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Support Information

Adsorption of Quinoline from Liquid Hydrocarbons on Graphite Oxide and Activated Carbons

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S.1. Experimental Section

S.1.1. Elemental analysis

Elemental analysis (EA) of all of the samples was conducted using a Vario EL-III Elemental Analyzer.

S.1.2. Textural Properties of the Adsorbents

The textural properties of the carbon materials were determined via the nitrogen adsorption/desorption technique at 77 K using the ASAP 2020 surface area and porosimetry analyzer. The pore size distribution was calculated according to the density functional theory (DFT) method.

S.1.3. X-ray photoelectron spectroscopy

X-ray photoelectron spectroscopy (XPS) data were collected using a Kratos Axis Ultradld using a monochromated AlKα (1486.7 eV) source with a 40 eV pass energy. The typical pressure during analysis was 2×10^{-9} Torr. The samples were typically kept under vacuum at 60°C for several hours prior to characterization. An electron gun was used for charge compensation. The energy scale was 279−298 eV. Before recording, GO was dried in a vacuum oven at 80 °C overnight. The other samples were dried at 120 °C overnight to remove the adsorbed water.

S.2. Results and Discussion

S.2.1. Elemental analysis

The total oxygen concentrations determined for the AC, OAC, GF and GO samples are summarized in Table S1. The total oxygen concentrations of AC and GF increased significantly after oxidation. The total oxygen concentration of GO is higher than that of OAC. The total oxygen content calculated using EA were overestimated due to the physically adsorbed water. The oxygen functional groups introduced by oxidation for both AC and GO make them highly hydrophilic. It is difficult to remove the physical adsorbed water especially for GO, due to its unstability. The oxygen groups can be slowly decompose above 60-80 ℃.[1] The physically adsorbed water can be clearly seen in the TPD results (Figure 3(b)).

Table S1. The total oxygen concentrations of AC, OAC,GF and GO calculated using EA.

Sample	C(wt%)	H(wt%)	N(wt%)	O*(wt%)
AC	91.9	0.0	0.0	8.1
OAC	66.3	1.5	0.0	32.2
GF	98.6	0.0	0.0	1.4

GO	45.1	2.3	1.4	51.2

*Oxygen contents are calculated by the differences.

S.2.2. Textural Properties of the Adsorbents

The Pore size distributions of adsorbents are shown in Figure S1.

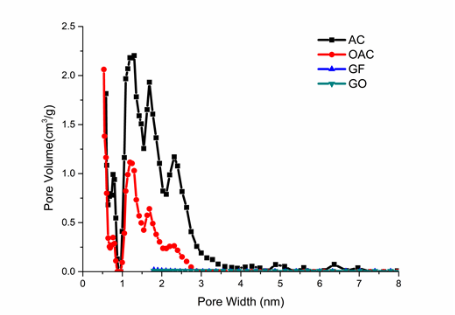

Figure S1. Pore size distributions of AC, OAC, GF, and GO.

S.2.3 XPS analysis

In order to confirm the oxygen groups on these samples, especially for GO, the XPS analysis was also used to evaluate the oxygen-containing groups on the oxidized samples. The C1s XPS spectrum of OAC and GO are presented in Figure S2. For activated carbon, we assign the peak at 284.7 to sp2 carbon, 286.2 to C-OH or C-O-C, 287.1 to C=O, 288.9 to O-C=O.[2] In the case to GO, typically, the C1s region can be fitted into following four curves.[3] The binding energies at 284.7, 286.7, 287.8, and 288.9 eV are assigned to sp2 carbon, C-OH, C=O and O-C=O, respectively. The high chemical shifts might be due to the different structure. The distribution of different O-groups introduced by oxidation on OAC is relatively uniform. The main oxygen group on GO is C-OH groups, which compromised 40% of the total groups. This results is in agreement with previous work.

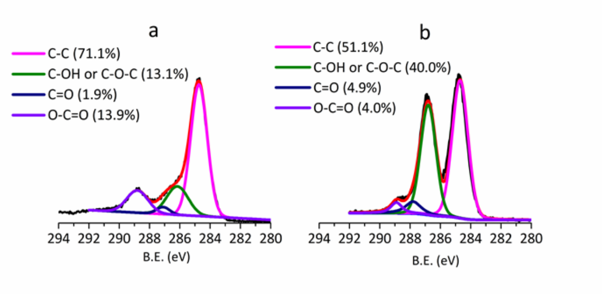

Figure S2. XPS data of (a) OAC, (b) GO.

Table S2. Oxygen contents based on the EA, XPS and TPD-MS.

Oxygen contents (w%)	EA(w%)	XPS(w%)	TPD-MS(w%)
AC	8.1	-	4.7
OAC	32.2	26.9	28.8

GF	1.4	-	0.5
GO	51.2	33.5	45.9

The total oxygen contents of GO and OAC derived using the different methods (EA, XPS and TPD-MS) are listed in Table S2 for comparison. The total oxygen content calculated using TPD-MS is slightly lower than that calculated using EA because the oxygen content calculated using the EA may include that the oxygen in the remaining physically adsorbed water. The three analytical methods clearly show that the oxygen content in GO is considerably higher than that in OAC, which might be due to the different structure of GF and AC. The graphite has the regular layer structure with weak vander Waals forces, which make it easier for the oxidation agent penetrating into the galley spaces for deep oxidation.[4] In contrast, the amorphous structure of AC along with developed microporous structure may show steric hindrance for the oxidation process.

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