rate of reduction due to the large kinetic barrier. A similar progress of reaction was observed with congo red where only 1.2 % of dye was degraded after 21 min in the presence of borohydride. The rate of eosin reduction without catalyst was very slow and took 63 min for the complete degradation.

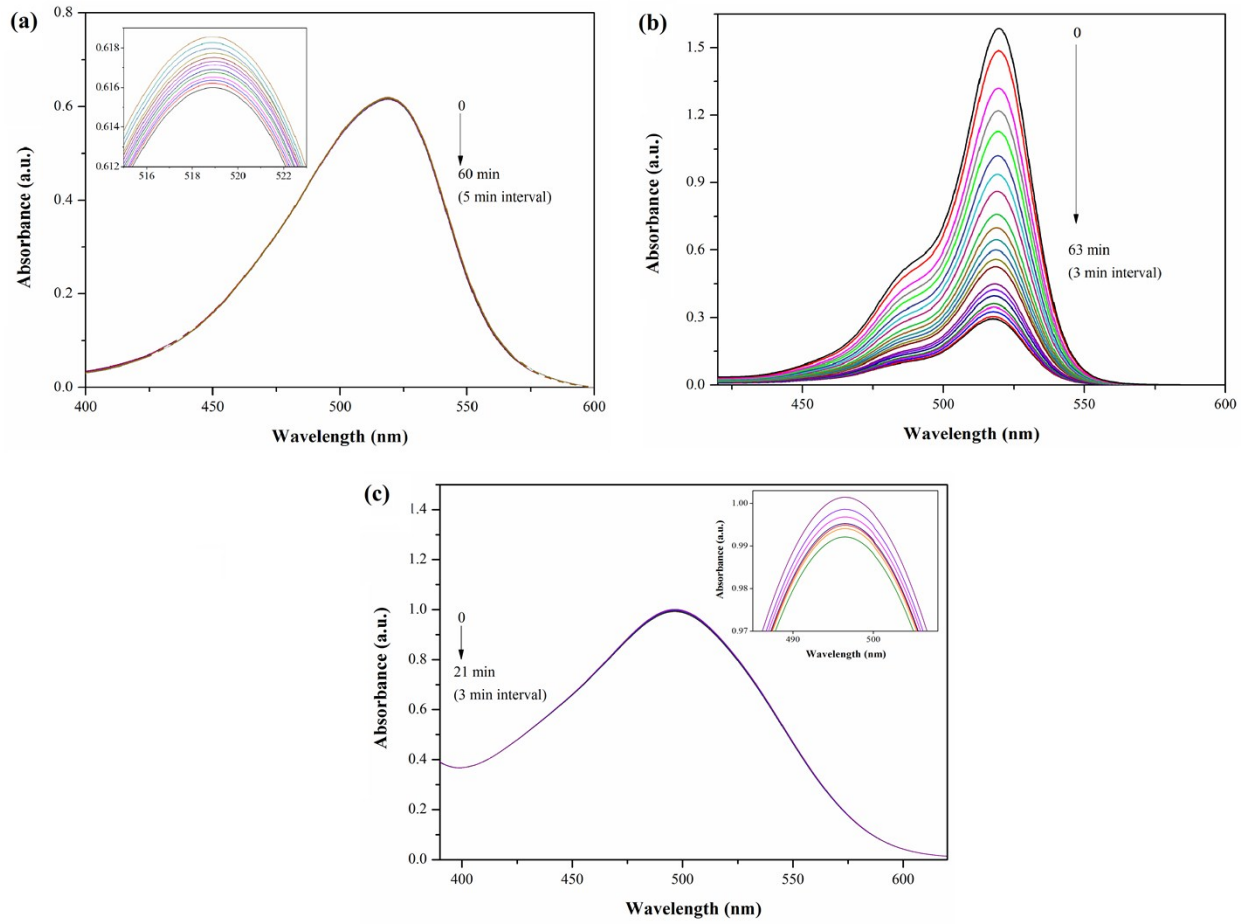

Figure S3 UV-Vis absorption spectra of the borohydride reduction of safranin T (**a**), eosin Y (**b**), and congo red (**c**).

4. Degradation of dyes by $NaBH_4$ – PL measurements. Almost no decolorization of safranin T and congo red by $NaBH_4$ was observed without the addition of a catalyst. On the contrary, the emission maximum of eosin Y at 613 nm was gradually blue shifted upon the time. The limit peak position (~553 nm) which was obtained after the exposition of a catalyst (Figure 4b) was not observed until 2 hours later.

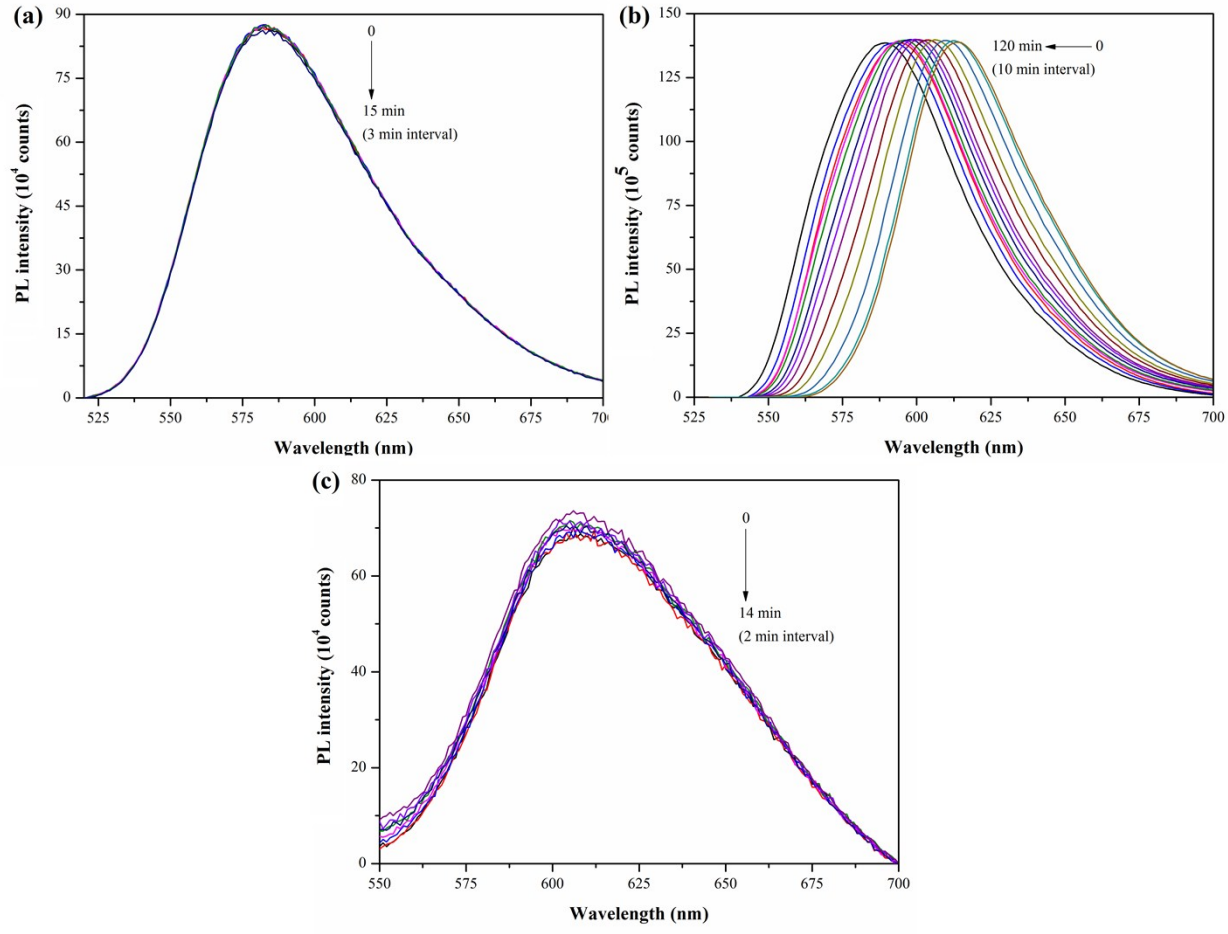

Figure S4 Fluorescence emission spectra of the borohydride reduction of safranin T (**a**), eosin Y (**b**), and congo red (**c**).

5. Degradation of dyes by rGO-AuNFs – UV-Vis measurements. Fig. S5 shows the change in the absorption spectra of dyes in the presence of rGO-AuNFs as a catalyst. There was almost no decrease in the absorption intensity of safranin T and congo red due to decolorization in 60 minutes and 20 minutes, respectively. The rate of eosin reduction in the presence of rGO was very slow and took 51 min for the complete degradation.

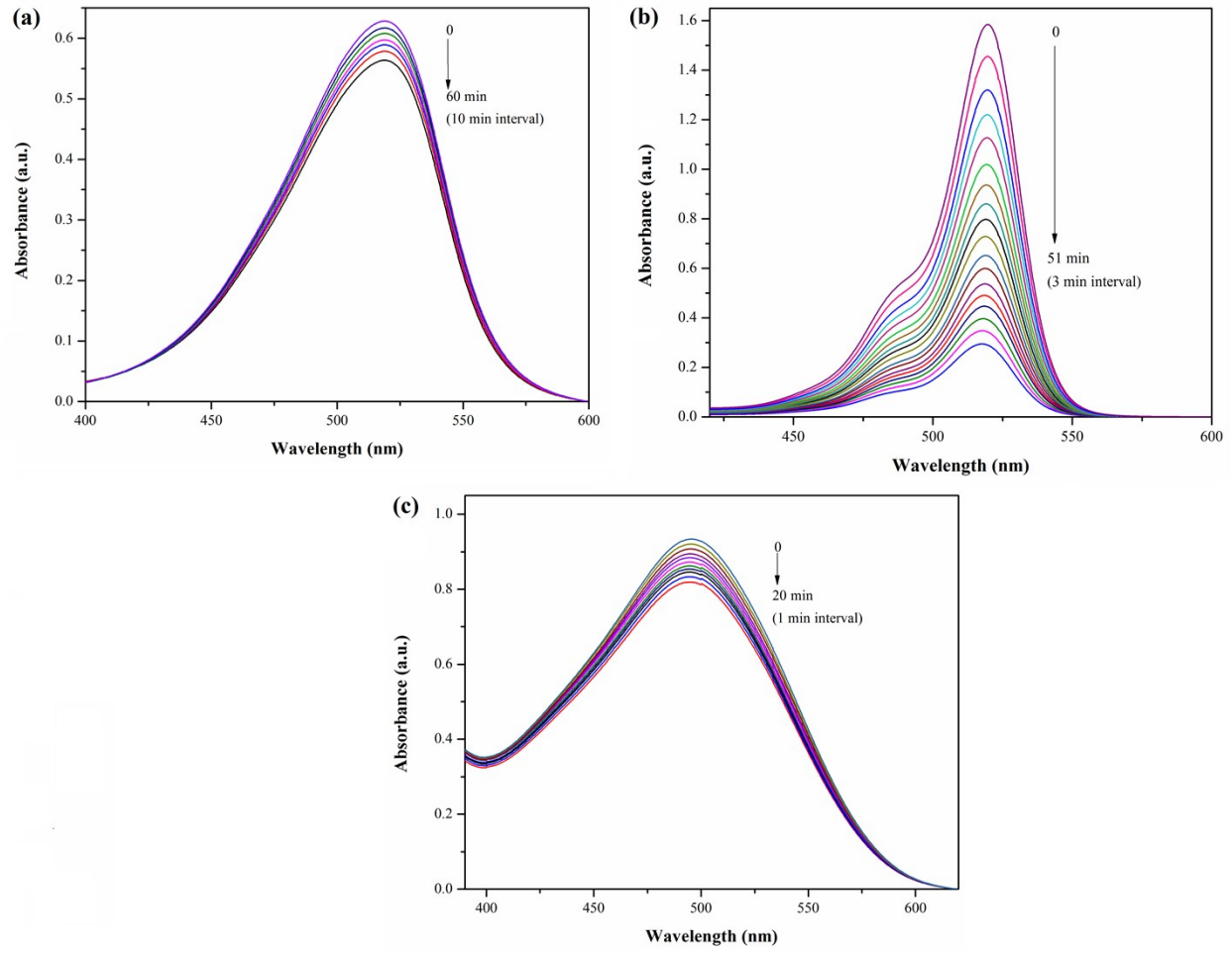

Figure S5 UV-Vis absorption spectra of decolorization of safranin T (**a**), eosin Y (**b**), and congo red (**c**) in the presence of rGO-AuNFs.