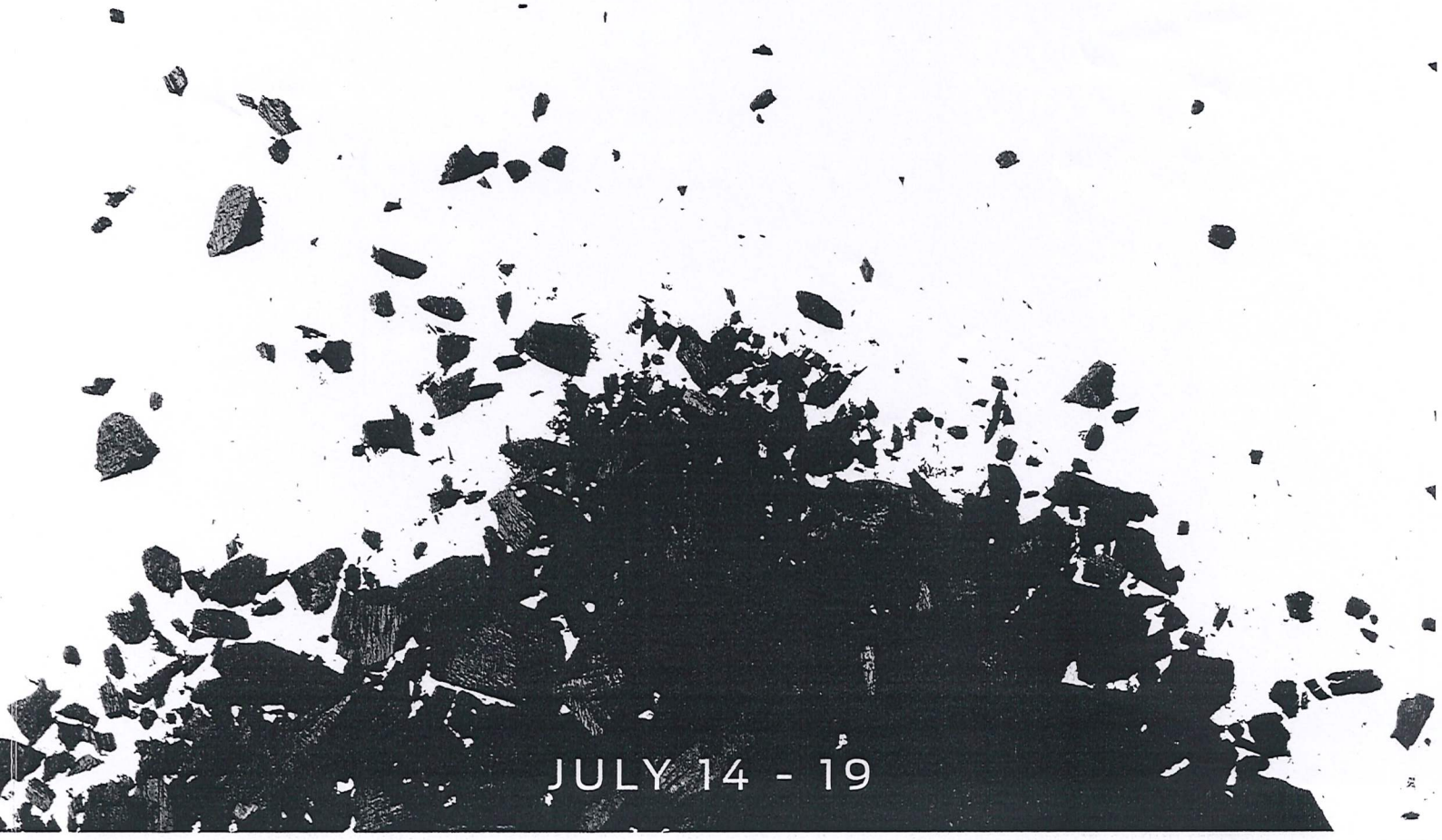
PROGRAM SCHEDULE

CARBON 2019

LEXINGTON, KY



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CARBON-CONTAINING Cu- AND Mo- BASED PHOTOCATALYTSTS FOR THE YELLOW 5 PHOTODEGRADATION

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Introduction

Heterogeneous photocatalysis has been recognized as one of the most promising sustainable technology capable of mitigating water pollution by eliminating organic pollutants under solar irradiation. It has been reported TiO_2 is the best photocatalyst, but it has important limitations such as low superficial area and it is limited under solar irradiation because the solar spectrum contains approximately 5-8% of UV light [1]. Consequently, the search for photocatalysts with visible light activity and low-cost becomes a widely researched subject. On the other hand, it has been reported that Cu- and Mo- based photocatalysts have a high photocatalytic potential [2,3], while carbon materials can greatly increase the photocatalytic activity of semiconductors [1]. For this reason, this work proposes the use of solar light and carbon-containing Cu-and Mo-based photocatalysts for the degradation of tartrazine (*aka*. yellow 5), an artificial colorant commonly used in the food industry.

Materials and Methods

The photocatalysts were prepared using the solvothermal method in a two-step procedure. In the first step, the raw samples were synthesized from furfural, copper acetylacetonate and ammonium heptamolybdate. The samples were denominated Cu4, Mo4 and Cu4Mo4. In the second step, a thermal treatment (e.g., calcination at 350°C and 550°C for 2 hours, and pyrolysis at 800°C for 2 hours under N_2 flux of 100 mL/min, 10°C/min) were carried out. The calcined samples were labelled: Cu4-350-O2, Cu4-550-O2, Mo4-350-O2, Mo4-550-O2, Cu4Mo4-350-O2, Cu4Mo4-550-O2, while those pyrolyzed were labelled as Cu4-800-N2, Mo4-800-N2, and Cu4Mo4-800-N2.

The photocatalytic tests were performed at 25°C under stirring using 31.5 mg of photocatalysts in 125 mL of dye (Y5) with an initial concentration of 5 ppm (9.36 μmol/L). The kinetic study was carried out keeping the solution of Y5 during in darkness until equilibrium was achieved. After this, the solution was exposed to irradiation with a xenon lamp during 6 hours. A Lambda 365 Perkin Elmer UV-visible spectrophotometer was used to follow the concentration of the dye. The characterization of the photocatalysts was performed by gas adsorption and diffuse reflectance UV-vis spectra.

Results and Discussion

Figure 1a shows the uptake of the dye in the studied catalysts; as seen, Y5 is mainly absorbed on the pyrolyzed Cu-containing photocatalysts. It seems that the calcination -thus removal of carbon from the catalyst- is responsible of a remarkable loss of adsorption sites in the samples. On the other hand, it can be noted from Fig. 1b that after 6 h irradiation, the pyrolyzed sample is the most active photocatalyst of the Cu-series, with a 40% conversion of Y5. The Mo-based and bimetallic CuMo-based catalysts showed lower photocatalytic activity, as well as lixiviation along the reaction.

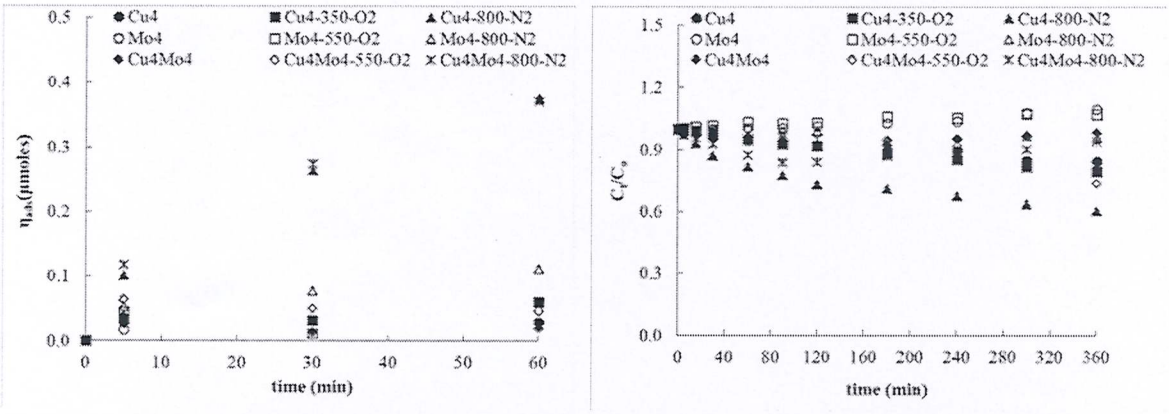

Figure 1. Yellow 5 (a) adsorption in the dark, and (b) photodegradation kinetics under the studied photocatalysts.

Conclusions

Carbon containing Cu- and Mo-based catalysts with varied photocatalytic activity for the degradation of Y5 were prepared. The Cu-based catalysts showed up to 40% conversion of Y5 even at low loadings, while the Mo-based ones displayed lower activity (ca. 10-20%) and presented an important lixiviation. The bimetallic Cu-Mo catalyst showed the activity of the copper, but suffered from an important lixiviation as the Mo-material. On the other hand, the catalysts with the lowest carbon content displayed a poor catalytic activity, indicating the beneficial role of the carbon matrix for the degradation of the dye.

Acknowledgment

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