Supporting Information

Effect of the Asphaltene Oxidation Process on the Formation of Emulsions of Water in Oil (W/O) Model Solutions

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S1. Thermogravimetric Analysis

Figure S1 shows the temperature at which there is a greater loss of mass under oxidative and inert atmospheres, which is reflected in the highest peak of the rate of mass loss [1-3]. At around 740 K there is a 50% loss of mass. Temperatures selected were 298, 373 and 473 K.

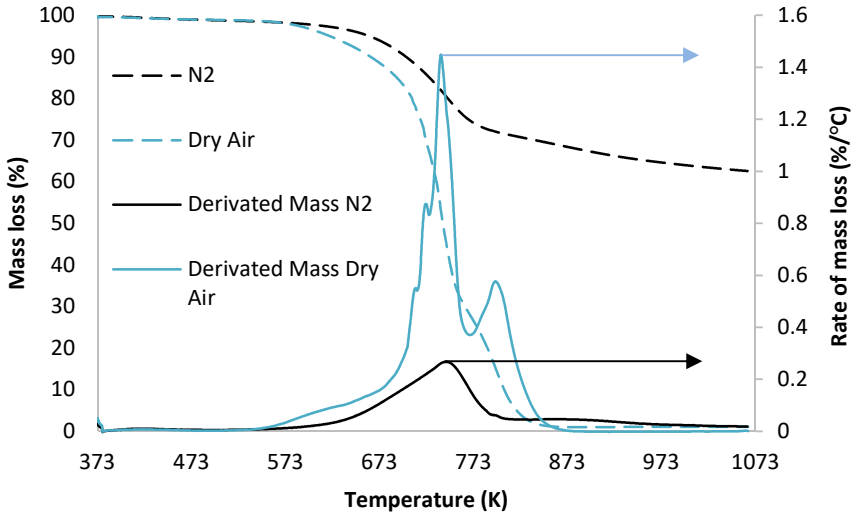

Figure S1. Thermogravimetric analysis of asphaltene decomposition under oxidative and inert atmospheres.

S2. FTIR indexes for structural characterization

These areas allow the calculation of various indexes in a comparative way of the different compositions of the fractions obtained. For example, the one calculated from the

band area to 1600 cm^{-1} is denoted as A_{1600}. Brief descriptions of the calculated indexes are presented in Table S1.

The qualitative compositional indexes of the asphaltenes samples are presented in Figures S2 and S3 as a function of oxidation temperature and oxidation exposure time, respectively. There are structural changes in the asphaltenes by oxidation processes, mainly acquiring greater aromaticity due to the increase in the C_{ar}/H_{ar} ratio and branching of the aliphatic chains, where the aromatic rings increase regarding the aromatic hydrogens. Also, there is an increase of the ketone group and the reduction of sulfoxides with oxidation. A_{ar}/A_{al} index reflects a proportional ratio of aromatic nuclei and aliphatic chains to the oxidation temperature while indexes H/C and CH_2/CH_3 aliphatic chain ratio, show an inverse trend as the treatment temperature increases.

Table S1. Indexes defined transmittance bands FTIR for structural characterization of n-C7 asphaltenes [4, 5].

Index	**Equation** $\sum A = A_{1700} + A_{1600} + A_{1460} + A_{1376} + A_{1030} + A_{864} + A_{814} + A_{743} + A_{724} + A_{(2953,2923,2862)}$	**Description**
Aromaticity Index	$A_{1600} / \sum A$ (Aromatic structures)	The higher the index, the higher the aromatic structures.
***Car/Har* Index**	$A_{1750-1520} / A_{3000-2800}$	The index is associated with aromaticity. Higher index, greater is the number of aromatic carbons aliphatic hydrogens.
Aliphatic Index	$(A_{1460} + A_{1376}) / \sum A$	A higher index is higher the aliphatic structures.
Chain length Index	$A_{724} / (A_{1460} + A_{1376})$ (Aliphatic structures)	A higher index, longer is the aliphatic chains.
CH_2/CH_3 ratio	A_{2922} / A_{2952}	A higher index, longer is the aliphatic chains.
Carbonyl Index	$A_{1700} / \sum A$	The higher the index, the greater the number of carbonyl groups.
Sulfoxide Index	$\frac{A_{1030}}{\sum A}$	A lower index, the smaller the number of sulfoxides groups.
Branch of aliphatic chains Index	$\frac{A_{1375}}{A_{1452} + A_{1375}}$	The higher the index increased branching in the aliphatic chains.
A_{ar}/A_{al} ratio	$\frac{A_{900-700}}{A_{3000-2815}}$	The higher the index, the greater number of aromatic rings on aliphatic chains.

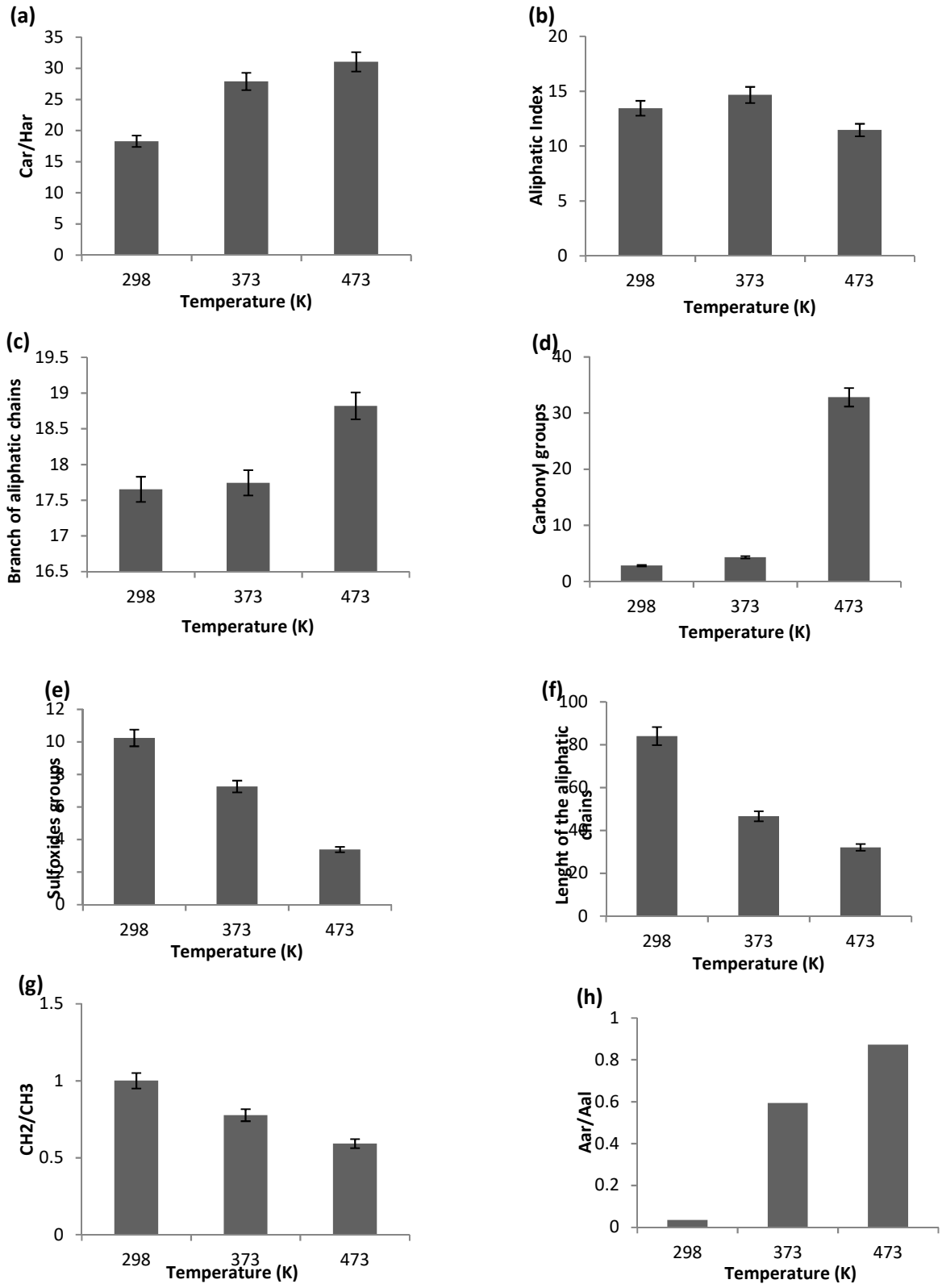

Figure S2. Qualitative compositional indexes of oxidized asphaltenes at different temperatures (Asf12, Asf12/373 and Asf12/473) from FTIR spectra: (a) Aromaticity Index, (b) Aliphatic index, (c) Branching of aliphatic chains, (d) Carbonyl groups, (e) Sulfoxide groups, (f) Length of aliphatic chains, (g) CH_2/CH_3 ratio and (h) Aar/Aal ratio.

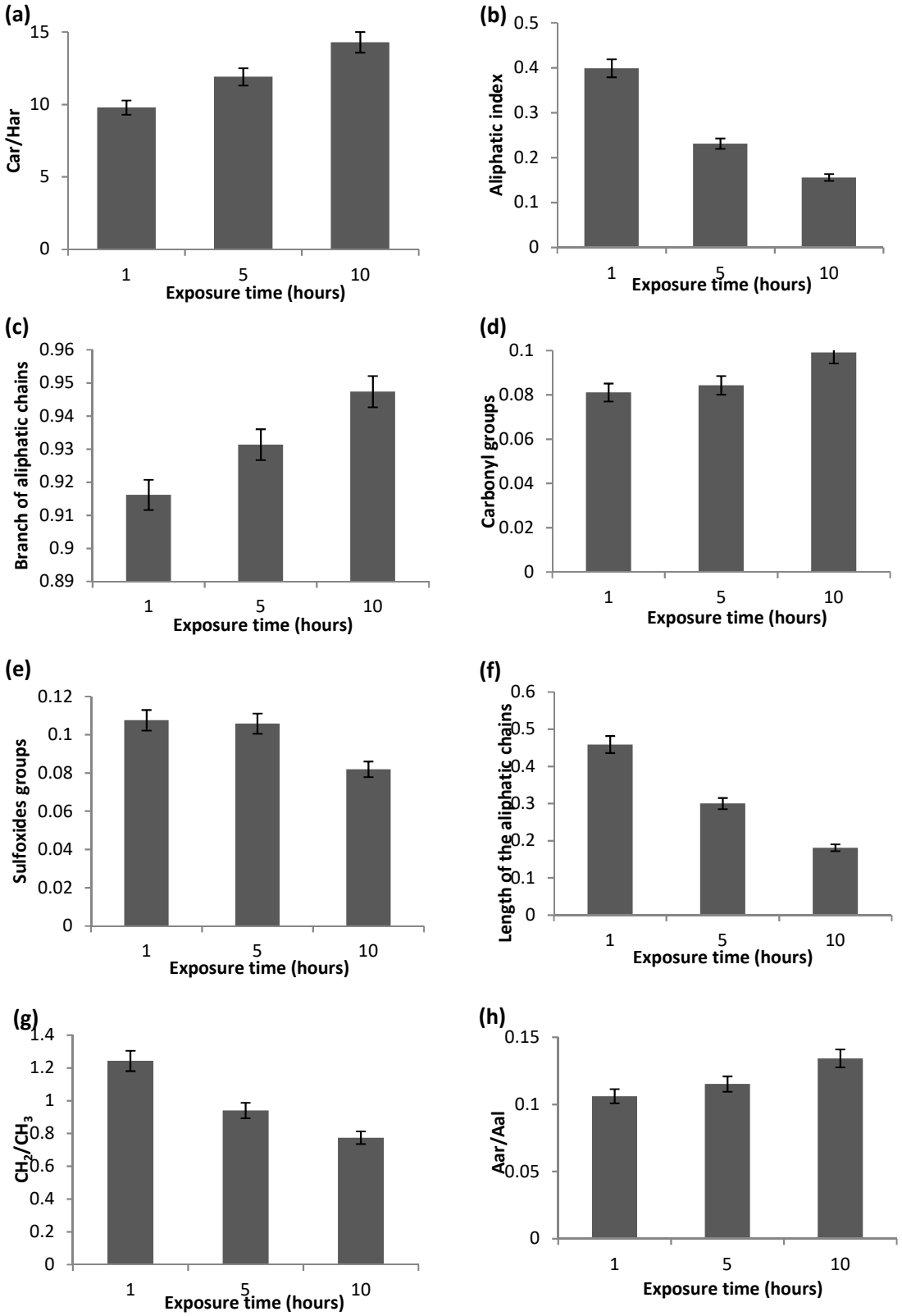

Figure S3. Qualitative structural indexes of asphaltenes (Asf12/473) oxidized at different exposure times: (a) aromaticity index, (b) aliphatic index, (c) branching of aliphatic chains, (d) Carbonyl groups, (e) Sulfoxides groups, (f) Length of aliphatic chains, (g) CH_2/CH_3 ratio and (h) Aar/Aal ratio.

References

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