EFFECT OF PENDANT DISTRIBUTION ON THE DISPERSANCY OF MALEATED EP COPOLYMERS

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1. Introduction

Why are oil-additives so important ?

Figure 1: Illustration of the detrimental effect of soot formation

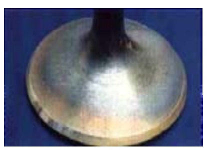
Formation of soot → Emission of carbon-rich particles → Health Hazard Global Warming

Formation of soot → **Engine Failure**

Advantages of using oil-additives:

. Improves the performance of the engine.
. Increases fuel efficiency.
. Prevents the negative impact on the environment

WITHOUT ADDITIVES



WITH ADDITIVES

Figure 2: Illustration of the advantage of using an oil additive

■ Mild dispersants are apolar polymers bearing polar pendants that stabilize colloidal particles suspended in the oil

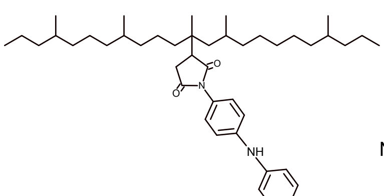


Figure 3: Chemical structure of a maleated ethylene-propylene random copolymer which has been reacted with N-phenyl-p-phenylenediamine (EP-NP_3D).

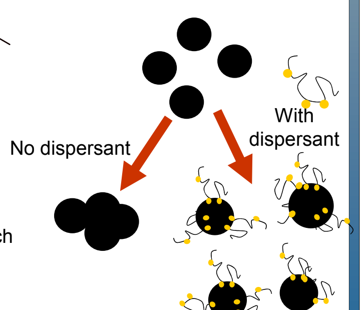


Figure 4: Steric stabilization of carbon-rich particles in oil

2. Proposal

The main goal of this project is to study the adsorption of EP-NP_3D onto carbon black particles (CBPs) in an apolar solvent by constructing Langmuir isotherms, which will be analyzed to yield both the equilibrium constant and the maximum coverage for the binding of the dispersant onto CBPs.

3. Methods and Results

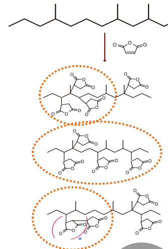


Figure 5:Chemical structures of the main products expected from a grafting reaction

a. *Infrared Spectroscopy*

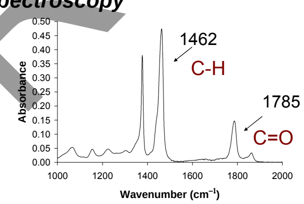


Figure 6:FT-IR spectra of a maleated EP copolymer in THF

b. UV-Vis

The level of clustering between the pyrene pendants by measuring the peak-to-valley ratio (P_A).

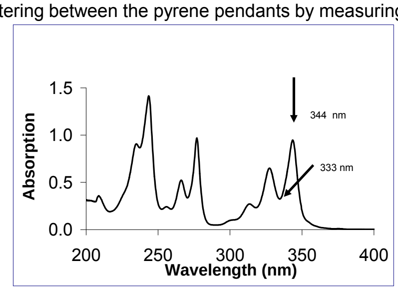


Figure 7: Spectrum of pyrene labeled EP in THF

c. *Fluorescence Spectroscopy*

$$f(t)=\sum A_{E-}e^{-t/\tau i}+\sum A_{E+}e^{-t/\tau i}$$

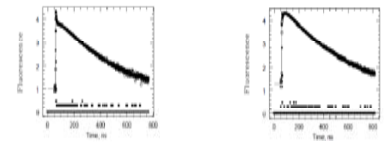


Figure 8: Pyrene excimer fluorescence decays obtained for the Py-EPM polyn in THF. λex= 344 nm , λem= 510 nm.

Table 1: P_A and A_-/A_+ ratios for the pyrene labeled samples

Pyrene-labeled sample	P_A	A_-/A_+	SAH Content µmol.g⁻¹
Py-EPM-1	2.93 ± 0.023	- 0.84	193 ± 9
Py-EPM-2	2.89 ± 0.015	- 0.83	158 ± 11
Py-EPM-3	2.42 ± 0.012	- 0.21	171 ± 11

d. Langmuir Isotherm

$$\Gamma=\frac{(C_0-C_{eq})\times V}{m\times A}$$ **Γ: The amount of adsorbed dispersant at equilibriun**

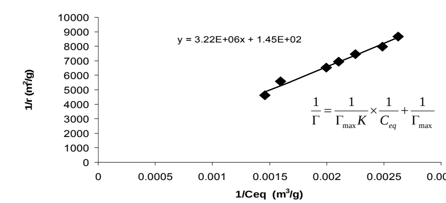


Figure 9: Langmuir isotherm curve for adsorption of the dispersant onto carbon black particles.

Table 2: Γ_{max} and K for the dispersant samples

Sample	Γ max	K
EPM-1	6.9×10^{-3} (g/m²) 1.3 (µmol of NP_3D/m²) 5.3 g of disp/g of CB	4.5×10^{-5} (m³/g) 2.5×10^{-7} (m³/µmol of NP_3D)
EPM-3	5.0×10^{-5} (g/m²) 0.1 (µmol of NP_3D/m²) 0.04 g of disp/g of CB	6.5×10^{-3} (m³/g) 3.6×10^{-5} (m³/µmol of NP_3D)

4. Concluding remarks

❖ The level of clustering and the content of the SAH were successfully characterized for the three EPM samples.
❖ The content of SAH can be determined by FT-IR and UV-Vis
❖ The results show that EPM-1 and EPM-2 are randomly distributed bu EPM-3 is more clustered and will affect the binding of the dispersant onto the carbon black particles.