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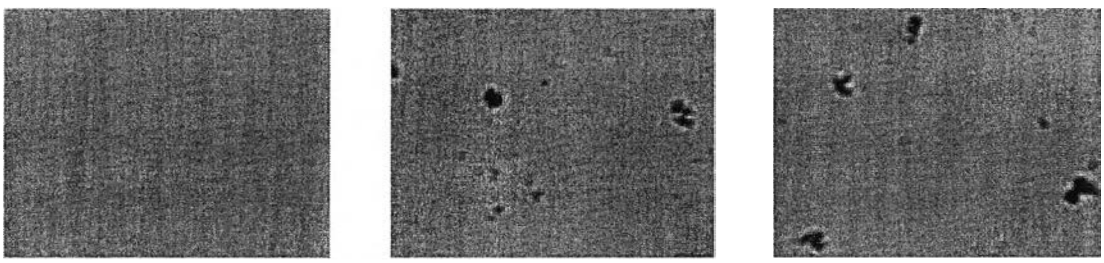
APPENDICES

Appendix A Onset Point of Oil W

As mention in 4.4, the onset point of Oil W was around 25% heptanes at 25°C and 35 vol% heptanes at 60°C. Micrographs of WY can be seen is Figure A1.



(a) Crude oil (b) 25%C7 (c) 35%C7

Figure A1 Micrographs showing the pictures of Oil W and precipitant's solution effluent of different concentrations.

Appendix B Shear Rate Calculation

In order to calculate shear rate, we need to know the flow rate and the radius of the capillary tube. The properties of our apparatus can be seen in Table B1.

Table B1 Capillary properties and experiment condition

Properties	Connecting line	Capillary
Diameter (in)	0.03	0.02
Radius (in)	0.015	0.01
Flow rate (mL/hr)	5	5

Example of shear rate calculation:

$$\text{Shear rate} = 4 * \frac{\text{Flow rate}}{\pi r^3}$$

$$\text{Shear rate} = 4 * \left(\frac{5}{\pi * 0.02^3}\right)\frac{mL}{in^3 \cdot hr} * \frac{1}{2.54^3}\frac{in^3}{cm^3} * \frac{1\,cm^3}{1\,mL}$$

$$\text{Shear rate} = 48561\frac{1}{hr} * \frac{1}{3600}\frac{hr}{s} = 13.5\ \frac{1}{\text{sec}}$$

Appendix C Residence Time Calculation

In order to calculate residence time, we need to know the details of every part in apparatus to calculate the residence time. The properties of our apparatus can be seen in Table C1.

Table C1 Properties of components in apparatus

Properties	Frit	Connecting line	Capillary
Shape	Cylinder	Cylinder	Cylinder
Radius (in)	0.031	0.015	0.005
Long (in)	0.062	2	12
Porosity	0.35	1	1

Example of frit's residence time calculation:

$$\text{Residence time} = \frac{\text{Volume of mixing section}}{\text{Volumetric Flow Rate (Q)}}$$

$$\text{Residence Time} = \text{Porosity} * \frac{(\pi r^2 L)}{\text{Flow Rate}}$$

$$\text{Residence Time} = 0.35 * \frac{(\pi * 0.031^2 * 0.062)}{5} \frac{in^3 \cdot hr}{mL} * \frac{2.54^3}{1} \frac{cm^3}{in^3} * \frac{1}{1} \frac{mL}{cm^3}$$

$$\text{Residence Time} = 0.000215\, hr * \frac{3600}{1} \frac{s}{hr} = 0.773 \sec$$

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