Chemical Characteristics of An Oil and the Relationship to Dispersant Effectiveness

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Abstract

Sufficient data now exist to enable correlation of oil properties to effectiveness results. This correlation will be very important to estimate the effectiveness of dispersion, even where it is not measured. Further, such correlation could point to areas where dispersion could be improved by dealing with negative influences such as the content of asphaltenes, etc.

The dispersant effectiveness data on 15 oils as well as their chemical and physical properties were measured for this study. In additional, data existed to make a total of 295 data points, although full data existed for the 15 oils. A total of 29 properties were correlated with the Corexit 9500 dispersability in Environment Canada's swirling flask apparatus. The highest correlation parameters were achieved with the content of nC12, naphthalenes, inversely with C26, the PAHs and the sum of C12 to C18 hydrocarbons. This is highly indicative that the smaller aliphatic hydrocarbons up to C18 and the PAHs are the most dispersible components of oil. Further, aliphatic hydrocarbons greater than C20 correlate inversely with the dispersant effectiveness indicating that these hydrocarbons suppress dispersion. The correlations provide a unique insight into dispersant effectiveness.

Thirteen models were constructed to predict the chemical dispersibility of oils. Models are based on commonly-available physical data and chemical analytical parameters. The simplest and best model is:

Corexit 9500 dispersibility (%) = -11.1 -3.19(ln(/C12 content) +0.00361(naphthalene content in ppm) - 7.62(PAH content squared) + 0.115(C12 to C18 content squared) + 0.785(%fraction oil boiling below 250 °C)

Models ranged from simple predictors involving only two parameters such as viscosity and density to 14-parameter models. The models developed were analyzed statistically and the dispersant effectiveness for several dispersants calculated. The more sophisticated models are able to predict dispersant effectiveness with high accuracy.

1.0 Introduction

Dispersant effectiveness is defined as the amount of oil that the dispersant puts into the water column versus that which remains on the surface. There are many factors that influence dispersant effectiveness: sea energy (or energy in the test apparatus), oil composition, state of oil weathering, rate of dispersant application, dispersant type, temperature, salinity of the water, etc. The most important factor for dispersant effectiveness is the composition of the oil, followed very closely by sea energy and amount of dispersant applied (Fingas *et al.*, 1997; Fingas 2000a, b).

Certain oil components such as resins, asphaltenes and larger aromatics or waxes are barely dispersable, if at all (NRC, 1989). Oils that contain mostly the latter components will disperse poorly even with dispersant application. On the other hand, oils that contain mostly saturates, such as diesel fuel, disperse both naturally and with the addition of dispersant. The additional amount of diesel dispersed using dispersants, over that naturally dispersed, depends primarily on the amount of sea energy present, however dispersant will often be unnecessary. Laboratory studies have found a trade-off interrelationship between the two factors of amount of dispersant applied (dose) and the sea energy. That is, less sea energy implies that a higher dose of dispersant is needed to yield the same amount of dispersion. There are other interrelationships as well, such as with salinity and temperature.

Effectiveness of dispersants are relatively easy to measure in the laboratory, however, there are many nuances in testing procedures (NRC, 1989). One concern is that these tests are representative of real conditions. Since it is impossible to mimic all conditions directly, it is important to both consider the important factors such as sea energy and salinity while considering the laboratory tests as a form of screening or representative value, rather than a direct representation of what can be obtained in the field. Field 'measurements' of dispersant effectiveness are also fraught with difficulty because it is very difficult to measure the concentration of oil in the water column over wide distances in appreciably small times, because there are no commonly-available oil slick thickness measures with which to assess the amount of oil remaining on the surface and because of the fact that the sub-surface oil often moves differently than the surface slick. Any field measurement at this time, is best viewed as an estimate. Actual dispersant effectiveness is very difficult to assess for the same reasons.

While effectiveness is easy to measure in the laboratory, it would be highly useful to be able to correlate oil chemical composition to effectiveness. This would improve the understanding of oil dispersibility, but also give one the ability to predict dispersibility.

In the past, it was thought that viscosity was the only quality of an oil that influenced the effectiveness of a dispersant. It soon became apparent, however, that the chemical constituents of oil had a major influence on the effectiveness of dispersants. Studies correlating effectiveness and oil composition revealed that the most important factor was the amount of saturates in the oil. It was also found that the effectiveness of dispersants decreases with increasing amounts of resins and asphaltenes in the oil. Furthermore, it was found that effectiveness could be predicted, albeit very crudely, using a simple model of saturates, less the other components of the oil, including resins, asphaltenes, and aromatics. This simple model may be useful only in that it shows that the components of oil are relevant in predicting dispersibility.

2.0 Previous Attempts at Modeling Dispersion

The first published attempt to model oil spill dispersion was by Mackay et al. (1984). They proposed a model:

$$F = 1 - \text{expt}(-K_e K_o K_d R) \qquad (1)$$

Where: F is the fraction of oil dispersed

R = an effective dispersant to oil ratio

K_e = a constant determined by the turbulence conditions

K_o = a constant related to the oil, most viscosity

K_d = a constant determined by the dispersant

The data are all based on initial testing of the new (at that time) Mackay apparatus. The values were set at K_o is 1, dispersants were set at values to correspond to results with Corexit

9527 being 0.77 and K_e set to the pressure drop in the apparatus, typically 100. Initial tests of these against 13 data points showed good correlation between the model and the results. Comparison to other test results required changing of the constants to achieve reasonable correlation. It should be noted that there was no specific oil composition data input to this model.

Subsequently Mackay (1985) published another model with a completely different basis. This new model presumed that a fraction oil is dispersed by the dispersant according to the ratio applied and then some of this rises depending on the droplet size produced. There is no input for oil type or composition. Three steps were defined. The first was the statement of the dispersant dosage to the thick and sheen sections of the oil slick. It is assumed that the dispersant dose to the sheen has little effect, but that the dispersant applied to the thick oil would disperse oil completely by dosage. This was based on observations during a dispersant application which had taken place at sea during that time. The second step of the model process was to calculate the oil initially dispersed into the water and this was calculated only on the bases of the first step information and the turbulence and oil slick thickness. An oil factor was noted, but appears not to have been used. The third step was to calculate the resurfacing rate of the dispersion. This was based on Stokes law and the estimated droplet size of the dispersion calculated in step 2. The final output then is the amount that remains in the water column, presuming a given time (not specified) has passed.

This newer Mackay model (1985) was published along with the code for the model. It did not include specific oil composition data and was not used extensively in the literature.

Fingas (2000a) proposed that a simple model using the amount of saturates less the amount of asphaltenes and resins would produce an estimate of dispersant effectiveness. In the past, it was thought that viscosity was the only quality of an oil that influenced the effectiveness of a dispersant. It soon became apparent, however, that the chemical constituents of oil had a major influence on the effectiveness of dispersants. Studies correlating effectiveness and oil composition revealed that the most important factor was the amount of saturates in the oil. It was also found that the effectiveness of dispersants decreases with increasing amounts of resins and asphaltenes in the oil. Furthermore, it was found that effectiveness could be predicted using a simple model of saturates, less the other components of the oil, including resins, asphaltenes, and aromatics. This simple model had a poor fit to the data, however, and additional information was thought to be required to accurately describe dispersant effectiveness as a function of the composition of the oil. The effort, however, shows that the composition of the oil is an important factor in the effectiveness of a dispersant.

Reed (2002) included a model of dispersion in the OSCAR spill model:

$$dm/dt = m(1=0.5^{\Delta t/t}{}_{1/2})\ f.(W^2/W_{ref}{}^2) \qquad (2)$$

where: m is the mass of the oil in the slick,
Δt is the time step
$t_{1/2}$ is the half time for survival of fully treated slicks at the reference wind speed
f is the ratio of dispersant to oil achieved
W is the wind speed
W_{ref} is the reference wind speed which is set to the 7 m/sec time.

All parameters are based on the Haltenbanken experiments, field experiments conducted off the Norwegian coast in 1985. Newer data sets have been since included (Daling et al., in press). The application of the dispersant is also considered through the factor ‘f’, the actual application achieved. The model presumes 100% efficiency at full treatment and that effectiveness is based on dispersant dosage. Energy is accounted for in the wind speed parameter.

Canevari and coworkers (2001) correlated the dispersant effectiveness of 14 heavy oils with various parameters and concluded that only viscosity correlated and that saturate content did not. It should be pointed out that all fuel oils were IFO fuel oil types of nearly identical composition.

This literature review points out that an extensive correlation of oil properties and dispersant effectiveness has not been conducted to date. This report will present the correlation of 18 properties or composition factors with the Corexit 9500 dispersabilities and the Corexit 9527 and Enersperse 700 dispersabilities, for 295 oils or oil weathered states.

3.0 Analytical Methodologies for Dispersibility

The dispersant effectiveness methodology reported in a recent paper was used without modification to study the oils (Fingas *et al.*, 2000a). This same method is now an American Society for Testing and Materials, ASTM, standard (F 2059-00).

The physical properties of the oils were also measured using standard procedures (Jokuty et al., 1999).

3.1 Summary of Test Method

Dispersant is pre-mixed with oil, placed on water in a test vessel. The test vessel is agitated on moving table shaker. At the end of the shaking period, a settling period is specified and then a sample of water taken. The oil in the water column is extracted from the water using a pentane/dichloromethane mixture and analyzed using gas chromatography.

The extract is analyzed for oil using a gas chromatograph equipped with a flame ionization detector (GC-FID). Quantification is by means of comparison to an internal standard. Effectiveness values are derived by calculation from calibration runs.

3.2 Reagents and Equipment

Water purified by reverse osmosis or equivalent means is used for the test water. Dichloromethane is distilled-in glass grade. Pentane is distilled- in-glass grade. Fine granular salt, non-iodized, is used for making the salt water. The chemical dispersant is used as supplied by the manufacturer. Oil is used as received.

A modified 120 mL Erlenmeyer flask is used as the test vessel. A side spout is added to enable taking the water sample with minimal disturbance of re-surfaced oil.

The shaker is a moving-table shaker with an orbital motion of 1 inch and fitted with flask holders. Ideally such shakers should be operated inside environmentally-controlled chambers, thereby increasing temperature control. If such an enclosed chamber is not used, the measurement should be conducted inside temperature-controlled rooms. (The New Brunswick Environmental Shaker model G27 (New Brunswick Scientific, Edison, NJ) is one enclosed shaker that meets these specifications.)

Analysis is accomplished using a gas chromatograph equipped with a flame ionization detector. The Hewlett Packard 5890 GC/FID with Chemstation software package is an equivalent unit. The column is a fused silica DB5ms column (J & W Scientific, Folsom, CA or equivalent).

3.3 Procedures

The bulk oil is mechanically mixed for 24 hours prior to obtaining a working sample. Working samples are stored in 2 L high-density polyethylene bottles with polypropylene screw closures. The working sample is mechanically shaken for 30 minutes prior to removing a sub-sample for testing. When not in use, all samples should be stored in a temperature controlled room at 5 °C. The dispersant is manually shaken, vigorously, prior to sampling.

A small amount of oil is weighed into a 5 mL amber vial with Teflon lined cap (approx. 1.0 mL). Approximately 100 mg of dispersant is added to the oil. Oil is added until a 1:25 ratio of dispersant to oil is achieved (approx. 2.5 mL oil is added). The sample is well mixed by manual shaking or stirring.

Granular salt is weighed and added to water from reverse osmosis (RO) filtration to obtain a 3.3% (w/v) solution. The water temperature is brought to 20 °C before use.

The 120 mL of salt water is placed into a 125 mL modified Erlenmeyer flask. The flask is inserted into the flask holders on the oscillating table of the shaker. A 100 µL volume of pre-mix solution is carefully applied onto the surface of the water using a positive displacement pipette. The tip of the pipette is applied to the water surface and the dispersant/oil mixture gently expelled. Extreme care should be taken when applying the oil to the surface such that mixing does not occur. The oil should gently glide across the water to form a slick. If the oil streams out into the water, the agitation can disperse the oil, increasing the amount of oil dispersed and erroneously raising the final dispersion result. Herding of the oil and some creeping of the mixture up the vessel wall is normal.

The flask and contents are mechanically mixed on the shaker in a temperature controlled chamber at 20 °C, immediately after applying the oil to the surface of the water. A rotation speed of 150 RPM and a mixing time of 20 minutes are used to agitate the samples followed by a 10 minute settling period. The flasks should be removed from the table-mounted holders prior to the settling period to limit the agitation between settling and sampling.

After the settling time is complete, 3 mL of the oil-in-water phase from the spout of the flask are drained to waste to dispose of any oil plugs and obtain a representative sample. A 30 mL aliquot of the dispersed oil in water sample is collected in a graduated cylinder and transferred to a 125 mL separatory funnel. The oil is extracted with 3 portions of 5 mL of a 70:30 dichloromethane:pentane solvent mixture, collected in a 25 mL graduated mixing cylinder. The final extraction volume is adjusted to 15 mL. Care is taken to ensure that water is not taken along with the solvent. During extraction, vigorous shaking is required to achieve full extraction. It is best to shake each separatory funnel individually to achieve consistent results.

Analysis consists of gas chromatographic analysis using a flame ionization detector (GC/FID) to determine the concentration of oil in solvent. A 900.0 µL portion of the 15 mL solvent extract and a 100.0 µL volume of internal standard (200 ppm 5-α-Androstane in hexane) are combined in a 12mm x 32mm crimp-style vial with aluminium/Teflon seals and shaken well. Petroleum hydrocarbon content is quantified by the internal standard method, with the average hydrocarbon relative response factor (RRF) determined over the entire analytical range in a separate run. The petroleum content is determined by integrating the resolved peak area by the following equation:

$$RPH = A_{total}/A_{is} \text{ X } 1/RRF \text{ X } 20\ (\mu g) \text{ X } 15/0.9 \text{ X } 120/30 \qquad (1)$$

which simplifies to:

$$RPH = A_{total}/A_{is} \times 1330/RRF(\mu g) \qquad (2)$$

Where:

RPH is the Resolved Petroleum Hydrocarbon amount in µg
A_{total} is the total area of resolved peaks in counts
A_{is} is the area of the internal standard
RRF is the Relative Response Factor which in turn is given by
$RRF = A/A_{is} \times C_{is}/C$, where A is the area, C is the concentration of the compound of interest.

3.4 Calibration Standards

A series of 6 oil-in-solvent standards are prepared for evaluating the efficiency of the dispersant for each dispersant/oil combination. The volume of premixed dispersant/oil solution for each standard is selected to represent a percentage efficiency of the dispersed oil, eg. 50 µL = 50% efficiency (see Step 4.10 below for method of choosing calibration standard volumes). The dispersant/oil mixture is then accurately measured and applied to the water surface, and treated in the same manner as the samples (see Step 4.4 and 4.5 above). At this point, the entire volume of water is transferred to a 250 mL separatory funnel and extracted with 3 portions of 20 mL of a solvent mixture of 70:30 dichloromethane:pentane. All oil is extracted, including the oil slick and oil on the walls of the swirling flask test vessel, using the volume of extraction solvent to rinse the flask of remaining oil before adding to the separatory funnel. The extracts are combined in a graduated cylinder and topped up to a total volume of 60 mL. Chromatographic analysis is then performed to determine the petroleum content by integrating the resolved peak area by the following equations:

$$RPH = A_{total}/A_{is} \times 1/RRF \times 20\ (\mu g) \times 60/0.9 \times 120/120 \qquad (3)$$

which simplifies to:

$$RPH = A_{total}/A_{is} \times 1330/RRF\ (\mu g) \qquad (4)$$

Where:

RPH is the Resolved Petroleum Hydrocarbon amount in µg
A_{total} is the total integrated area
A_{is} is the area of the internal standard
RRF is the Relative Response Factor which in turn is given by
$RRF = A/A_{is} \times C_{is}/C$, where A is the area, C is the concentration of the compound of interest.

The volumes of the six calibration standards are chosen such that the RPH determined for each of the six samples of each dispersant/oil combination fall within the RPH range of the standards. The following guide is used to determine the range of standards for each type of oil being dispersed:

Heavy Oil - 10, 15, 20, 25, 30, 35%
Medium Oil - 10, 20, 30, 40, 50, 60%
Light Oil - 30, 40, 50, 60, 70, 80%

The percentage of dispersion was calculated by creating a calibration curve of effectiveness versus RPH from the standards and then taking the RPH of the experimental value and setting the appropriate effectiveness value.

At least six measurements of the RPH and effectiveness were measured. The standard deviation is determined and reported. A standard deviation of more than 10 (absolute value) indicates poor reproducability and the experiments should be repeated.

Low RPH values that fall below the range of the lowest calibration value should be reported as less than the value of that calibration standard. This last calibration standard is also the detection limit of the test.

The test was applied to a variety of crude oils taken from stock at Environment Canada's Laboratories. The properties of these oils are given in Jokuty *et al.* (1999).

4.0 Results of Testing of Crude Oils and Weathered Crude Oils

Several oils were tested for effectiveness with the dispersant Corexit 9500. Test results are given in Table 1. These data will be used in the subsequent correlation. Additional data were taken from the oil properties catalogue (Jokuty et al, 1999) and included in the analysis. This included data on 299 oils including the oils that were completed in this study. All data were measured under standard conditions and procedures as described in Jokuty et al. (1999). These data are given in Appendix A Table A1.

5.0 Correlation Procedure and Results

The procedure for development of the models was a two-step process. First, the available data were correlated, one at a time, with dispersant effectiveness to assess the relationship and the form of the relationship if any. Second, the data that correlated were fitted in a series of multiple correlation steps to yield the models here. The output parameters of the best fit equation constitute the model. The quality of fit of these models can be judged by examining the multiple R^2. A value of 0.9 and higher is a very good fit, and one about 0.7, a poorer fit. The adjusted multiple R^2, as presented in this project as R^2 is calculated on the basis of fit but also incorporates factors relating to the number of input parameters. The quality of the models can also be judged by comparing the predicted values versus the input values and the statistics such as the standard deviation of these predictions from the starting values.

The entire data set as shown in Table A1 were test for correlation to the Corexit 9500 dispersibility data. This data was used as it is the most extensive and the most recent, hence probably the most accurate. Each property or data listed in Table A1 was tested using the software TableCurve (SPSS Inc.). The correlations achieved and the relationships used in later regression are shown in Table 2. The correlation coefficient is the regression coefficient or R^2 and is the mathematical expression of the relationship between the Corexit 9500 dispersibility and the parameter noted. The closer the number is to 1, the closer the relationship predicted.

It should be noted from Table 2, that the parameters that correlate most highly with the suite of parameters are those composition parameters that relate to smaller compounds in the oil. These include n-C12, naphthalenes, and the sum of the C12 to C16 components. Those that relate to the large compounds in the oil relate negatively to the dispersibility, including C26, and resins. This will be discussed in greater detail later, however is indicative that dispersion largely affects only the smaller components of the oil.

The highest correlation was achieved with the n-C-12 component as noted in Table 2 and illustrated in Figure 1. The regression coefficient was 0.79 and this indicates that C12 is highly dispersable. It should be noted that only about 15 of the 299 values in Table 1, which were correlated, had data for C-12 and some of the other specific component data. The next highest correlation coefficient was 0.76 for the Naphthalene content as illustrated in Figure 2. This also indicates a high dispersibility for Naphthalene. The third highest correlation is for n-C26 and this is an inverse correlation as shown in Figure 3. This indicates that the more n-C26, the less dispersion. This also indicates that components of the size of C26 and greater are not dispersed and in fact inhibit dispersion. The fourth highest correlation is the PAH content and this correlates positively, namely that the higher the PAH content, the higher the dispersion as shown in Figure 5. This is somewhat surprising since the PAH content, especially the larger PAHs such as Phenanthrene and Chrysene, were not thought to be dispersable. This high correlation indicates that most of the PAHs are dispersable. The fifth highest correlation is that of the sum of the C12, C14, C16 and C18 components as shown in Figure 5. This correlation is highly indicative that alkanes up to C18 are the prime components dispersed along with the PAHs. The fact that C12 correlates the highest of these n-alkanes and that this correlation rapid drops off to C18 with no useable correlation for C20, indicates that only hydrocarbons up to C18 disperse and that past C20, compounds actually suppress dispersion.

Figure 6 shows the correlation of viscosity ($R^2 = 0.64$) with Corexit 9500 dispersibility. Viscosity correlates somewhat, however, would not be a good predictor by itself. As can be seen by Figure 6, viscosity has a tendency to be a logarithmic parameter and higher viscosity oils over about 5000 mPa.s have no dispersability. The problem with using viscosity alone is that some of the oils in any test set can have viscosity as much as 4 orders-of- magnitude above that which would still achieve dispersant effectiveness. This results in lack of continuity in dispersant effectiveness over the typical viscosity range.

Figure 7 shows the correlation of the oil fraction that boils below 250 ºC. The correlation coefficient of 0.62 shows that this component of the oil is strongly dispersed using a chemical dispersant. This fraction (BP < 250 ºC) is also the fraction that evaporates with the first few hours after a spill. In fact, some algorithms match this fraction with the percent that would evaporate in 2 days. This fact then indicates that chemical dispersion is strongly competitive to evaporation in that the same fraction is subject to either process.

The n-alkane 14 and 16 correlation with Corexit 9500 dispersion are illustrated in Figures 8 and 9. The correlation coefficient of 0.61 and 0.56 shows that these component of the oil are preferentially dispersed using a chemical dispersant. It should be noted the correlation coefficient declines progressively from C12 to C20 and then rises inversely to C26. This will be discussed later.

Figure 10 shows the correlation of the oil density with chemical dispersability yield a correlation coefficient of 0.54. This correlation may be quite useful since the density of the oil is usually known and since the correlation is relatively good and continuous throughout the density range. This correlation can be used when little else is known about the oil.

Figure 11 shows the correlation of the resin content with the Corexit 9500 dispersibility. The resins are the highest of the SARA (Saturates, Aromatics, Resins, Asphaltenes) to correlate. It was thought that the SARA analysis would yield a good simple prediction system (Fingas, 2000b), however this study shows that the SARA fraction actually is a poor predictor of dispersibility. Similarly the correlation of the Saturates, Aromatics and Asphaltene components are shown in Figures 12, 13 1nd 14, respectively. The correlation coefficients are 0.36, 0.18 and

0.24, respectively. These latter three components display an even greater scatter than the resins with the corresponding low correlation coefficients. The reason for the poor fit of the SARA components, particularly the saturates and aromatics is that compounds grouped in these categories have variable dispersibility. For example, the C12-C18 group as described above are saturates and are highly dispersible. On the other hand the C20 fraction and above is not dispersible as noted above, but are also saturates. The same situation exists for the aromatics group.

Figure 15 illustrates the correlation of the fraction of the oil that boils below 200 °C, R^2 = 0.44. It is noted that the correlation of the 250 °C fraction is much higher at 0.63. It is suspected that the 250 °C component contains less compounds that are simply lost by evaporation and more compounds that are dispersed. Figure 16 shows the correlation of pour point with Corexit 9500 dispersibility, R^2 = 0.25. This latter correlation is poor and is not useful for prediction. Pour point is not a truly continuous function and thus becomes a poor predictor of physical behaviour.

Figure 17 shows the correlation of the effectiveness of Corexit 9537 with Corexit 9500, Figure 18, that of the effectiveness of Dasic LTS and Figure 19, the effectiveness of Enersperse 700. The correlation coefficients are 0.45, 0.43 and 0.31 respectively. There is a significant amount of scatter in these correlation plots. This may be due to the fact that many of the measurements of the dispersant effectiveness values other than Corexit 9500 may be older and may have more error associated with them.

Figure 20 shows the correlation of sulphur content (R^2 = .23) with Corexit 9500 dispersibility. The sulphur content does not show any relationship to dispersibility, as might be expected and most sulphur values cluster around the 0 to 10% sulphur content.

Figure 21 shows the total VOC and Figure 22 the C18 content. The correlation coefficients are 0.33 and 0.32 respectively. The total VOC content displays a large scatter with dispersibility. This is probably the result of rapid loss of some of the VOC components before dispersion. The C18 content is the largest n-alkane factor to show a correlation with the dispersion. This indicates that C18 is probably the largest n-alkane to undergo chemical dispersion. The next member chosen, C20 shows no useful correlation.

The factors that were correlated and show little correlation include the Reid vapour pressure, flash point, waxes and surface tension (and interfacial tension with water). There is no reason to believe that any of these have a relationship to chemical dispersibility.

It should be noted that Figures 1 to 22 were plotted using the best, simple equation using TableCurve. The curve fit has no significance to the discussion at hand and therefor is not presented.

6.0 Development of Correlation Models

The data in section 5.0 above was used to develop specific equations. The correlation resulting from each parameter, as listed in Table 2, was correlated in a series of models using DataFit (Oakdale Engineering) which calculates linear models. The two step process is necessary as DataFit, nor any other one, are able to calculate the correct function with more than 2 variables. Thus, the function, eg. linear, square, log, were calculated using a two-way regression and these functions were in turn, used in developing a predictor model for dispersion. Thirteen models were developed and these will be discussed and characterized below. The models are presented in Table 13, along with the parameters and relevant statistics. The statistics given are the R^2 or regression coefficient. The higher this value, the higher the predicted value relates to the actual data. Other statistics such as average standard deviation and maximum standard deviation are also very relevant and are illustrated in Figures 23 and 24. Figure 23 shows the relationship between the standard deviation values and Figure 24 shows the values for each model set. The other test that is given in Table 3 is the Prob(t) or probability associated with the t-test. This value gives the importance of the particular variable in the model at hand. The higher the value of the Prob(t), the greater the probability that the variable could be eliminated from the model with minimal loss to its prediction capability.

The predicted values for Corexit 9500 dispersibility for the measured set of data are shown in Table 4 and for all data are given in Table A2.

Model 1 uses the four highest correlating parameters of C12, Naphthalene, PAHs, C12 to C18 and the fraction that boils at less than 250 ºC. The regression coefficient achieved was 0.98. The model is:

Corexit 9500 dispersibility (%) = -11.1 -3.19(ln C12 content) +0.00361(Naphthalene content in ppm) - 7.62(PAH content squared) + 0.115(C12 to C18 content squared) + 0.785(%fraction oil boiling below 250 ºC) (7)

The Prob(t) shows that all factors are very relevant and are needed to form the reliable prediction. It should be noted that only 15 oils have the full data set to form this prediction set.

Model 2 uses the six highest correlating parameters of C12, Naphthalene, PAHs, C12 to C18, the C26 fraction (negative correlation) and the fraction that boils at less than 250 ºC. The regression coefficient achieved was 0.98.

The model is:

Corexit 9500 dispersibility (%) = -10.7 -2.75(ln C12 content) +0.00354(Naphthalene content in ppm) + 0.113(1/C26 content) - 7.48(PAH content squared) + 0.0107(C12 to C18 content squared) + 0.761(%fraction oil boiling below 250 ºC) (8)

The Prob(t) shows that all factors are relevant and are needed to form the reliable prediction. This prediction set is very similar to model 1 and the predictions are similar, but slightly more accurate.

Model 3 uses the 5 highest correlating parameters of C12, Naphthalene, PAHs, C12 to C18, the C26 fraction (negative correlation) and the viscosity of the oil rather than fraction that boils at less than 250 ºC. The regression coefficient achieved was 0.94. The model is:

Corexit 9500 dispersibility (%) = -2.93 -1.29(ln C12 content) +0.00368(Naphthalene content in ppm) - 0.0185(1/C26 content) - 8.65(PAH content squared) + 0.0144(C12 to C18 content squared) + 100(1/viscosity) (9)

The Prob(t) shows that there may be redundancy in the values of C12 and C26. This prediction set is very similar to model 2 and the predictions are similar, but less accurate as viscosity is not as good a predictor as the values associated with the fraction boiling below 250 ºC.

Model 4 is a simple 2-parameter predictor using only density and viscosity. The regression coefficient is 0.71. The model is:

Corexit 9500 dispersibility (%) = $-77.6 + 214e^{-density} + 60/viscosity^{0.5}$ (10)

This model produces a poorer prediction than most, however requires very little input data and this data, the density and viscosity, are readily available. The overall standard deviation is 4.6 as an average, but the maximum standard deviation is 32.

Model 5 is also a simple 2-parameter predictor using only density and the fraction boiling below 250 ºC. The regression coefficient is 0.7. The model is:

Corexit 9500 dispersibility (%) = $-68.8 + 67.4/density^{1.5} + 0.787BP^{1.5}$ (11)

This model produces a poorer prediction similar to model 4 above, however requires very little input data and this data, the density and fraction that boils at less than 250 °C, are commonly available. The overall average standard deviation is 5, and the maximum standard deviation is 30. Both the accuracy and other features of model 5 are similar to model 4, however the maximum deviations with model 5 are less. It should be noted that as many as 295 data points were used to generate both models 4 and 5.

Model 6 uses the SARA parameters of saturates, aromatics, resins, asphaltenes and the viscosity of the oil. The regression coefficient achieved was 0.68. The model is:

Corexit 9500 dispersibility (%) = -7.78 + 0.315(saturate content) + 3.44(square root of aromatic content in percent) - 4.32(ln resin content) - 1.81(ln asphaltene content) + 58.9(1/viscosity) (12)

The Prob(t) shows that there is little redundancy. As noted above, it was thought that the SARA analysis would yield a good simple prediction system (Fingas, 2000b), however this study shows that the SARA fraction actually is a poor predictor of dispersibility. The reason for the poor correlation achieved with SARA components, particularly the saturates and aromatics is that compounds grouped in these categories have variable dispersibility. For example, the C12-C18 group as described above are saturates and are highly dispersible. On the other hand the C20 fraction and above is not dispersible as noted above, but are also saturates. The same situation exists for the aromatics group. Model 6 does not show good predictability as shown in Table 4 and Table A2. Model 6 has the second poorest correlation coefficient of all of the 13 models described in this study.

Model 7 uses the SARA parameters of saturates, aromatics, resins, asphaltenes and the sum of the C12 to C18 components. The regression coefficient achieved was 0.95. The model is:

Corexit 9500 dispersibility (%) = 296 - 1.86(saturate content) - 18.2(square root of aromatic content in percent) - 33.6(ln resin content) - 9.03(ln asphaltene content) + 0.0065(square of the C12 to C18 content in ppm) (13)

The Prob(t) shows that there is little redundancy in any input parameter. This model is very much better in terms of fit and accuracy than the very similar model 6. This is because the C12 to C18 component provides the information to the model as to what is being dispersed. In model 6 this term was that of viscosity which is much less powerful.

Model 8 is similar and uses the SARA parameters of saturates, aromatics, resins, asphaltenes and the VOCs. The regression coefficient achieved was 0.71. The model is:

Corexit 9500 dispersibility (%) = 73.4 - 0.0298(saturate content) - 2.24(square root of aromatic content in percent) - 12.2(ln resin content) - 4.873(ln asphaltene content) + 0.000681(VOC content in ppm) (14)

The Prob(t) shows that there is little redundancy in any input parameter. Model 8 does not show good predictability as shown in Table 4 and Table A2. The VOC content does not substitute for the high predictability of the C12 to C18 content as used in model 7.

Model 9 uses only the SARA parameters of saturates, aromatics, resins, and asphaltenes. The regression coefficient achieved was 0.68, the poorest of the 13 models described in this study. The model is:

Corexit 9500 dispersibility (%) = 62.7 - 0.103(saturate content) - 0.678(square root of aromatic content in percent) - 13.3(ln resin content) - 4.38(ln asphaltene content) (15)

The Prob(t) shows that there is little redundancy in input parameters except somewhat for the saturate component. Model 9 shows the SARA component does not provide good information upon which to build a dispersibility model.

Model 10 is a larger model and uses all the composition components for which data had been collected the SARA parameters of saturates, aromatics, resins, asphaltenes and the VOCs, the C12 to C18 component, the C12, C14, C16, C18, C26 Naphthalene and PAH components. The regression coefficient achieved was 0.998. This is the second-best model developed in this study. The model is:

Corexit 9500 dispersibility (%) = 368 - 2.25(saturate content) - 15.4(square root of aromatic content in percent) - 42.6(ln resin content) - 14(ln asphaltene content) + 0.000472(VOC content in ppm) + 0.074(C12 to C18 content squared) - 1.71(ln(C12 content) - 8.34(ln C14 content) - 17(C16 content) + 8.87(C18 content) + 0.821(1/C26 content) +0.00156(naphthalene content in ppm) - 1.36(PAH content squared) (16)

The Prob(t) shows that there is redundancy in all parameters, especially the C12 and C14 parameters. Model 10 shows good predictability as shown in Table 4.

Model 11 is the largest model described in this study and uses many of the composition components including the SARA parameters of saturates, aromatics, resins, asphaltenes and the VOCs, the C12 to C18 component, the C12, C14, C26 Naphthalene, but physical components were substituted for those component parameters which showed high redundancy in model 10. The physical components added were density, viscosity, and the fraction that boils at less than 250 ºC and less than 200 ºC. The regression coefficient achieved was 0.998. This is the best model developed in this study, however the fit is only marginally better than model 10. The model is:

Corexit 9500 dispersibility (%) = 855(1/density) -250(1/viscosity) - 7.09(saturate content) - 72.6(square root of aromatic content in percent) - 69.7(ln resin content) - 11.6(ln asphaltene content) + 0.00045(VOC content in ppm) - 6.82(%fraction oil boiling below 200 ºC) + 4.96(%fraction oil boiling below 250 ºC) - 0.0226(C12 to C18 content squared) + 11.4(ln(C12 content) + 2.8(ln C14 content) + 0.299(1/C26 content) - 0.00414(naphthalene content in ppm(17)

The Prob(t) shows that there is redundancy in all parameters, especially the C12, C14 and C26 parameters. Model 11 shows good predictability as shown in Table 4.

Model 12 is based on physical measurements. The physical components used were density, viscosity, and the fraction that boils at less than 250 ºC and less than 200 ºC. The regression coefficient achieved was 0.71. The model is:

Corexit 9500 dispersibility (%) = - 95.6 + 90(1/density) + 22.9(1/viscosity - 0.443(%fraction oil boiling below 200 ºC) + 0.855(%fraction oil boiling below 250 ºC) (18)

The Prob(t) shows that there is little redundancy in input parameters.

Model 13 is based on physical measurements as model 12, however pour point was added. The physical components used were density, pour point, viscosity, and the fraction that boils at less than 250 ºC and less than 200 ºC. The regression coefficient achieved was 0.69. The model is:

Corexit 9500 dispersibility (%) = - 124 + 121(1/density) - 0.00071(pour point squared)+ 15.3(1/viscosity - 0.488(%fraction oil boiling below 200 ºC) + 0.732(%fraction oil boiling below 250 ºC) (19)

The Prob(t) shows that there is little redundancy in input parameters. The model is poorer than model 12 which includes the same parameters without pour point. This shows that the addition of pour point actually decreases the accuracy of the model. As discussed above, pour point is a very poor predictor and is not a continuous variable.

The work presented above used the dispersibility with Corexit 9500 as the prime parameter. This was carried out as the Corexit 9500 data was the newest and most accurate. Using the program TableCurve and the data in Table A1, predictor equations were developed for the dispersability of other dispersants with the various oils.

The equation for the prediction of Corexit 9527 dispersability is:

Corexit 9527 dispersibility (%) = - 0.35 + 0.80(Corexit 9500 dispersibility) (20)

The equation for the prediction of Dasic LTS dispersability is:

Dasic LTS dispersibility (%) = 1.5 + 0.42(Corexit 9500 dispersibility) (21)

The equation for the prediction of Enersperse 700 dispersability is:

Enersperse 700 dispersibility (%) = 1.9 + 0.55(Corexit 9500 dispersibility) (22)

The regression coefficients for the three models are 0.45, 0.42, and 0.27, respectively. The predicted values and actual values for the three dispersants shown above are given in Table 5.

7. Conclusions

Thirteen models for the prediction of chemical dispersibility have been developed. The models range widely in terms of input parameters and also in statistical quality. These are described in Section 6 above. These models can be used to predict the chemical dispersibility of oils given the required input parameters.

The development of these models also reveals essentials of chemical dispersion. The results clearly show that small n-alkanes are prone to dispersion and that this ends at about C20 and hydrocarbons as large as C26 actually suppress dispersion. This is illustrated in Figure 25 in which the regression coefficients (R^2) are plotted against the n-alkane carbon number. It can be seen that there is a steady progression downwards beginning at C12 and crossing 0 at about the C20 carbon number. The aromatic component may show a similar tendency, however sufficient data were not available to provide details. The naphthalene component showed a high regression coefficient ($R^2 = 0.76$) and the total PAHs were also relatively high ($R^2 = 0.67$). This indicates that the PAHs are relatively dispersible and that the smaller ones (naphthalenes) are highly dispersible.

The development of the model shows that certain parameters are very good predictors of chemical dispersibility. These include the specific chemical composition indicators such as the n-alkane values of C12, C14, naphthalenes, etc. The group composition indicators such as SARA, are poor predictors. The physical properties are also poor predictors of chemical dispersibility. This is illustrated in Figure 26 in which the average correlation coefficient is plotted for each group. There are some properties which have no or very little dispersibility prediction indication and these include: wax content, interfacial tension, and flash point.

The study also reveals some facts about the interrelationship of the data used. The properties and composition parameters were inter-correlated. Results are shown in Table 6. The values that correlate at regression coefficients higher than 0.7 are highlighted in bold. If the values correlate inversely, this is indicated with a negative value. This table shows that many of the values are unique and do not relate to other values, however many composition values show an interrelationship.

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Table 1 Properties of Oils

Oil Name	Evap'n %	Sulphur (wt%)	Reid VP (kPa)	Density (g/mL)	Pour Point (°C)	Viscosity (mPa s)	Dispersibility % w/Corexit 9500	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)	Total VOCs (ppm)	BP < 200 (wt%)	BP < 250 (wt%)	small HC	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)
Sockeye (2000)	0	4.51		0.9354	-25	761	12	50	18	18	15	14040	14	19	5	1.14	1.43	1.52	1.19
Sockeye (2000)	20	5.47		0.9839	13	274000	9	42	18	20	20		0	5	5	0.63	1.52	1.76	1.41
West Texas (2000)	0	0.86		0.8474		9	28	78	15	6	1	33560	26	35	21	6.72	5.93	5.02	3.30
Arabian Light (2000)	0	1.93		0.8641	-21	13	19	76	15	6	4	19570	21	29	20	6.41	5.62	4.76	3.42
South Louisiana (2001)	0	0.79		0.8562		10	26	81	13	6	1	18890	22	32	14	4.25	3.01	3.46	2.24
Arabian Light (2000)	26	2.60		0.8193	-8	174	8	70	16	9	5	8550	1	9	24	5.41	7.13	6.46	4.55
ASMB #5	0	0.63		0.8404	-18	6	28	77	17	4	2	30570	26	35	16	4.45	4.37	4.16	3.14
West Texas (2000)	32	1.24		0.8973	7	112	13	75	14	10	2	320	2	12	26	6.21	9.10	7.19	4.76
South Louisiana (2001)	28	0.88		0.8818	-11	141	10	77	13	8	2	200	2	11	17	3.81	5.19	4.75	3.11
ASMB #5	37	0.89		0.8814	9	123	11	72	18	8	3	120	1	10	22	4.12	5.92	8.89	5.19
Chayvo #6	0	0.34		0.8345	-4	4	41	88	9	3	0	42745	27	40	27	6.47	7.06	7.14	8.67
Chayvo #6	14	0.38		0.8542	-1	12	48	86	10	4	0	31890	20	35	35	6.73	9.26	8.73	9.00
Chayvo #6	22	0.40		0.8609	8	21	29	81	12	7	0	14955	12	29	37	6.75	10.09	10.31	8.73
Chayvo #6	33	0.48		0.8721	8	33	24	81	12	7	0	386	2	17	30	6.71	9.98	10.25	8.28
Diesel (2002)	0	0.09		0.8310	-50	3	72	88	10	2	0	19330	27	58	43	13.23	12.33	10.96	8.72
Diesel (2002)	22	0.10		0.8416	-41	4	66	86	11	3	0	2267	11	47	53	15.25	15.77	13.70	9.20

Table 2 Correlation of Parameters with Corexit 9500 Dispersibility

Parameter	Correlation Coefficient	Relationship	Simplest Relationship	Used
n-C12	0.79	lnx		lnx
Naphthalenes	0.76	$x^{1.5}$	x	x
n-C26	0.7	$(\ln x)^2$	1/x	1/x
Total PAHs	0.67	x^2		x^2
Sum of C12 to C18	0.66	x^2		x^2
Viscosity	0.64	1/x		1/x
BP < 250	0.63	xlnx	x	x
n-C14	0.61	x^2		lnx
n-C16	0.56	$x^{2.5}$	x^2	x
Density	0.54	$(\ln x)^2$	1/x	1/x
Resins	0.53	lnx/x	lnx	lnx
Dispersibility % (9527)	0.45	x		x
BP < 200	0.44	xlnx	x	x
Dispersibility % (Dasic)	0.42	x		x
Saturates	0.36	x		x
Total VOCs	0.33	x		x
n-C18	0.32	$(\ln x)^2$	x	x
Dispersibility % (Enersperse 700)	0.31	lnx		x
Pour Point	0.25	x^2		$(67+x)^2$
Asphaltenes	0.24	lnx		lnx
Sulphur	0.23	power	NC	not used
Aromatics	0.18	$(\ln x)^2$	$x^{1/2}$	not used
Reid Vapour Pressure	0.13	x^3		not used
Flash Point	NC	NC		not used
Complex modulus	NC	NC		not used
Waxes	NC	NC		not used
Surface Tension	NC	NC		not used
Interfacial Tension	NC	NC		not used
n-C20	NC	NC		not used

NC = no useful correlation

Table 3 Model sets

Number	Description	Number of Variables	R^2	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5	Variable 6	Constant	Variable 7	Variable 8	
1	High correlators only	5	0.98	lnC12	Napthalene	PAH^2	c12-c18^2	BP<250					**parameter**
				-3.19	0.00361	-7.62	0.0115	0.785		-11.1			**value**
				0.19	0.028	0.094	0.16	0.00002		0.029			**prob(t)**
2	Best plus boiling point	6	0.98	lnC12	Napthalene	1/C26	PAH^2	c12-c18^2	BP<250				**parameter**
				-2.75	0.00354	0.113	-7.48	0.0107	0.761	-10.65			**value**
				0.31	0.039	0.65	0.12	0.22	0.000012	0.046			**prob(t)**
3	Best plus viscosity	6	0.94	lnC12	Napthalene	1/C26	PAH^2	c12-c18^2	1/viscos				**parameter**
				-1.29	0.00368	-0.0185	-8.65	0.0144	100	-2.93			**value**
				0.76	0.17	0.97	0.25	0.31	0.011	0.73			**prob(t)**
4	Two-way - Density and Viscosity	2	0.71	Model $Z = a + be^{-density} + c/viscosity^{0.5}$									
				a= -77.6	b= 214	c=60							
5	Two-way - Density and BP<250	2	0.7	Model $Z = a + b/density^{1.5} + cBP^{1.5}$									
				a= -68.8	b= 67.4	c= 0.0787							
6	Groups plus viscosity	5	0.68	Saturates	Aromatics$^{1/2}$	lnResins	lnAsphaltenes	1/viscos					**parameter**
				0.315	3.44	-4.32	-1.81	58.9		-7.78			**value**
				0.043	0.031	0.21	0.21	0		0.7			**prob(t)**
7	Groups plus low HC	5	0.95	Saturates	Aromatics$^{1/2}$	lnResins	lnAsphaltenes	c12-c18^2					**parameter**
				-1.86	-18.2	-33.6	-9.03	0.00951		296			**value**
				0.0041	0.017	0.0001	0.099	0.0065		0.00047			**prob(t)**
8	Groups plus VOCs	5	0.71	Saturates	Aromatics$^{1/2}$	lnResins	lnAsphaltenes	VOCs					**parameter**
				-0.0298	-2.24	-12.2	-4.87	0.000681		73.4			**value**
				0.039	0.13	0	0.00037	0		0.00004			**prob(t)**
9	Groups alone	4	0.57	Saturates	Aromatics$^{1/2}$	lnResins	lnAsphaltenes						**parameter**
				-0.103	-0.678	-13.3	-4.38			62.7			**value**
				0.55	0.7	0	0.0071			0.0031			**prob(t)**
10	Composition component	13	0.998	Saturates	Aromatics$^{1/2}$	lnResins	lnAsphaltenes	VOCs	c12-c18^2		lnC12	lnC14	**parameter**
				-2.25	-15.4	-42.6	-14	-0.000472	0.074	368	-1.71	8.34	**value**
				0.43	0.47	0.32	0.39	0.46	0.29	0.38	0.95	0.84	**prob(t)**
				C16	C18	1/C26	Napthalene	PAH^2					**parameter**
				-17	8.87	0.821	0.00156	-1.36E-07					**value**
				0.36	0.32	0.43	0.71	0.29					**prob(t)**
11	Smallest complete set	14	0.998	1/density	1/viscos	Saturates	Aromatics$^{1/2}$	lnResins	nAsphaltenes		VOCs	BP<200	**parameter**
				855	-250	-7.09	-72.6	-69.7	-11.6		0.00045	-6.82	**value**
				0.45	0.39	0.51	0.45	0.42	0.42		0.44	0.59	**prob(t)**
				BP<250	c12-c18^2	lnC12	lnC14	1/C26	Napthalene				**parameter**
				4.96	-0.0226	11.4	2.8	0.299	-0.00414				**value**
				0.62	0.82	0.87	0.94	0.94	0.56				**prob(t)**
12	Physical data less pp	4	0.71	1/density	1/viscos	BP<200	BP<250						**parameter**
				90	22.9	-0.443	0.855			-95.6			**value**
				0	0.0049	0.0016	0			0			**prob(t)**
13	Physical data	5	0.69	1/density	Pour point^2	1/viscos	BP<200	BP<250					**parameter**
				121	-0.00071	15.3	-0.488	0.732		-124			**value**
				0	0.0186	0.11	0.0045	0		0			**prob(t)**

Table 4 **Comparison of Actual Versus Predicted Values**

Oil Name	Evap'n %	**Actual Dispersibility % w/Corexit 9500**	**1** High Correlators	**2** Best plus BP<250	**3** Best plus Viscosity	**4** Density & Viscosity	**5** Density & BP<250	**6** SARA & Viscosity	**7** SARA & Low HC	**8** SARA & VOCs	**9** SARA	**10** Compos a one	**11** Complete ap	**12** Physic - PP	**13** Physic
			Predicted with the Equation noted												
Arabian Light (2000)	0	19	20	20	17	29	27	24	15	47	22	22	22	26	28
Arabian Light (2000)	26	8	5	6	11	12	10	16	10	34	17	10	6	10	11
ASMB #5	0	28	27	27	28	39	35	33	27	62	30	31	28	24	35
ASMB #5	37	11	10	11	14	15	12	20	19	35	24	12	10	13	13
Chayvo #6	0	41	42	42	48	45	39		49	80	37	44	40	40	39
Chayvo #6	14	48	41	40	35	31	33		44	69	34	49	49	33	32
Chayvo #6	22	29	36	35	31	26	28		31	50	27	32	25	29	29
Chayvo #6	33	24	25	24	26	22	20		30	40	27	29	24	22	23
Diesel (2002)	0	72	71	72	72	50	54		70	69	43	74	71	58	57
Diesel (2002)	22	66	65	65	66	45	44		66	52	37	68	65	52	52
Sockeye (2000)	0	12	14	14	8	9	12	5	4	24	4	15	16	11	12
Sockeye (2000)	20	9	6	7	10	3	1	1	13	12	3	30	18	0	-2
South Louisiana (2001)	0	26	24	25	21	32	30	28	21	54	28	27	25	29	29
South Louisiana (2001)	26	10	11	11	13	14	13	19	14	34	22	13	17	13	16
West Texas (2000)	0	28	30	30	26	34	34	29	24	63	28	30	32	32	32
West Texas (2000)	32	13	15	15	20	15	14	16	11	32	19	16	11	14	15
Overall Statistics of Equations		Std. Deviation (average)	1.6	1.3	2.4	4.6	5	4.9	6.7	11.8	6	2.6	2	4.8	4.9
		Maximum Dev	5	6	9	32	30	34	18	42	39	15	6	31	34
		R^2	0.98	0.98	0.94	0.71	0.7	0.68	0.95	0.71	0.57	0.998	0.997	0.71	0.69

Abbreviations

SARA = Saturates, Aromatics, Resins, Asphaltenes

BP<250 = fraction having boiling point less than 250 °C

Compos = composition elements

VOCs - Volatile Organic Compounds

Low HC - low hydrocarbons

ap - as is possible

Table 5	Experimental and Predicted Dispersibilities for Corexit 9527, Dasic, and Enersperse							
Oil Name	Evap'n	Dispersibility % w/Corexit 9500	Actual Dispersibility % w/Corexit 9527	Predicted Dispersibility % w/Corexit 9527	Actual Dispersibility % w/Dasic LTS	Predicted Dispersibility % w/Dasic LTS	Actual Dispersibility % w/Enersperse 700	Predicted Dispersibility % w/Enersperse 700
Adgo	0	29			10	14		
Amauligak	0	45	55	36	25	21		
ANS (1989)	0	10		8	15	6		
Arabian Light	0	21	25	16	25	11	10	13
BCF 24	0	12	20	9	0	7	5	9
Belridge Heavy	0	4	9	3	0	3	0	4
Bent Horn	0	25			15	13	15	16
Beta	0	0	0	0	0	2	0	2
Bunker C Light Fuel Oil	0	5	0	4	0	4	0	5
California (API 11)	0	0	0	0	0	2	0	2
California (API 15)	0	0	0	0	0	2	0	2
Carpinteria	0	16	0	12	0	9	11	11
Carpinteria	10	7	0	5	0	5	0	6
Carpinteria	15	7	0	5	0	5	0	6
Catalytic Cracking Feed	0	10	5	8	5	6	5	7
Dos Cuadras	0	37	5	29	5	18	5	22
Dos Cuadras	11	15	8	12	8	8	10	10
Dos Cuadras	20	7	10	5			0	6
Empire	0	31	10	24	10	15	10	19
Endicott	0	10	10	8	5	6	10	7
Eugene Island Block 43	0	22	5	17	20	11	0	14
Federated (1994)	0	61	20	48	19	28	15	35
Federated (1994)	16	38	8	30	16	18	13	23
Federated (1994)	28	22	4	17	9	11	3	14
Federated (1994)	42	18	2	14	1	9	5	12
Granite Point	0	41	87	32	9	20	27	24
Green Canyon Block 109	0	20	5	16	10	10	5	13
Green Canyon Block 65	0	15	5	12	5	8	10	10
Gullfaks	0	25	20	20	10	13	10	16
Hondo	0	8	5	6	0	5	4	6
Hondo	17	6	0	4	0	4	0	5
Hondo	32	4	0	3	0	3	0	4
Hout	0	18	2	14	10	9	5	12
Iranian Heavy	0	14	10	11	5	8	10	10
Lago	0	10	0	8	0	6	5	7
Louisiana	0	34	13	27	17	16	14	21
Lucula	0	20	5	16	5	10	5	13
Main Pass Block 306	0	27	25	21	20	13	30	17
Main Pass Block 37	0	33	20	26	25	16	10	20
Malongo	0	15	5	12	0	8	5	10
Mississippi Canyon Block 194	0	29	15	23	15	14	10	18
Norman Wells	0	35			20	17	65	21
Oseberg	0	15	30	12	10	8	20	10
Pitas Point	0	65	42	52	55	30	66	38
Pitas Point	24	66	38	52	50	31	59	38
Point Arguello Comingled	0	3	0	2	0	3	0	4
Point Arguello Comingled	9	0	0	0	0	2	0	2
Point Arguello Comingled	16	0	0	0	0	2	0	2
Point Arguello Comingled	22	0	0	0	0	2	0	2
Point Arguello Heavy	0	0	0	0	0	2	0	2
Point Arguello Heavy	9	0	0	0	0	2	0	2
Point Arguello Heavy	18	0	0	0	0	2	0	2
Point Arguello Light	0	13	10	10	3	7	6	9
Port Hueneme	0	12	0	9	0	7	0	9
Port Hueneme	4	5	0	4	0	4	0	5
Port Hueneme	8	0	0	0	0	2	7	2
Sakhalin	0	84	76	67				
Sakhalin	25	49	73	39				
Sakhalin	42	31	49	24				

Table 6 Cross-Correlation Matrix of Parameters

	Disp 9500	Density	Pour Point	Viscosity	Disp 9527	Disp Dasic	Disp Enersperse	Saturates	Aromatics	Resins	Asphaltenes	Waxes	VOCs	BP<200	BP<250	c12-18	C12	C14	C16	C18	C20	C26	Napthalenes	PAHs
Disp 9500		-0.54	-0.25	-0.64	0.45	0.42	0.31	0.36	-0.18	-0.53	-0.24	-0.02	0.33	0.44	0.63	0.66	**0.79**	0.61	0.56	0.32	0.16	**-0.7**	**0.76**	**0.7**
Density	-0.54		**0.09**	0.02	-0.2	-0.18	-0.28	**-0.81**	0.47	**0.7**	0.58	-0.14	-0.29	-0.55	-0.65	0.39	-0.5	-0.35	-0.32	-0.28	-0.19	0.06	-0.4	-0.31
Pour Point	-0.25			0.23	-0.16	-0.16	-0.29	0.08	0.04	0.06	0.05	0.28	-0.1	-0.18	-0.28	0.3	-0.48	-0.33	-0.25	-0.17	0.17	0.56	-0.49	-0.44
Viscosity	-0.64				-0.37	-0.6	-0.52	-0.6	0.28	0.62	0.6	0.06	-0.29	-0.57	**-0.76**	0.38	-0.6	-0.35	-0.31	-0.24	-0.15	0.19	-0.5	-0.38
Disp 9527	0.45					0.16	0.29	0.14	-0.08	-0.15	-0.2	-17	0.24	0.29	0.3	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd
Disp Dasic	0.42						0.54	0.25	-0.15	-0.24	-0.17	-0.09	0.1	0.42	0.53	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd
Disp Enersperse	0.31							0.2	-0.09	-0.15	-0.13	-0.16	0.12	0.38	0.43	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd
Saturates	0.36								-0.77	-0.76	-0.62	0.11	0.15	0.21	0.36	0.61	0.62	0.55	0.54	0.48	0.3	0.1	0.53	0.54
Aromatics	-0.18									0.24	0.07	-0.1	0.08	-0.12	-0.21	-0.55	-0.5	-0.51	-0.5	**-0.5**	-0.31	-0.03	-0.53	0.53
Resins	-0.53										0.49	-0.09	-0.16	-0.22	-0.39	-0.5	-0.65	-0.45	-0.42	-0.33	-0.23	-0.03	-0.55	-0.49
Asphaltenes	-0.24											-0.04	-0.15	-0.11	-0.2	-0.66	-0.72	-0.6	-0.55	-0.48	-0.43	-0.39	-0.56	-0.4
Waxes	-0.02												-0.03	-0.02	-0.01	0.1	0	0.07	0.16	0.4	**0.72**	**0.89**	0.16	0.24
VOCs	0.33													0.61	0.51	0.02	0.08	-0.04	-0.05	-0.01	0.02	0.08	0.16	-0.03
BP<200	0.44														0.83	0.18	0.24	0.18	0.17	0.15	0.13	0.06	0.11	0.1
BP<250	0.63															0.38	0.63	0.36	0.29	0.16	0.11	-0.19	0.53	0.4
C12-18	0.66																0.87	0.99	0.98	0.81	0.48	0.15	**0.92**	**0.91**
C12	**0.79**																	0.89	0.79	0.52	0.27	-0.2	**0.81**	**0.71**
C14	0.61																		0.98	0.78	0.45	0.4	**0.88**	**0.86**
C16	0.56																			0.87	0.54	0.19	**0.91**	**0.92**
C18	0.32																				0.83	0.39	0.61	**0.75**
C20	0.16																					0.72	0.26	0.41
C26	**-0.7**																						**0.8**	0.62
Napthalenes	**0.76**																							0.98
PAHs	**0.7**																							

Abbreviations Disp = dispersibility nsc = not sufficient data

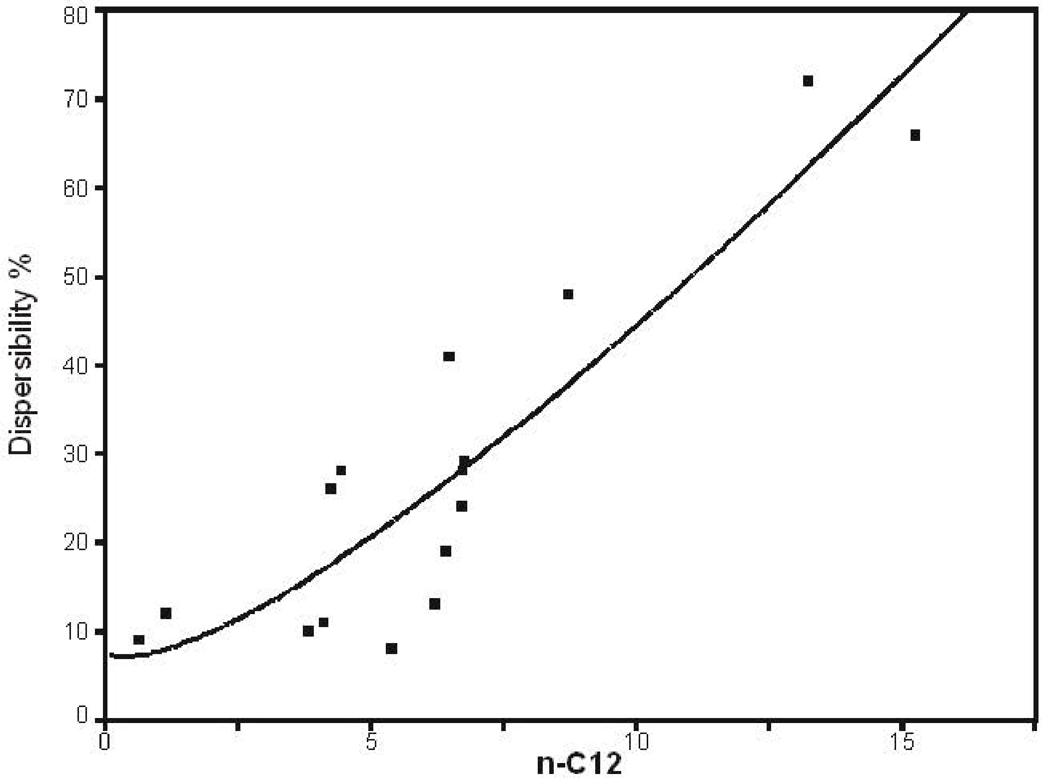

Figure 1 Correlation of C12 Components and Corexit 9500 Dispersibility

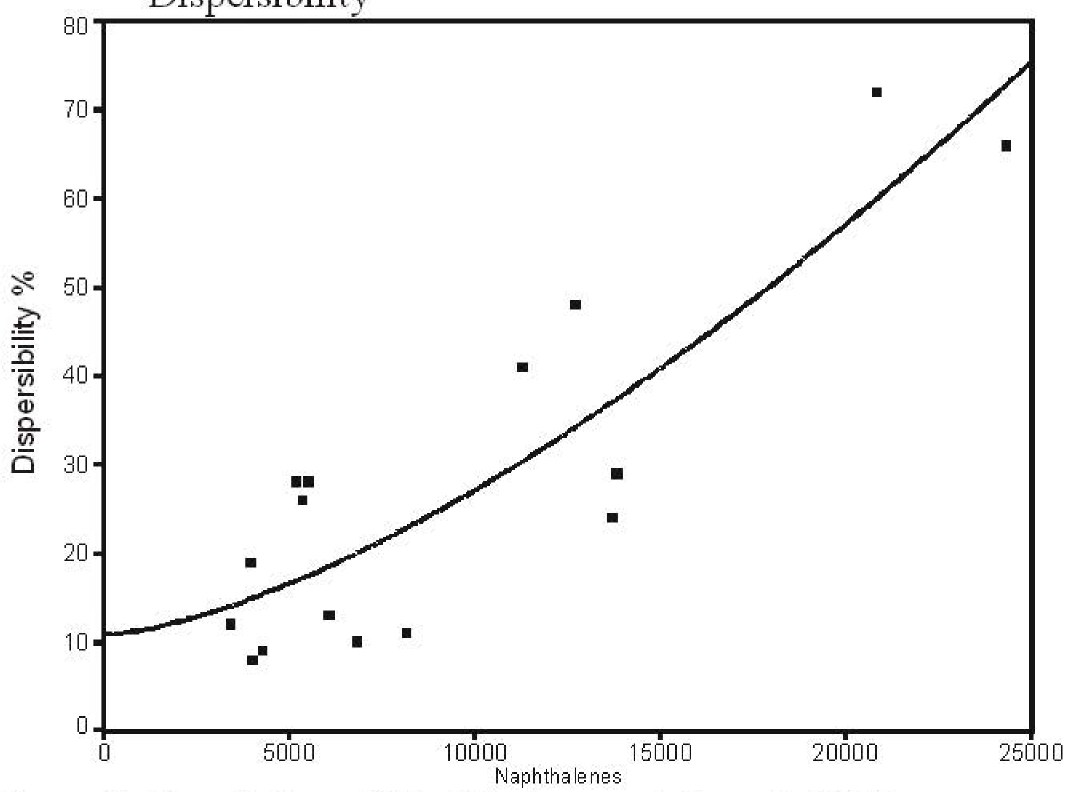

Figure 2 Correlation of Naphthalene and Corexit 9500 Dispersibility

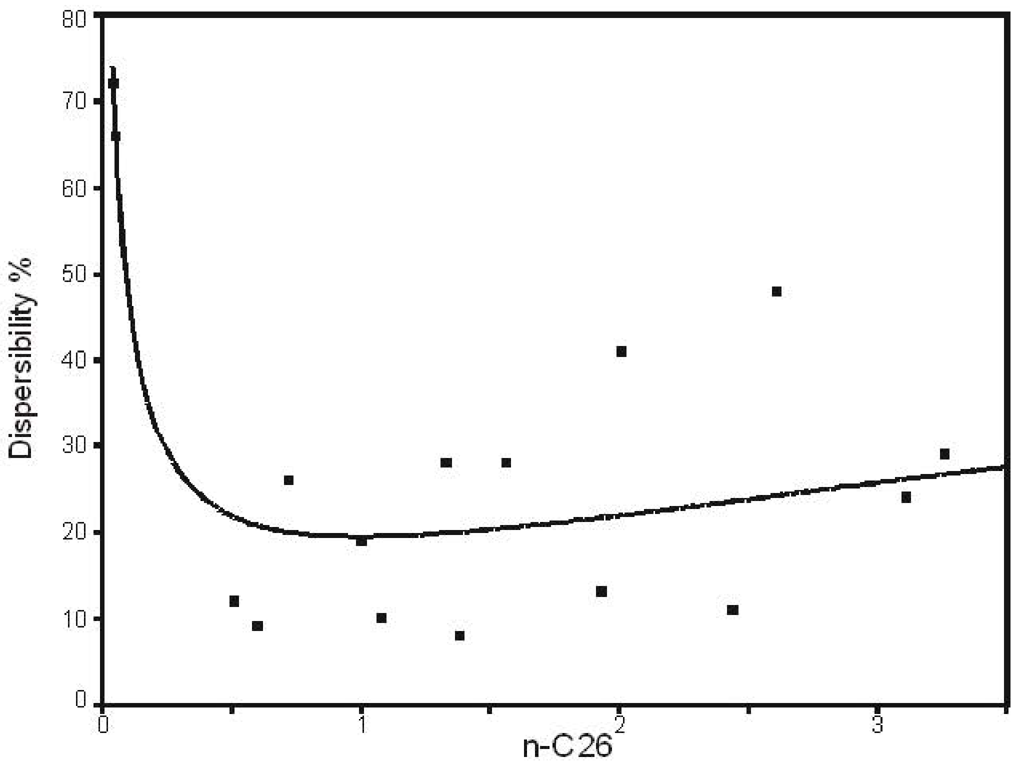

Figure 3 Correlation of C26 Components and Corexit 9500
Dispersibility

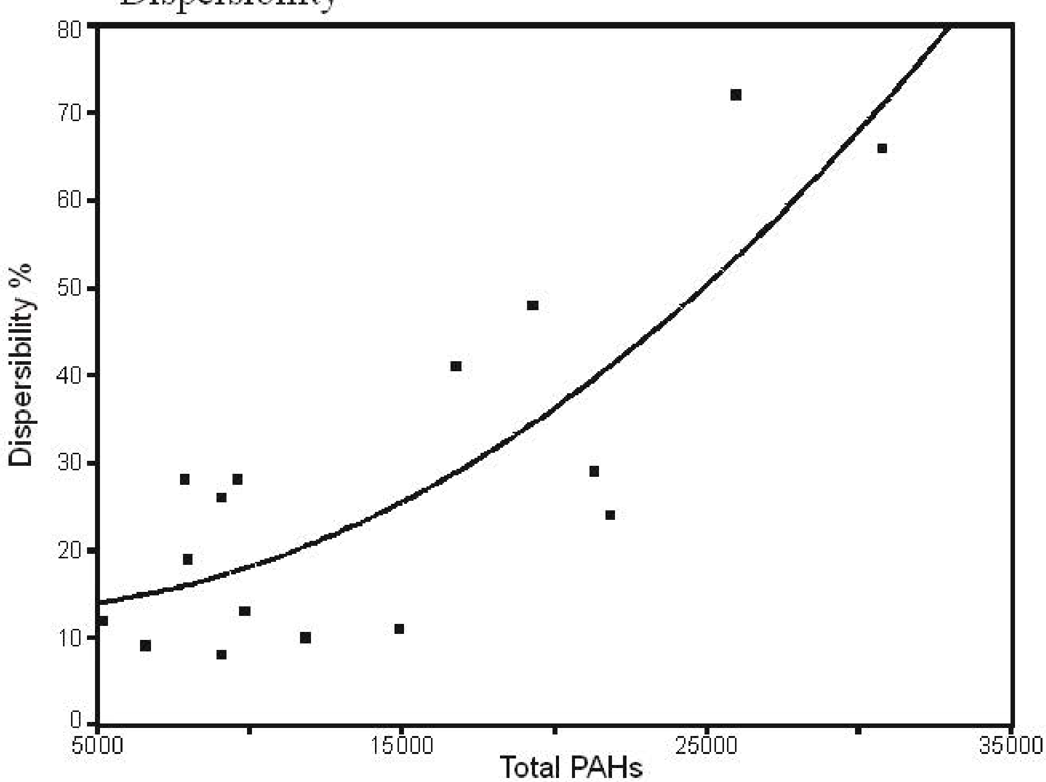

Figure 4 Correlation of PAHs and Corexit 9500
Dispersibility

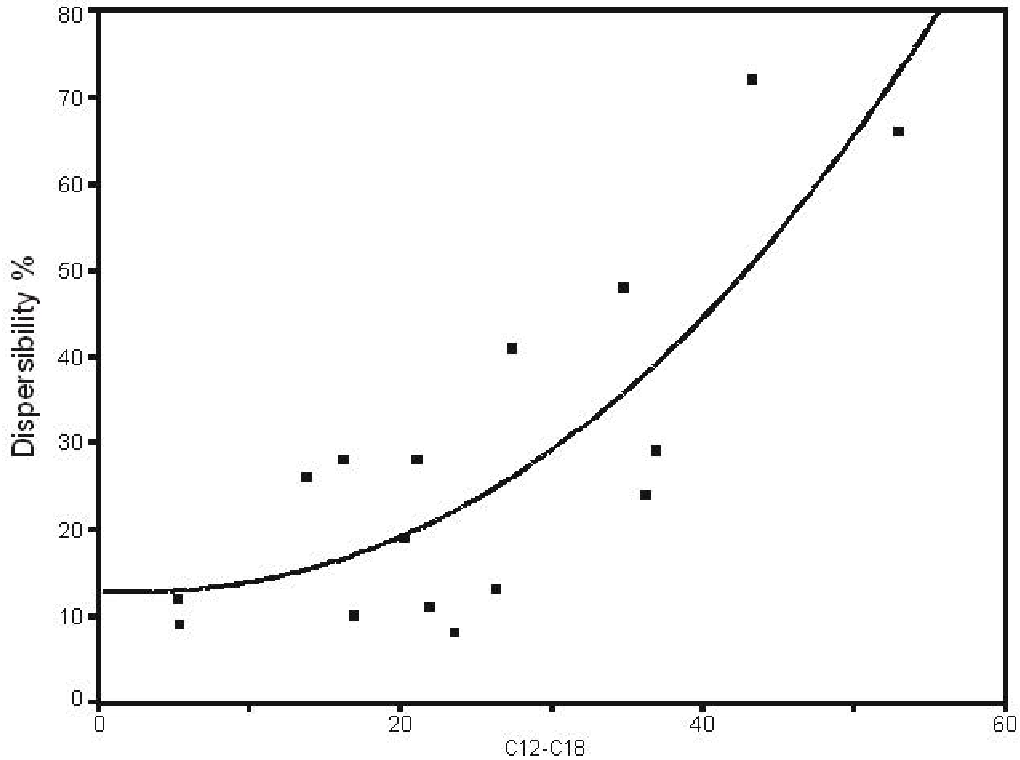

Figure 5 Correlation of C12 to C18 Components and Corexit 9500 Dispersibility

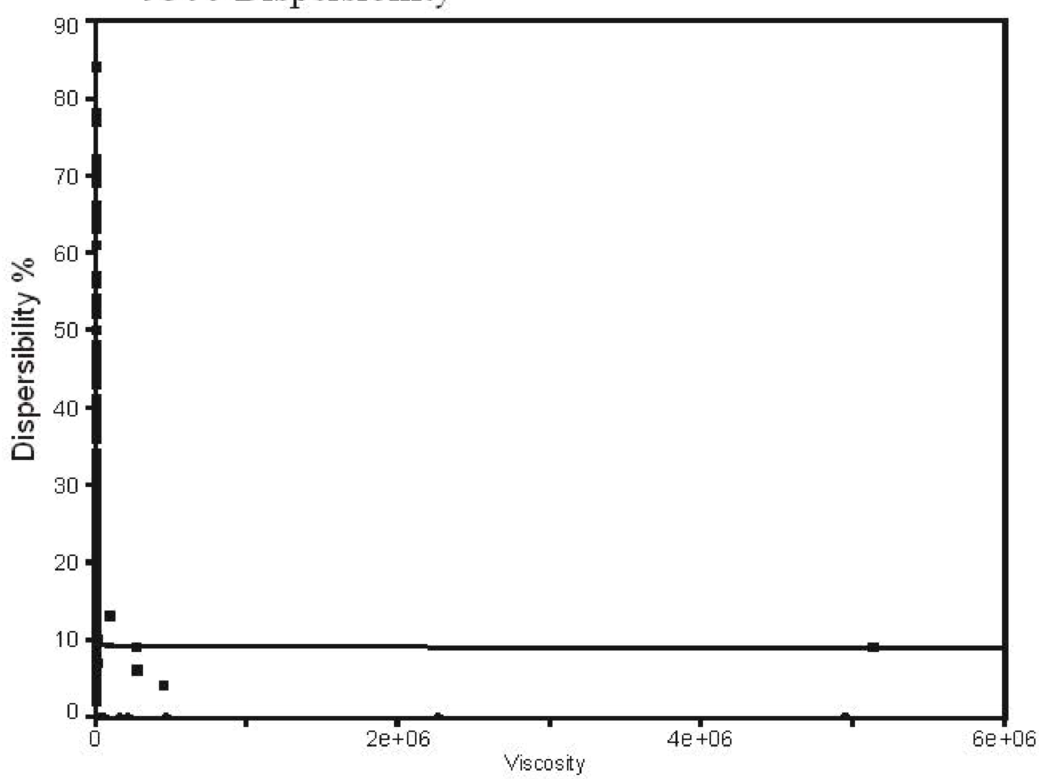

Figure 6 Correlation of Viscosity and Corexit 9500 Dispersibility

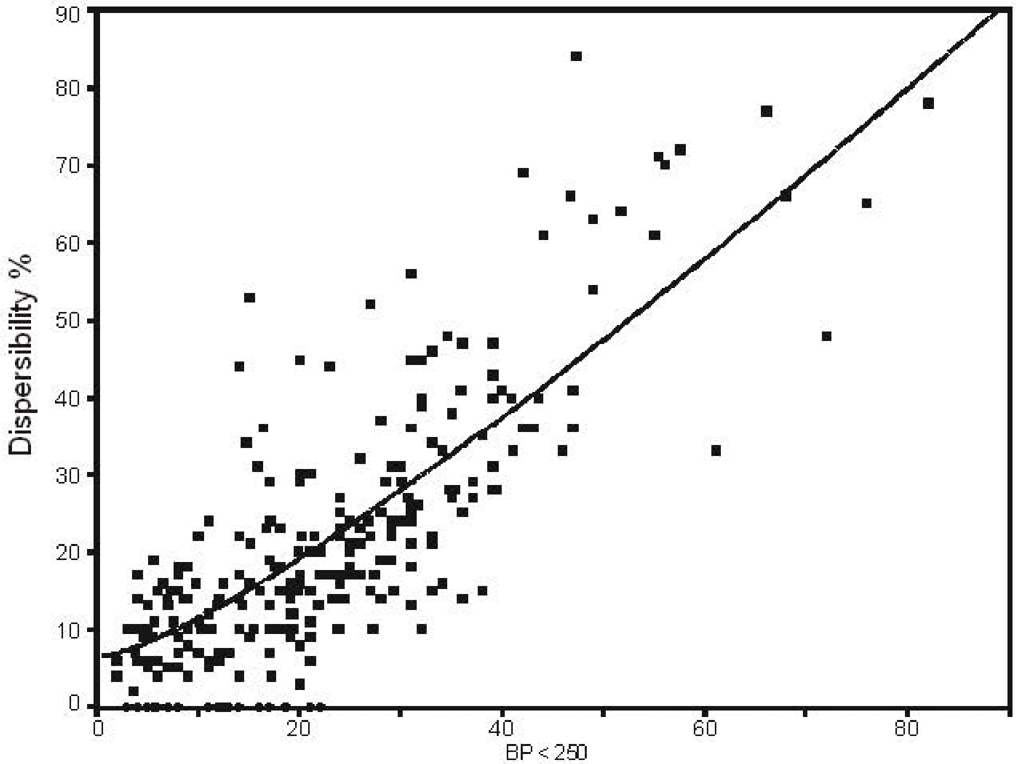

Figure 7 Correlation of Components Boiling at Less Than 250 °C and Corexit 9500 Dispersibility

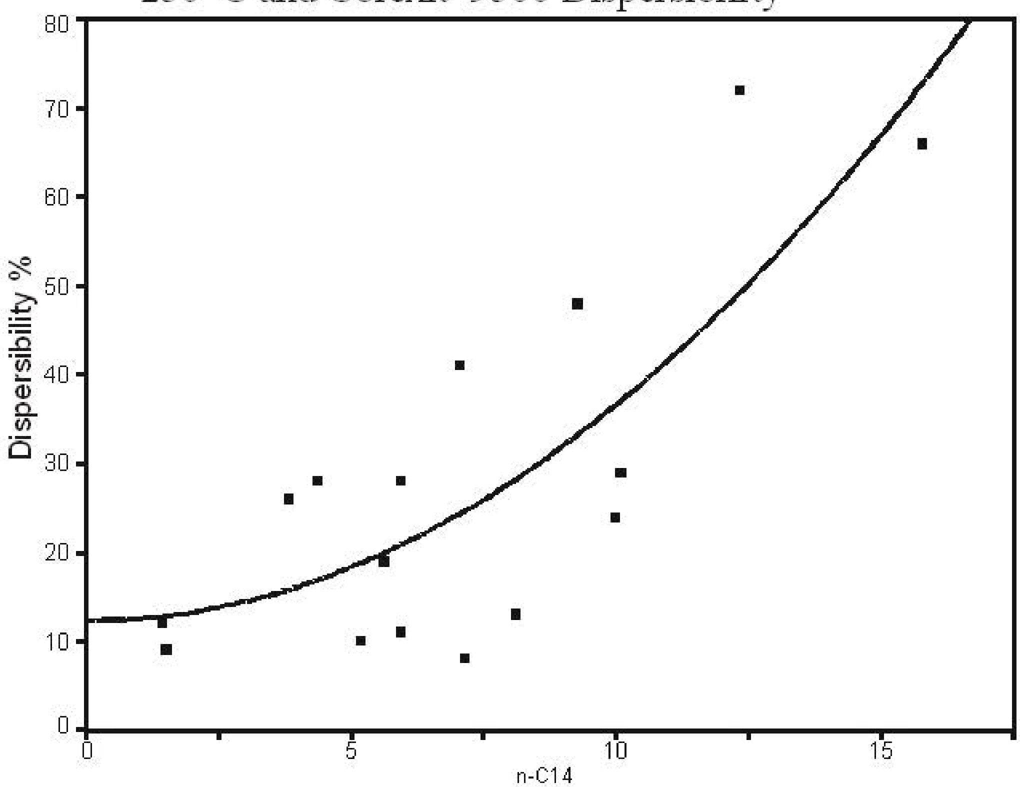

Figure 8 Correlation of C14 Components and Corexit 9500 Dispersibility

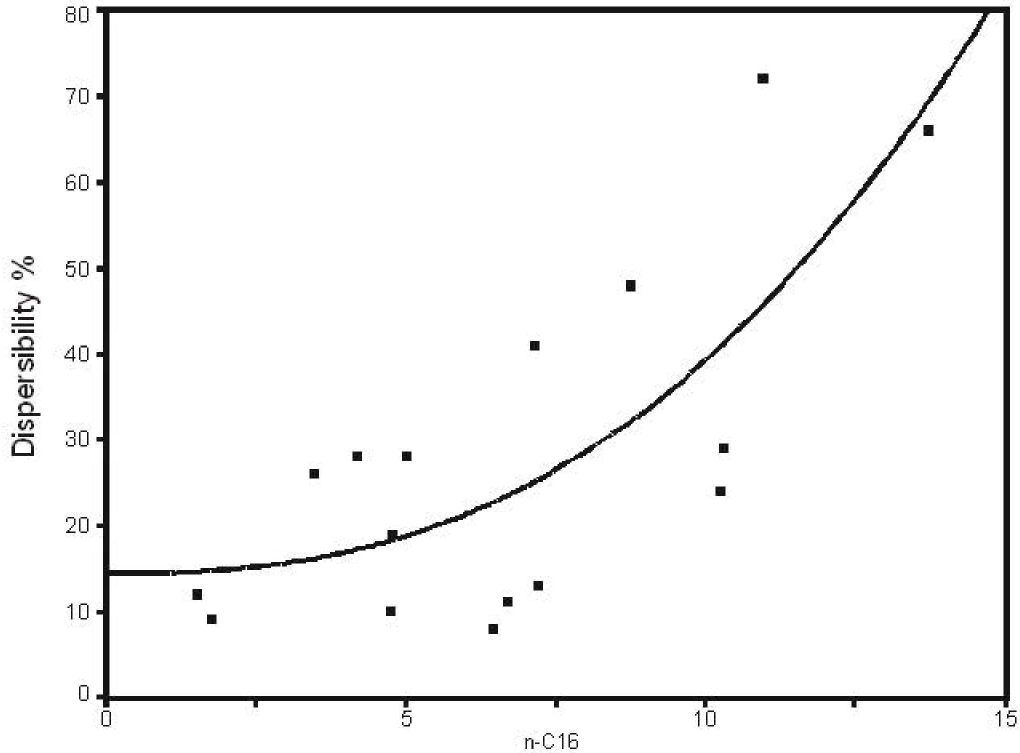

Figure 9 Correlation of the C16 Components and Corexit 9500 Dispersibility

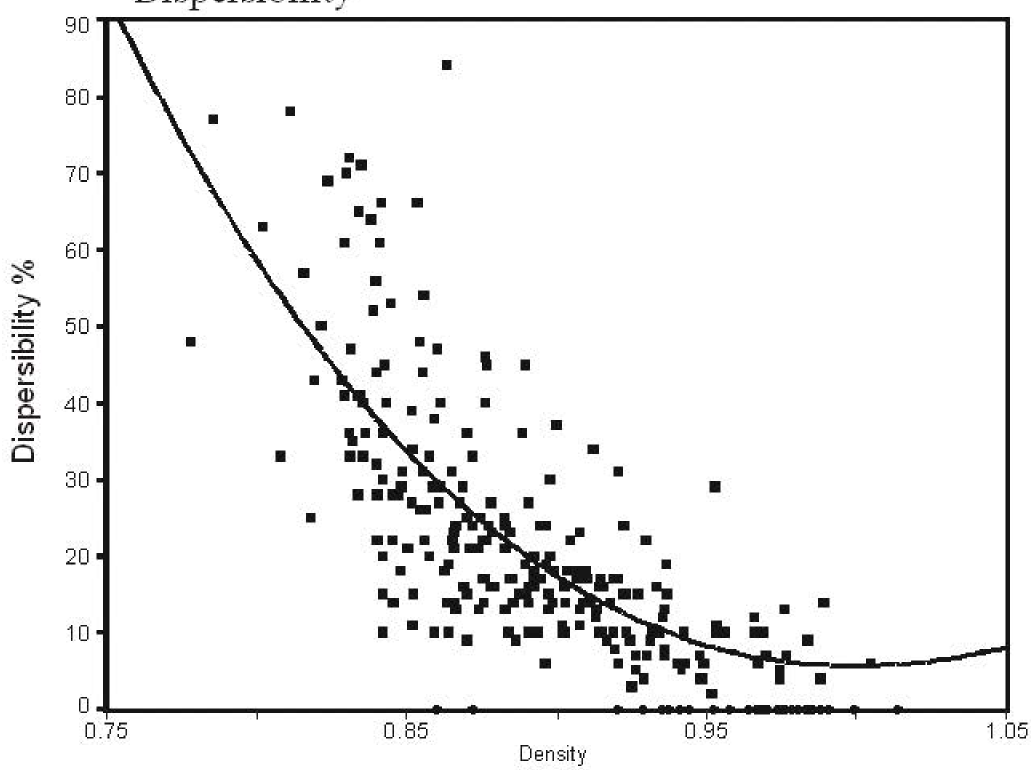

Figure 10 Correlation of Density and Corexit 9500 Dispersibility

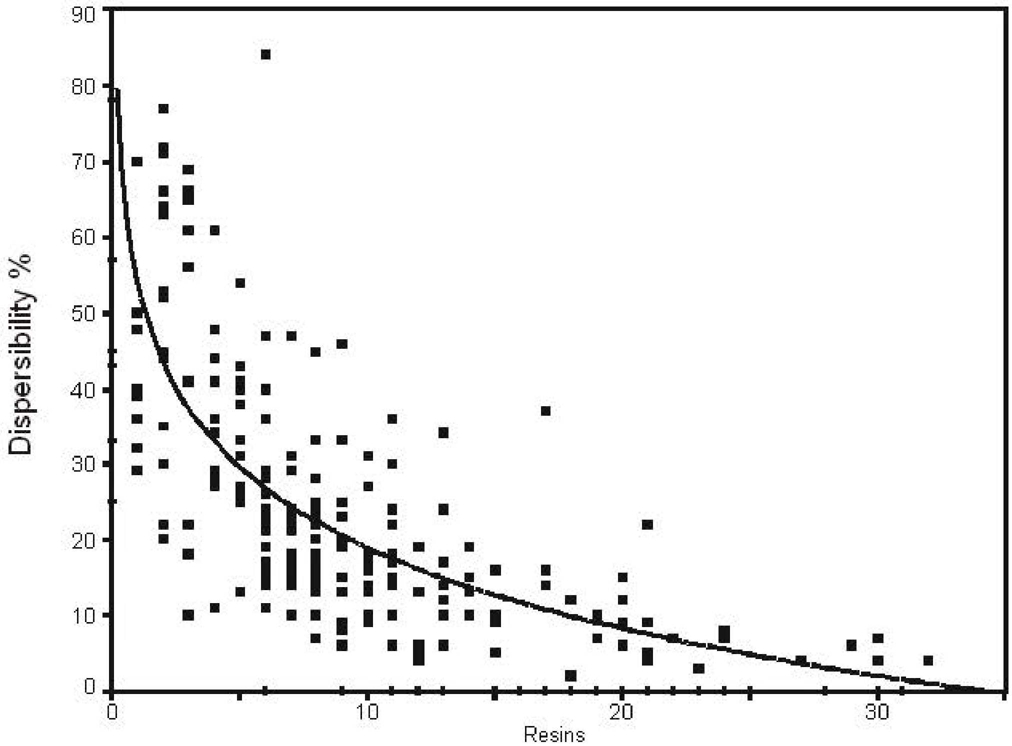

Figure 11 Correlation of the Resin Component and Corexit 9500 Dispersibility

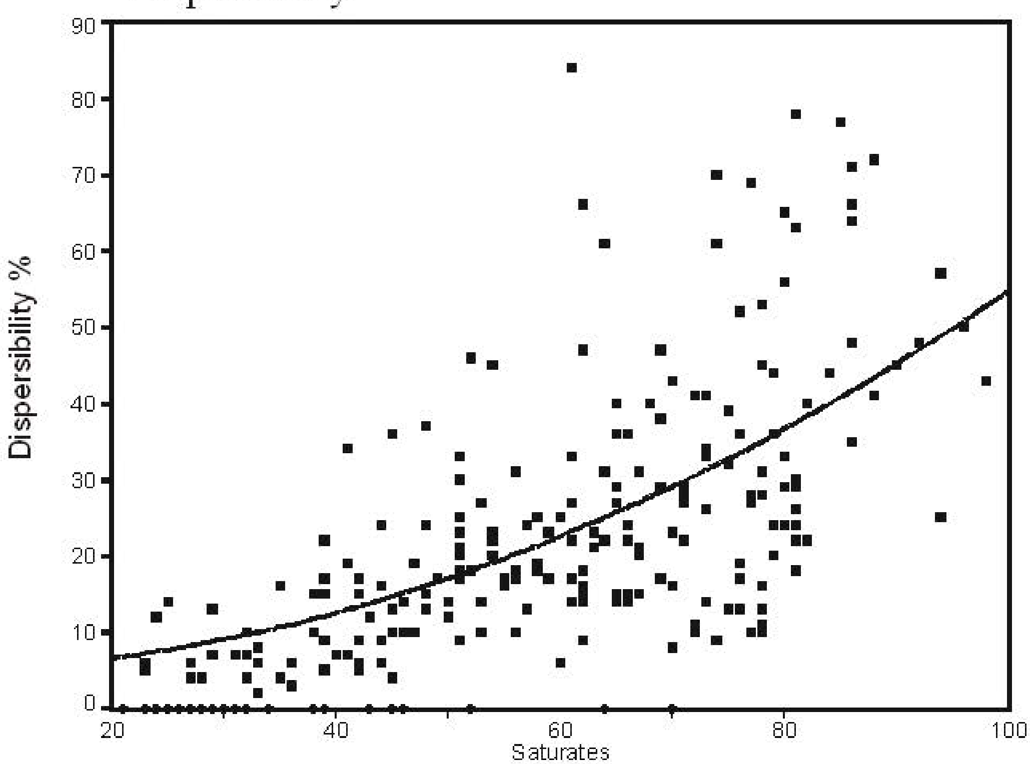

Figure 12 Correlation of the Saturate Component with Corexit 9500 Dispersibility

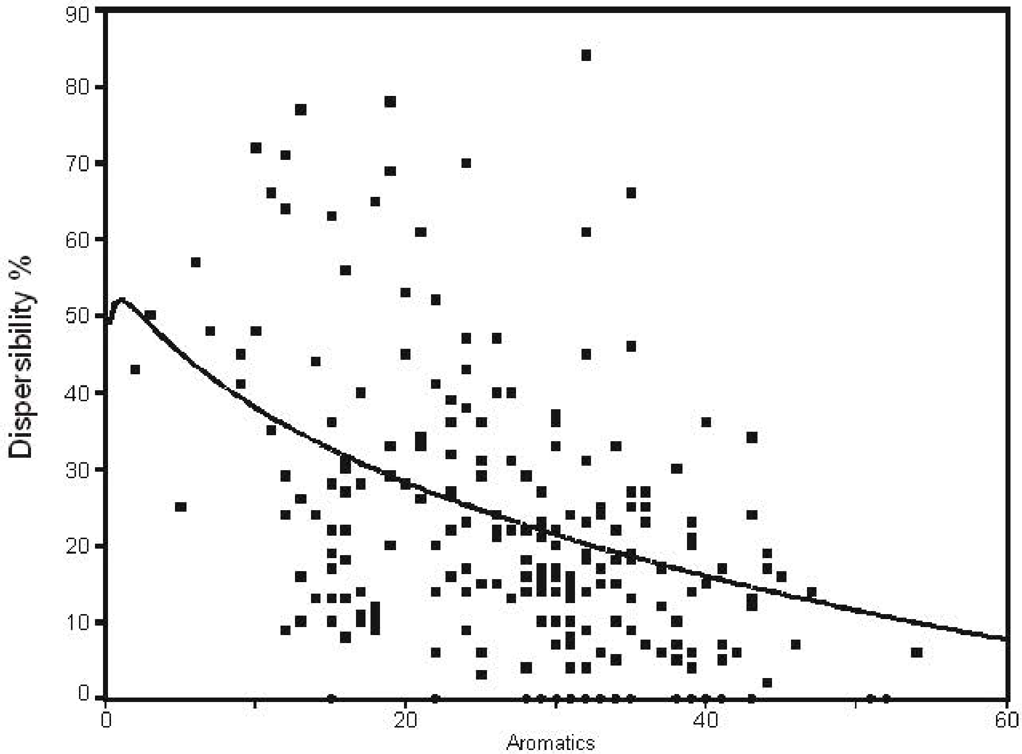

Figure 13 Correlation of the Aromatics and Corexit 9500 Dispersibility

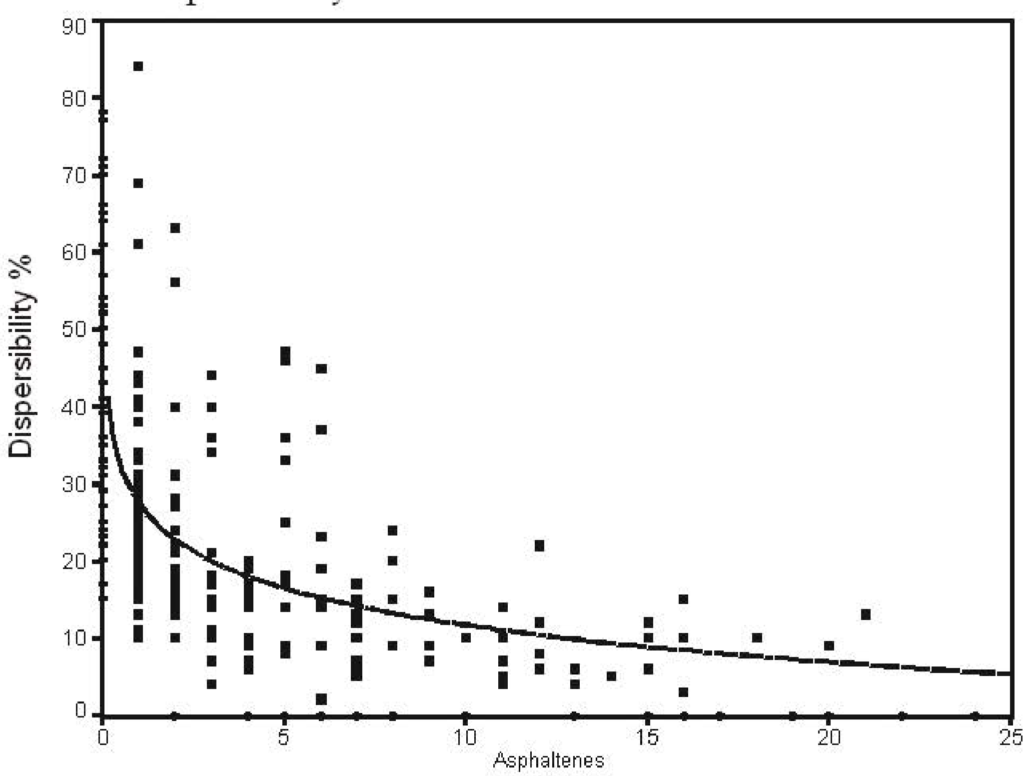

Figure 14 Correlation of Asphaltenes with Corexit 9500 Dispersibility

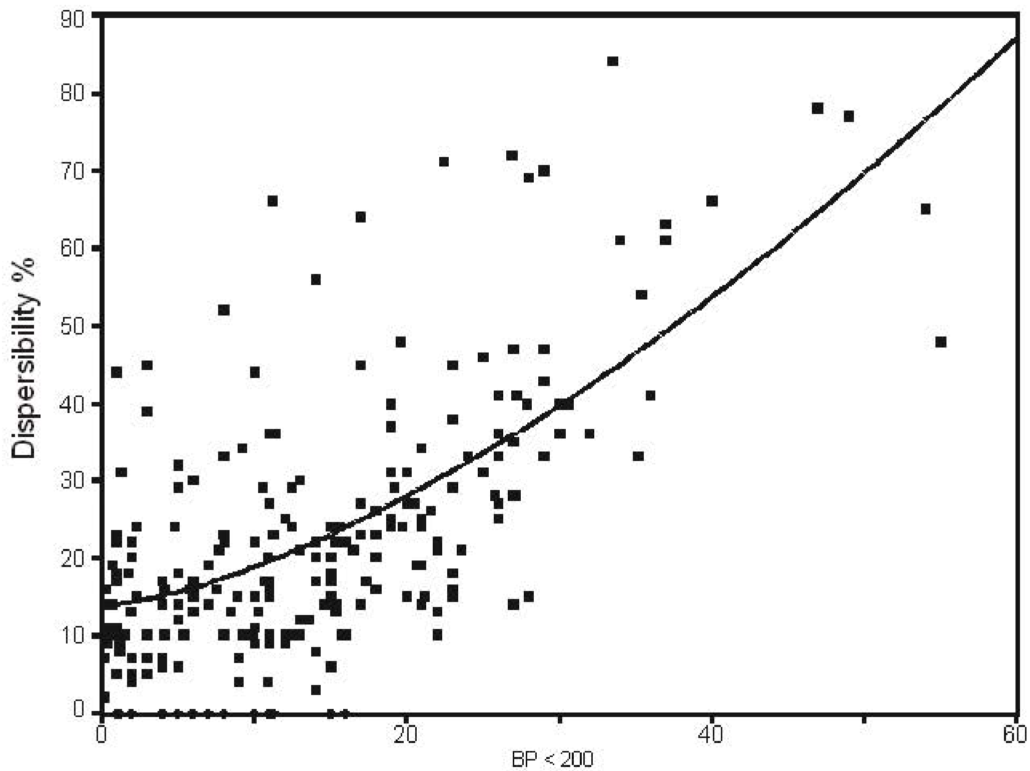

Figure 15 Correlation of the Fraction Boiling <200 °C and Corexit 9500 Dispersibility

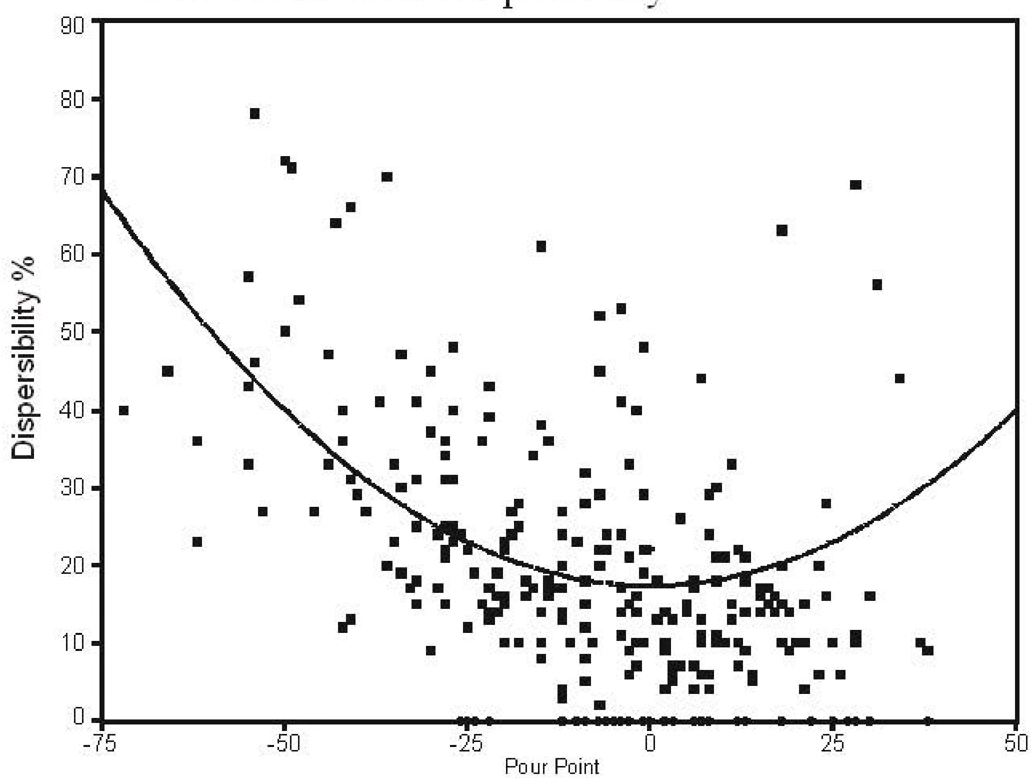

Figure 16 Correlation of Pour Point with Corexit 9500 Dispersibility

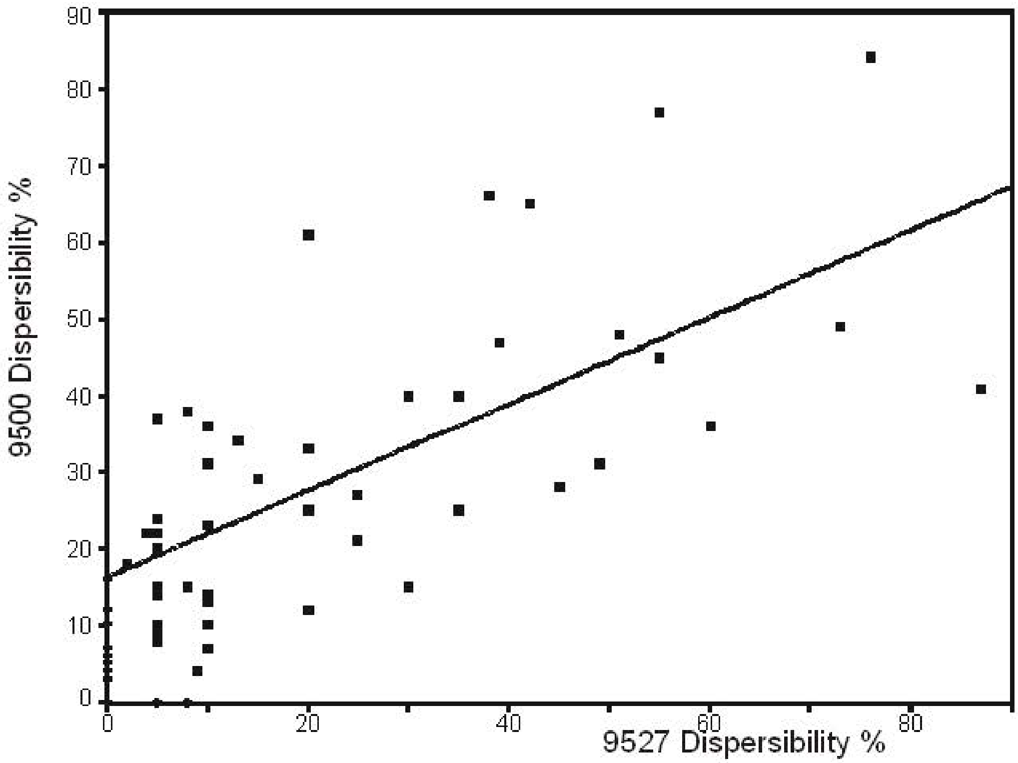

Figure 17 Correlation of the Corexit 9527
and Corexit 9500 Dispersibility

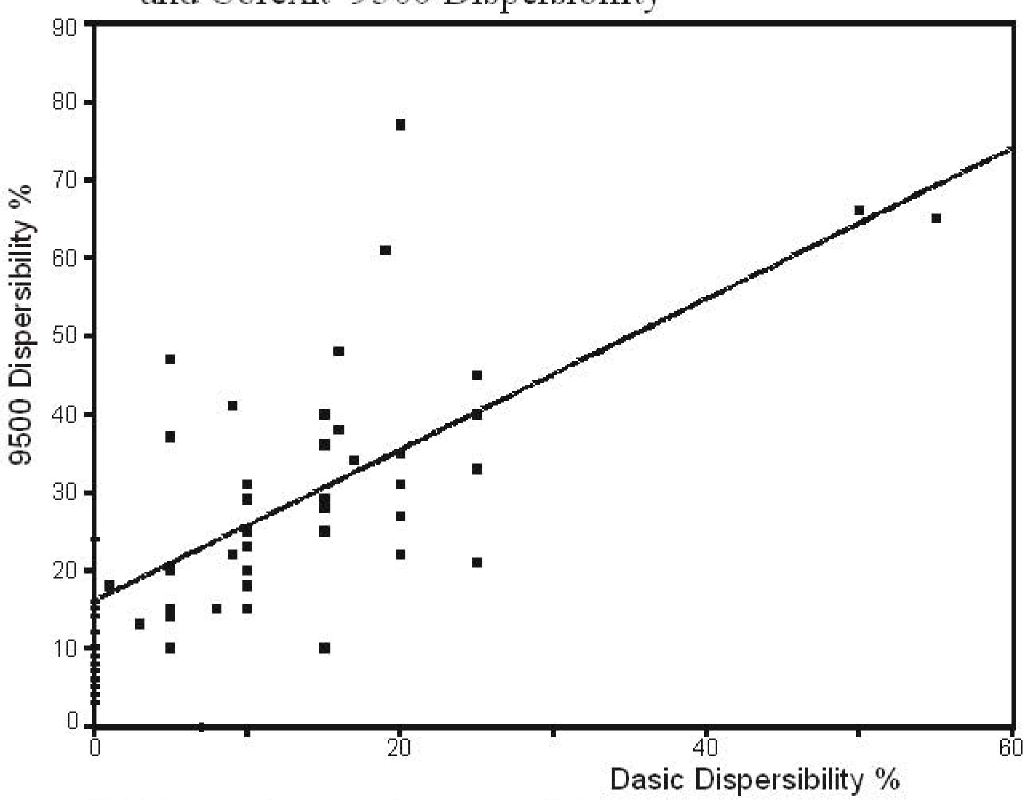

Figure 18 Correlation of Corexit 9500 and
Dasic LTS Dispersibility

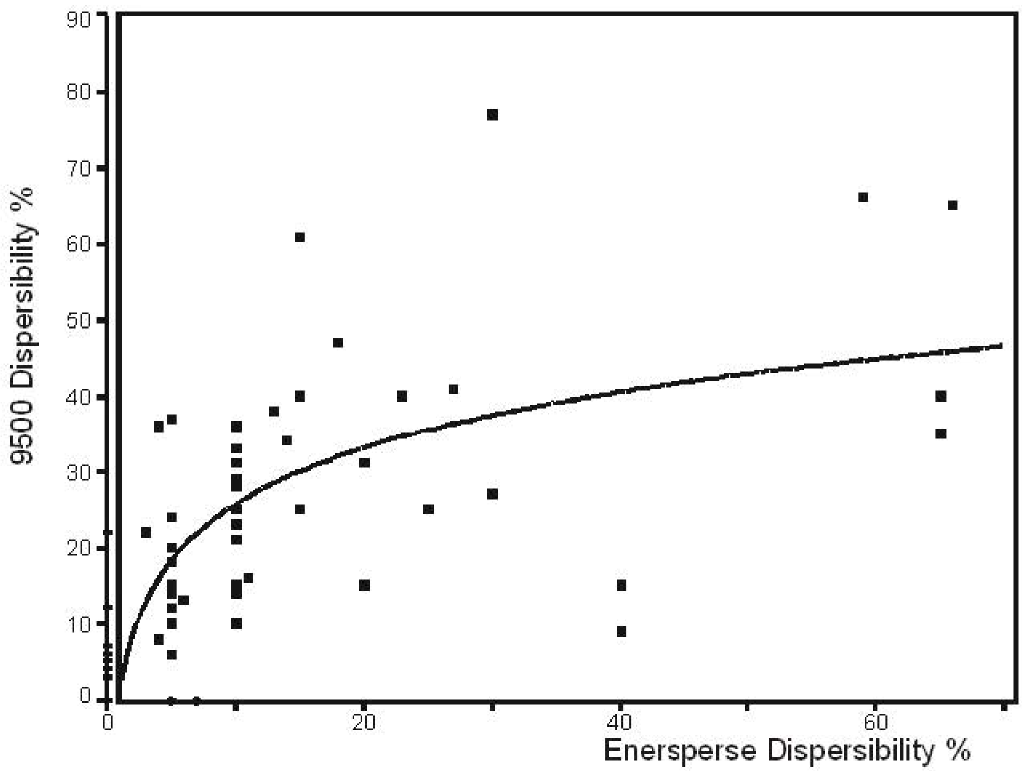

Figure 19 Correlation of the Enersperse 700
and Corexit 9500 Dispersibility

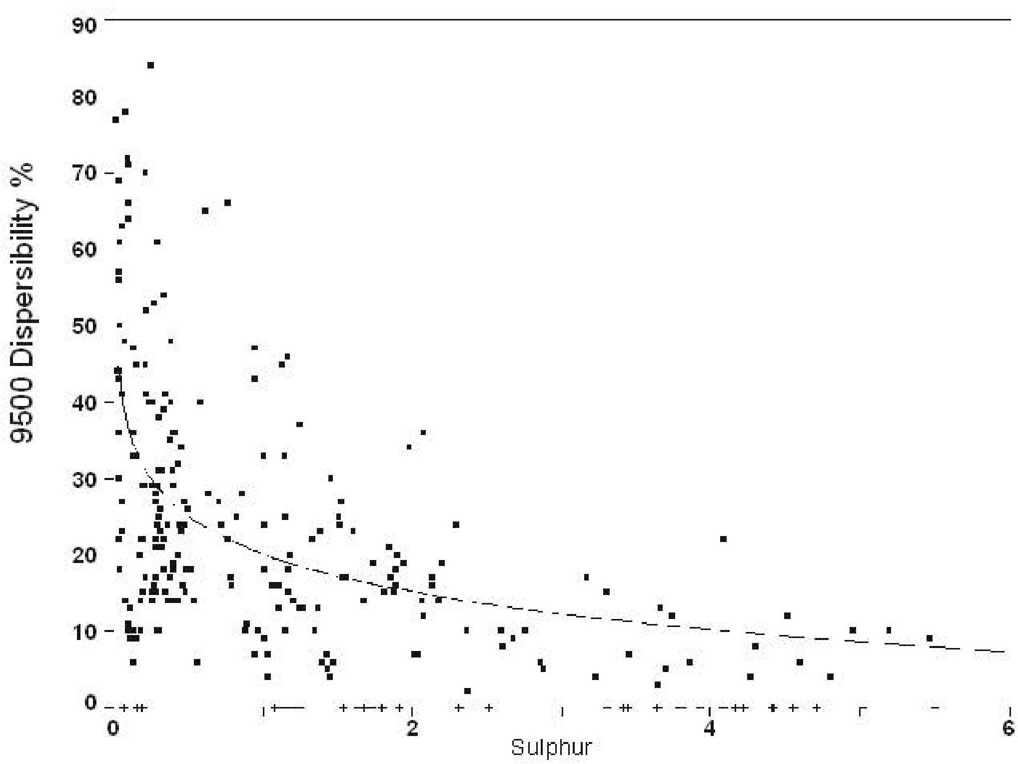

Figure 20 Correlation of Sulphur Content and
Corexit 9500 Dispersibility

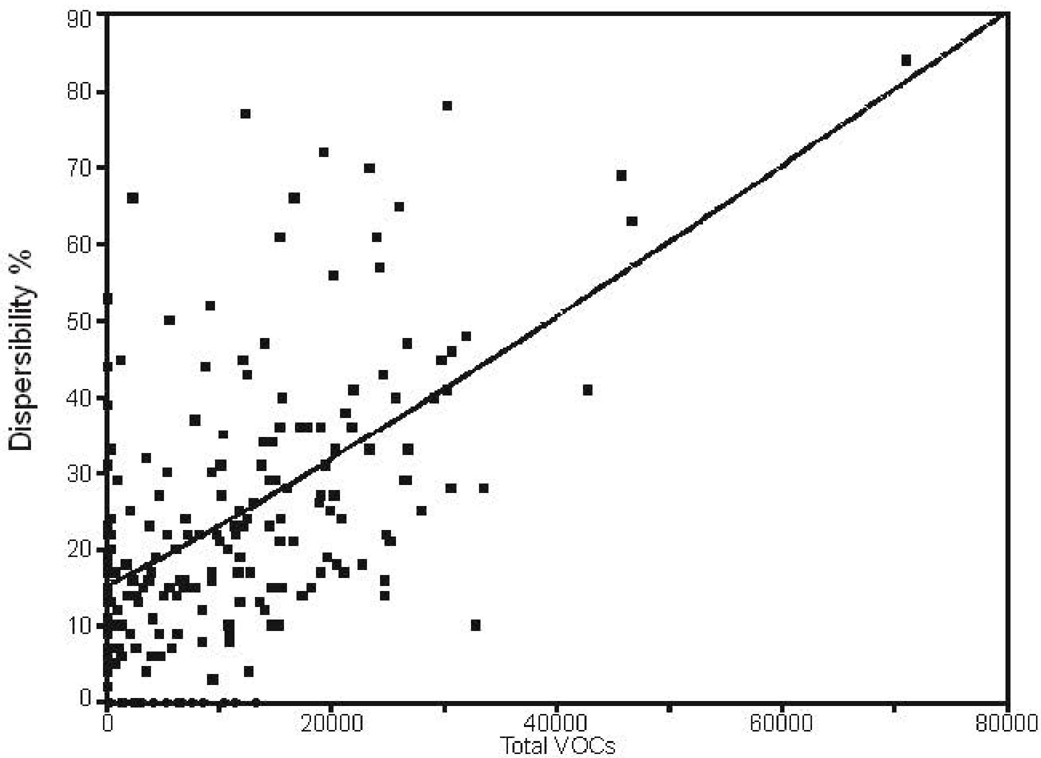

Figure 21 Correlation of the Total VOC Content
and Corexit 9500 Dispersibility

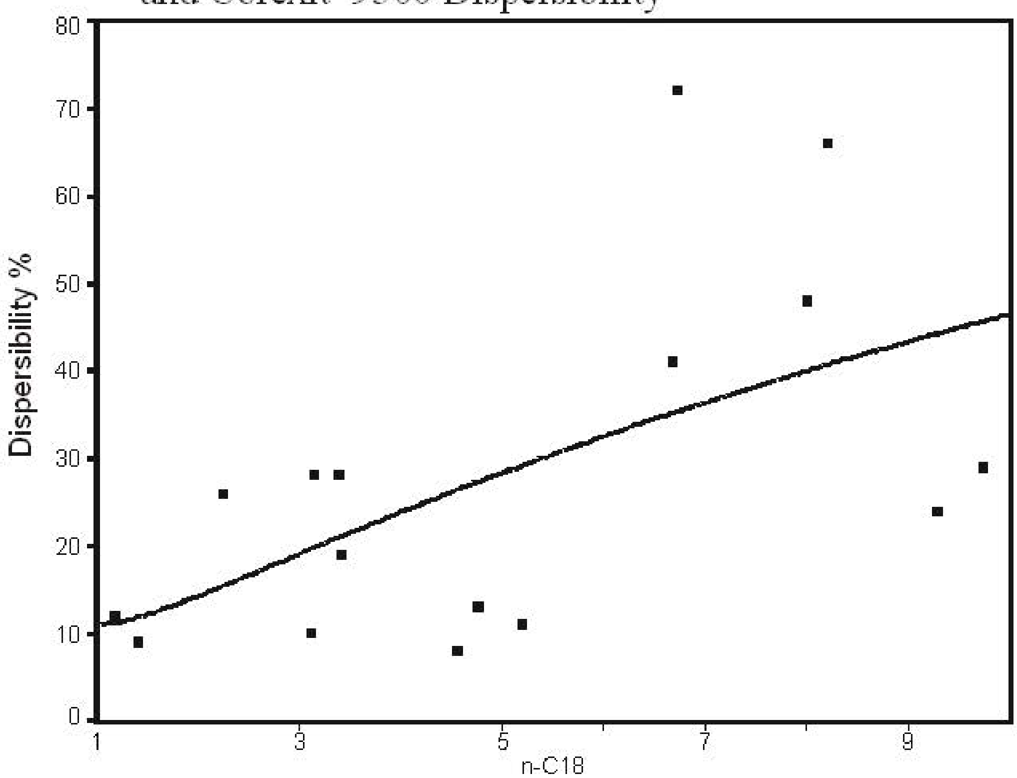

Figure 22 Correlation of C18 Content and
Corexit 9500 Dispersibility

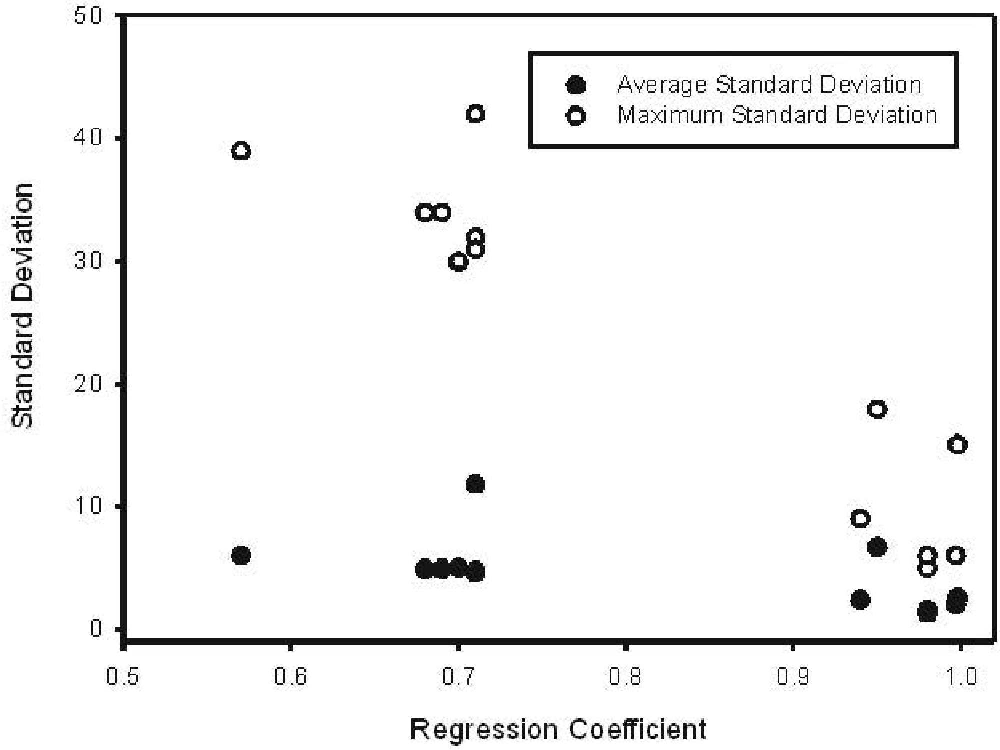

Figure 23 Comparison of Average and Standard Deviation to the Regression Coefficient

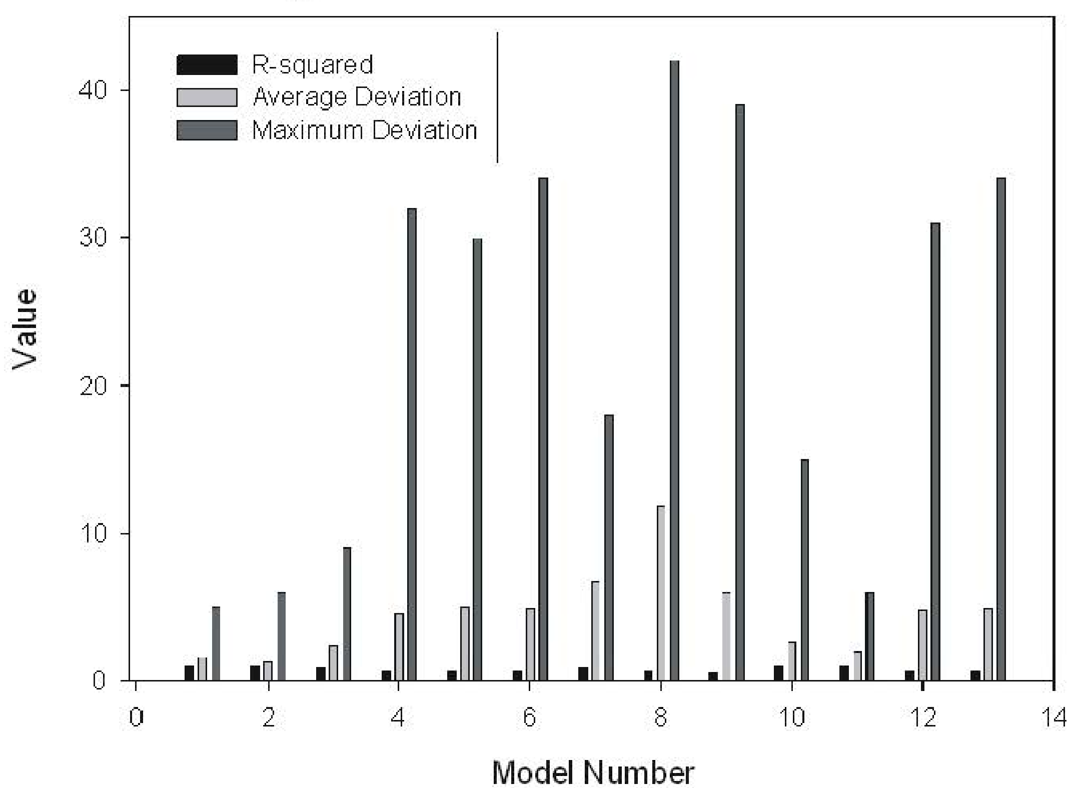

Figure 24 Error and Fit Indicators of Each Model

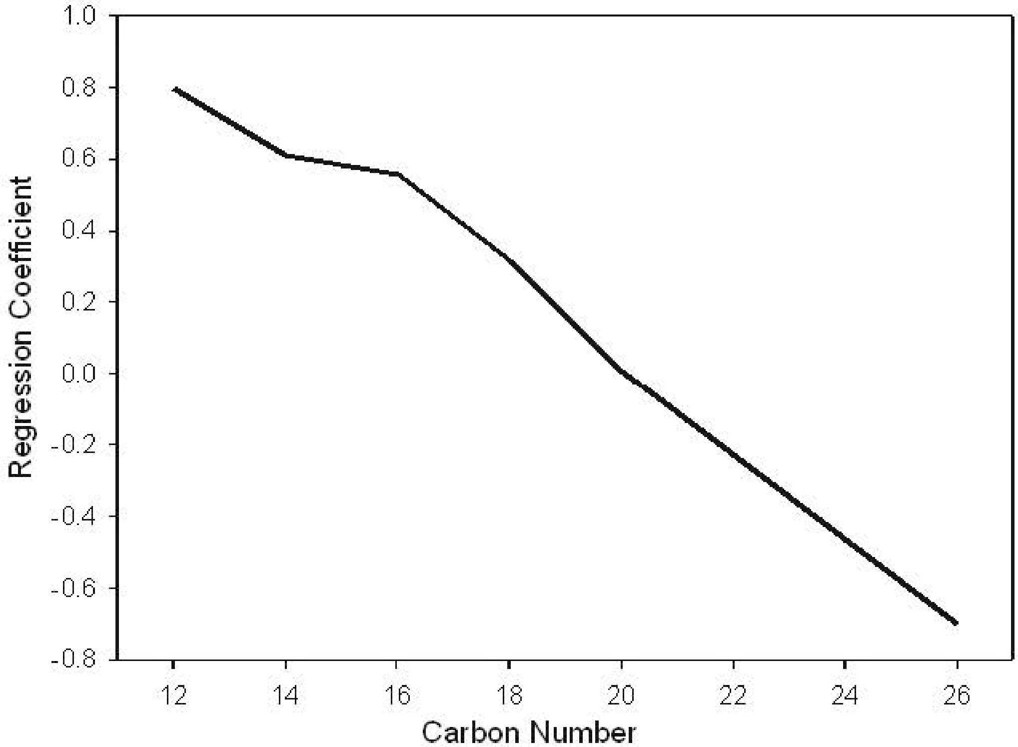

Figure 25 Comparison of Regression Coefficients
with n-Alkane Carbon Number

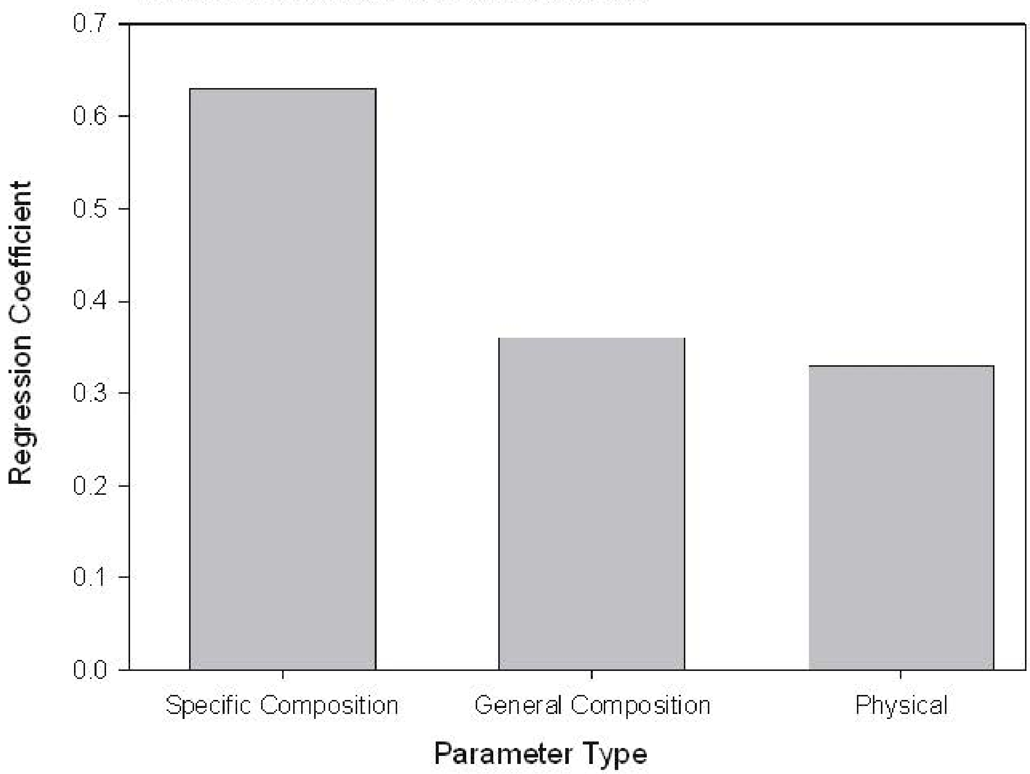

Figure 26 Regression Coefficients Classified by Type

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (°C)	Reid VP (kPa)	Density (g/mL)	Pour Point (°C)	Viscosity (mPa.s)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enersperse 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Adgo	0	0.19			0.9530		62		29		10		80	19	1	0
Amauligak	0	0.15	2		0.8896	-66	14		45	55	25		90	9	0	0
ANS (1989)	0	1.15		19	0.8936	-8	23		10		15					2
ANS (1989)	9	1.19			0.9086		66			10	10	10				3
ANS (1989)	16	1.30			0.9225		184			5	0	5				5
ANS (Middle Pipeline)	0	1.16	-23		0.8761	-51	16		46				52	35	9	5
ANS (Middle Pipeline)	31	1.43			0.9418	14	900	120	5				42	38	12	7
ANS (Northern Pipeline)	0	1.14	-19		0.8719	-55	14		33				51	34	9	5
ANS (Northern Pipeline)	31	1.39	90		0.9402	8	748	110	8				44	37	12	7
ANS (Southern Pipeline)	0	1.13	-21		0.8766	-30	18		45				54	32	8	6
ANS (Southern Pipeline)	30	1.46			0.9431	14	961	190	6				42	39	13	7
Arabian Heavy (2000)	0		-16		0.8697	-32	43		15							
Arabian Heavy (2000)	9		39		0.9176	-21	157		14							
Arabian Heavy (2000)	16		80		0.9356	12	621		13							
Arabian Heavy (2000)	24		100		0.9536	-4	3244		11							
Arabian Light	0	1.84	-20		0.8658	-28	14	470	21	25	25	10	51	39	6	3
Arabian Light	12	1.85	22		0.8921	-13	33	400	17				49	37	8	5
Arabian Light	24	2.06	80		0.9111	-12	94	510	11				46	38	10	6
Arabian Light (2000)	0	1.93	-10		0.8641	-21	13	93	19				76	15	6	4
Arabian Light (2000)	9	2.17	36		0.8660	-15	27	212	14				73	17	6	4
Arabian Light (2000)	18	2.36	72		0.9028	-8	60	274	10				72	17	7	4
Arabian Light (2000)	26	2.60			0.9193	-9	174	503	8				70	16	9	5
Arabian Medium	0	1.60	-13		0.8763	-10	29	550	23	10	10	10	54	32	7	6
Arabian Medium	13	3.16	52		0.9102	-4	91	150	17				42	44	7	7
Arabian Medium	21	3.44	90		0.9263	-2	275	740	7				40	46	8	7
Arabian Medium	31	3.86			0.9495	7	2155	190	6				33	54	9	7
ASMB #3	0		-17		0.8366	-10	5				20					2
ASMB #4	0	0.58	-22		0.8434	-27	7		40	30		23	65	27	5	3
ASMB #5	0	0.63	-4		0.8404	-18	6	133	28				77	17	4	2
ASMB #5	13	0.70	28		0.8676	-12	14	700	27				77	16	4	2
ASMB #5	24	0.78	68		0.8852	-12	32	630	17				76	15	6	2
ASMB #5	37	0.89			0.9017	9	123	1025	11				72	18	6	3
Avalon	0	0.71	14	64	0.8440	12	141			20	5	5	83	13	2	3
Barrow Island	0	0.04			0.8410		2		31				64	32	4	0
Barrow Island	17	0.03	42		0.8700	-62	4		36				66	30	4	0
Barrow Island	32	0.05	80		0.8906	-46	11		27				61	35	4	0
Barrow Island	48	0.06			0.9075	-27	23		23				59	36	6	0
BCF 24	0	2.07	43	5	0.9129	42	125		12	20	0	5	43	37	13	7
Belridge Heavy	0	1.03			0.9746	2	12610	140	4	9	0	0	26	39	30	3
Belridge Heavy	3	1.03			0.9770	4	17105	200	7				29	38	30	4
Bent Horn	0	0.82	9		0.8181	18	24		25		15	15	94	5	0	0
Beta	0	3.78	2		0.9736	3	13300		0	0	0	0	21	39	31	7
Brent Blend	0	0.39			0.8351	-6	6			45	15	25	72	23	4	1
Bunker C Fuel Oil (Alaska)	0	0.53	83		0.9891	-2	8706	130	14				25	47	17	11
Bunker C Fuel Oil (Alaska)	8	0.56	95		1.0050	23	280000		6				23	42	20	15
Bunker C Light Fuel Oil	0								5	0	0	0				
California (API 11)	0	3.30	28		0.9882	0	34000		0	0	0	0				16
California (API 15)	0	5.50	12		0.9770	-9	6400		0	0	0	0	19	35	23	22
Carpinteria	0	1.88	-15		0.9155	-21	164		16	0	0	11	44	30	17	9
Carpinteria	10	2.01	54		0.9299	6	755	73	7	0	0	0	40	30	19	11
Carpinteria	15	2.04			0.9462	12	3426	130	7	0	0	0	31	36	22	11
Catalytic Cracking Feed	0	0.29			0.9139	25	780		10	5	5	5	53	38	7	2

Table A1 Data Used in the Correlation

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Adgo	0	32.0	6.9	5	20								
Amauligak	0	29.2	20.9	17	32								
ANS (1989)	0	28.1	27.4										
ANS (1989)	9	29.1	26.6										
ANS (1989)	16	29.7	24.9										
ANS (Middle Pipeline)	0	27.0	19.9	25	33								
ANS (Middle Pipeline)	31	31.5	14.7		5								
ANS (Northern Pipeline)	0	26.8	20.6	26	34								
ANS (Northern Pipeline)	31	31.4	21.5		6								
ANS (Southern Pipeline)	0	27.0	21.7	23	31								
ANS (Southern Pipeline)	30	31.4	17.7		5								
Arabian Heavy (2000)	0	26.4	22.5	21	29								
Arabian Heavy (2000)	9	28.5	23.2	15	23								
Arabian Heavy (2000)	16	29.3	6.3	15									
Arabian Heavy (2000)	24	30.4		0	6								
Arabian Light	0	26.6	20.4	22	31								
Arabian Light	12	28.0	17.3	15	25								
Arabian Light	24	28.5	20.2	5	14								
Arabian Light (2000)	0	26.0	21.6	21	29	6.41	5.62	4.76	3.42	2.57	1.00	3939	7947
Arabian Light (2000)	9	27.9	22.8	15	24								
Arabian Light (2000)	18	28.4	24.6	8	18								
Arabian Light (2000)	26	30.2	20.4	1	9	5.41	7.13	6.46	4.55	3.43	1.38	4002	9055
Arabian Medium	0	27.0	20.8	18	26								
Arabian Medium	13	28.7	24.4	11	20								
Arabian Medium	21	29.9	23.3	4	13								
Arabian Medium	31	31.3	20.0		2								
ASMB #3	0			33	43								
ASMB #4	0	25.8	12.2	31	41								
ASMB #5	0	25.5	23.1	26	35	4.45	4.37	4.18	3.14	2.80	1.56	5498	9565
ASMB #5	13	27.2	23.1	21	31								
ASMB #5	24	28.0	24.1	11	22								
ASMB #5	37	29.9	23.2	1	10	4.12	5.92	6.69	5.19	4.33	2.44	8165	14895
Avalon	0	26.4	20.5	15	23								
Barrow Island	0	26.2	15.9	37	55								
Barrow Island	17	28.3	14.9	26	47								
Barrow Island	32	29.8	12.7	11	35								
Barrow Island	48	31.0	12.1	1	18								
BCF 24	0	28.2	21.3	13	19								
Belridge Heavy	0	31.2	20.0	2	9								
Belridge Heavy	3	32.9	30.4	2	8								
Bent Horn	0	26.2	38.5	19	28								
Beta	0	32.2	30.4	6	11								
Brent Blend	0	25.5	22.5	32	42								
Bunker C Fuel Oil (Alaska)	0	32.5		4	12								
Bunker C Fuel Oil (Alaska)	8				4								
Bunker C Light Fuel Oil	0			1	7								
California (API 11)	0	37.0		7	12								
California (API 15)	0	33.6		8	12								
Carpinteria	0	27.8	23.7	18	24								
Carpinteria	10	28.6	21.3	9	17								
Carpinteria	15	33.3	30.0	3	10								
Catalytic Cracking Feed	0	32.3	27.7	1	3								

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (C)	Reid VP (kPa)	Density (g/mL)	Pour Point (C)	Viscosity (mPa s)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enersperse 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Chayvo #6	0	0.34	10		0.8345	4	4		41				66	9	3	0
Chayvo #6	14	0.38	47		0.8542	-1	12		48				66	10	4	0
Chayvo #6	22	0.40	70		0.8609	6	21		29				61	12	7	0
Chayvo #6	33	0.48	105		0.8721	8	33		24				61	12	7	0
Cohasset	0		32		0.7900	-30					5	35				0
Cold Lake Bitumen	0	6.80	81		1.0002	9	235000			0	0	0				13
Diesel (2002)	0	0.09	57		0.8310	-50	3		77				88	10	2	0
Diesel (2002)	7	0.10	65		0.8350	-49	3		71				86	12	2	0
Diesel (2002)	14	0.10	76		0.8383	-43	3		64				86	12	2	0
Diesel (2002)	22	0.10	85		0.8416	-41	4		66				88	11	3	0
Diesel (Alaska)	0	0.21	40		0.8300	-36	2		70				74	24	1	0
Diesel (Alaska)	37	0.33			0.8515	22	5		39				75	23	1	0
Diesel (Southern U.S.A., 1994)	0	0.22	70		0.8369	-7	5		52				76	22	2	0
Diesel (Southern U.S.A., 1994)	8	0.21			0.8427	-7	5		45				78	20	2	0
Diesel (Southern U.S.A., 1994)	16	0.27			0.8447	4	6		53				76	20	2	0
Diesel (Southern U.S.A., 1997)	0	0.40	66		0.8362	-14	4		36				76	23	1	0
Diesel (Southern U.S.A., 1997)	8	0.43			0.8400	-9	5		32				75	23	1	0
Diesel (Southern U.S.A., 1997)	14	0.43			0.8420	7	6		20				79	19	2	0
Dos Cuadras	0	1.24		32	0.9000	-30	51		37	5	5	5	46	30	17	6
Dos Cuadras	11	1.17	53		0.9270	-3	187	3	15	8	8	10	42	31	20	7
Dos Cuadras	20	1.42			0.9359	6	741	33	7	10		0	41	31	19	9
Empire	0	0.30	-9		0.8554	-41	11		31	10	10	10	67	25	7	1
Endicott	0	1.34		25	0.9149	-2	84		10	10	5	10				4
Endicott	8	1.34			0.9318	8	321			5	0	5				4
Endicott	13	1.40			0.9401	14	662			5	0	0				4
Eugene Island Block 32	0	0.02	21		0.8399	7	10		44				84	14	2	1
Eugene Island Block 32	6	0.03	79		0.8418	9	9		30				81	16	2	1
Eugene Island Block 32	13	0.03			0.8453	12	16		22				82	15	2	1
Eugene Island Block 32	20	0.04			0.8481	13	21		19				81	16	3	1
Eugene Island Block 43	0	0.18	12		0.8404	0	13		22	5	20	0	81	16	3	0
Eugene Island Block 43	7	0.10	65		0.8518	7	21		11				78	17	4	1
Eugene Island Block 43	16	0.10			0.8594	7	36		10				77	15	7	1
Eugene Island Block 43	24	0.11			0.8665	11	65		13				78	16	5	1
FCC Medium Cycle Oil	0	0.27			0.9635	-6	31			60	5	15	30	62	7	1
Federated (1994)	0	0.29			0.8293	-15	4		51	20	18	15	74	21	3	1
Federated (1994)	16	0.30	35		0.8569	15	10		38	8	16	13	69	24	5	1
Federated (1994)	28	0.33	78		0.8767	-1	29		22	7	9	3	64	27	7	2
Federated (1994)	42	0.40			0.8924	9	101		18	2	1	5	62	28	7	2
Fuel Oil No. 5 (2002)	0								15							
Fuel Oil No. 5 (2002)	7								7							
Garden Banks Block 387	0	1.52	-28		0.8782	-39	29		27				53	36	10	1
Garden Banks Block 387	7	1.45	33		0.8979	-34	64		30				51	38	11	1
Garden Banks Block 387	15	1.55	80		0.9144	-29	181		17				51	37	11	1
Garden Banks Block 387	23	1.68			0.9287	-25	579	8	0				46	40	13	2
Garden Banks Block 426	0	0.94	-24		0.8265	-22	6		43				70	24	5	1
Garden Banks Block 426	12	0.76	24		0.8561	-7	13		22				61	30	8	1
Garden Banks Block 426	25	1.06	68		0.8779	-2	34		16				62	28	8	2
Garden Banks Block 426	38	1.17			0.8993	6	136	80	18				56	32	10	3
Genesis	0	1.38	-22		0.8641	-62	26		23				51	39	9	1
Genesis	8	1.36	35		0.9074	-41	66		13				45	43	12	1
Genesis	15	1.51	71		0.9223	26	157		24				44	43	11	1
Genesis	23	1.73			0.9364	-24	543	26	19				41	44	14	1
Granite Point	0	0.06	-23		0.8293	-37	4		41	57	9	27	72	22	5	1

Table A1 **Data Used in the Correlation**

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Chayvo #6	0	26.6	15.8	27	40	6.47	7.06	7.14	6.67	5.38	2.01	11296	16768
Chayvo #6	14	28.1	12.4	20	35	8.73	9.26	8.73	8.00	6.52	2.61	12705	19272
Chayvo #6	22	28.6	9.7	12	29	6.75	10.09	10.31	9.73	7.77	3.26	13832	21285
Chayvo #6	33	28.4	28.4	2	17	6.71	9.98	10.25	9.28	7.69	3.11	13722	21832
Cohasset	0	25.6	16.5										
Cold Lake Bitumen	0			1	3								
Diesel (2002)	0	27.5	18.1	27	58	13.23	12.33	10.96	6.72	3.01	0.04	20852	25938
Diesel (2002)	7	27.7	19.5	22	55								
Diesel (2002)	14	28.1	20.7	17	52								
Diesel (2002)	22	28.3	21.9	11	47	15.25	15.77	13.70	8.20	3.74	0.05	24337	30776
Diesel (Alaska)	0	27.4	34.5	29	56								
Diesel (Alaska)	37	28.5	21.1	3	32								
Diesel (Southern U.S.A., 1994)	0	28.5	18.8	8	27								
Diesel (Southern U.S.A., 1994)	8	28.9	13.7	3	20								
Diesel (Southern U.S.A., 1994)	16	29.0	15.1		15								
Diesel (Southern U.S.A., 1997)	0	27.3	22.8	11	31								
Diesel (Southern U.S.A., 1997)	8	28.5	20.5	5	26								
Diesel (Southern U.S.A., 1997)	14	28.6	16.8	2	21								
Dos Cuadras	0	28.1	21.2	19	28								
Dos Cuadras	11	28.7	22.6	10	19								
Dos Cuadras	20	30.6	21.0	3	12								
Empire	0	27.4	15.9	19	30								
Endicott	0	29.1	25.8	11	17								
Endicott	8	27.7	26.0										
Endicott	13	30.9	23.0										
Eugene Island Block 32	0	27.5	18.5	10	23								
Eugene Island Block 32	6	28.5	23.5	6	20								
Eugene Island Block 32	13	27.9	23.7	2	14								
Eugene Island Block 32	20	27.9	21.3		9								
Eugene Island Block 43	0	27.5	2.9	16	27								
Eugene Island Block 43	7	28.5	3.6	10	21								
Eugene Island Block 43	16	29.2	4.2	3	14								
Eugene Island Block 43	24	29.7	6.0		7								
FCC Medium Cycle Oil	0	32.7	22.8	1	5								
Federated (1994)	0	25.8	16.2	34	44								
Federated (1994)	16	28.1	18.4	23	35								
Federated (1994)	28	29.4	18.9	10	24								
Federated (1994)	42	30.8	16.9	1	8								
Fuel Oil No. 5 (2002)	0			2	7								
Fuel Oil No. 5 (2002)	7			0	4								
Garden Banks Block 387	0	27.5	22.9	17	24								
Garden Banks Block 387	7	28.7	23.2	13	21								
Garden Banks Block 387	15	30.1	22.9	6	14								
Garden Banks Block 387	23	31.0	18.6		6								
Garden Banks Block 426	0	23.3	23.2	29	39								
Garden Banks Block 426	12	26.3	26.6	22	33								
Garden Banks Block 426	25	28.2	25.2	11	24								
Garden Banks Block 426	38	30.1	21.8	1	9								
Genesis	0	26.8	22.9	11	17								
Genesis	8	28.5	21.5	9	14								
Genesis	15	28.9	21.2	5	11								
Genesis	23	30.6	16.4	1	6								
Granite Point	0	25.6	20.7	36	47								

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (°C)	Reid VP (kPa)	Density (g/mL)	Pour Point (°C)	Viscosity (mPas)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enerspense 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Granite Point	45	0.08			0.9028	2	75	340	14				62	28	7	3
Green Canyon Block 109	0	1.89	0		0.8921	-36	39		20	5	10	5	51	39	9	1
Green Canyon Block 184	0	0.94	-18		0.8314	-44	5		47				69	24	6	1
Green Canyon Block 184	12	1.00	18		0.8575	-35	11		33				61	30	8	1
Green Canyon Block 184	26	1.15	67		0.8824	-26	31		25				58	33	8	1
Green Canyon Block 184	38	1.32			0.9043	-25	117	22	22				54	34	11	1
Green Canyon Block 65	0	1.87	-4		0.9365	-28	177		15	5	5	10	38	40	14	8
Gullfaks	0	0.30	-9		0.8701	-32	13		25	20	10	10	60	35	5	1
Heavy Fuel Oil 6303	0								9							
Hebron M-04	0		9		0.9189	-2	154		10							
Hebron M-04	9		55		0.9344	9	676		10							
Hebron M-04	16		82		0.9423	12	1442		10							
Hebron M-04	23				0.9564	20	7369		10							
Hibernia (1999)	0		17		0.8504	10	13		21							
Hibernia (1999)	10		30		0.8753	15	35		17							
Hibernia (1999)	21		71		0.8893	18	99		15							
Hibernia (1999)	33				0.9075	26	773		11							
High Viscosity Fuel Oil	0	1.91			1.0140	2	13460	310	0				18	43	13	26
Hondo	0	4.30	-5		0.9356	-15	735	920	8	5	0	4	33	31	24	12
Hondo	17	4.60	71		0.9674	3	9583	1300	6	0	0	0	27	33	29	12
Hondo	32	4.80			0.9881	21	449700		2	0	0	0	27	28	32	13
Hout	0	1.88	-18		0.8626	-14	15		19	7	10	5	56	32	8	5
IFO 180	0	1.54	91		0.9670	10	2324	240	0				29	51	11	10
IFO 180	8	1.64			0.9840	6	27200	610	0				26	39	17	15
IFO 300	0	1.72			0.9859	-6	14470	390	0				26	52	12	10
IFO 300	5	1.80			0.9996	12	220000		0				24	28	30	17
Iranian Heavy	0	1.20	-15		0.8756	-22	20		14	10	5	10	53	30	11	6
Issungnak	0	0.08			0.8490							50	92	3	0	0
Jet A/Jet A-1	0	0.03	54		0.8159	-55	2		57				94	6	0	0
Jet A/Jet A-1	12	0.03	66		0.8193	-55	2		43				96	2	0	0
Jet A/Jet A-1	23	0.04	71		0.8216	-50	2		50				96	3	1	0
Jet A/Jet A-1	37	0.06	76		0.8244	-44	2						98	2	0	0
Jet B (Alaska)	0	0.08	42		0.8111	-54	2		76				81	19	0	0
Jet B (Alaska)	53	0.13	80		0.8354	-44	3		33				80	19	0	0
Lago	0	0.30	-13		0.8907	21	153		10	0	0	5	56	31	11	3
Lago Treco	0	2.59	-3		0.9230	-20	272		10				36	38	14	11
Lago Treco	16	2.75			0.9661	-1	16160		10				32	38	15	15
Lagomedio	0		57	16	0.8720		41			20	5	10				5
Loi Islana	0	0.45	-11		0.8516	-26	6		34	13	17	14	73	21	4	1
Lucula	0	0.17	-10		0.8571	18	43		20	5	5	5	67	22	8	4
Main Pass Block 306	0	0.28			0.8606	-53	9		27	25	20	30	65	29	5	1
Main Pass Block 306	12	0.31	22		0.8849	-35	19		23				63	29	8	1
Main Pass Block 306	24	0.33			0.9031	-32	51		19				58	32	10	1
Main Pass Block 306	37	0.38			0.9203	-16	219		17				55	33	11	1
Main Pass Block 37	0	0.16	-6		0.8311	-3	7		33	20	25	10	73	21	5	1
Main Pass Block 37	15	0.31	48		0.8543	4	16		26				73	21	5	1
Main Pass Block 37	30	0.46			0.8689	15	36		16				70	23	6	1
Main Pass Block 37	50	0.39			0.8855	17	115		14				66	24	8	2
Malongo	0	0.20	-9		0.8701	21	63		15	5	0	5	62	25	9	4
Mars TLP	0	2.07	-26		0.8883	-28	33		36				45	40	11	3
Mars TLP	8	1.97	26		0.9122	-16	93	13	34				41	43	13	3
Mars TLP	17	2.13	71		0.9331	-17	104	31	16				35	45	15	4
Mars TLP	26	2.37			0.9520	-7	2237	64	2				33	44	18	6

Table A1 **Data Used in the Correlation**

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Granite Point	45	30.7	14.6		9								
Green Canyon Block 109	0	28.0	21.5	15	22								
Green Canyon Block 184	0	25.0	23.3	29	39								
Green Canyon Block 184	12	27.0	23.2	24	34								
Green Canyon Block 184	26	28.9	25.2	12	24								
Green Canyon Block 184	38	30.7	19.3	1	10								
Green Canyon Block 65	0	29.4	23.9	11	18								
Gullfaks	0	27.7	25.4	21	31								
Heavy Fuel Oil 6303	0			1	6								
Hebron M-04	0	28.3	24.9	16	24								
Hebron M-04	9	28.8		10	18								
Hebron M-04	16	34.6		5	14								
Hebron M-04	23			0	5								
Hibernia (1999)	0	26.5	21.6	24	33								
Hibernia (1999)	10	28.1	26.3	17	27								
Hibernia (1999)	21	28.9	24.9	9	20								
Hibernia (1999)	33			0	8								
High Viscosity Fuel Oil	0	32.9	43.3	2	14								
Hondo	0	29.2	15.8	14	20								
Hondo	17	30.3	22.8	5	11								
Hondo	32				2								
Hout	0	26.7	15.2	23	31								
IFO 180	0	31.4	30.7	2	12								
IFO 180	8	33.1		1	6								
IFO 300	0	32.6	37.3	2	8								
IFO 300	5			1	4								
Iranian Heavy	0	26.1	22.5	21	28								
Issungnak	0	26.2	16.8	20	35								
Jet A/Jet A-1	0	26.4	31.2										
Jet A/Jet A-1	12	27.2	31.0										
Jet A/Jet A-1	23	26.8	29.0										
Jet A/Jet A-1	37	27.0	29.0										
Jet B (Alaska)	0	26.3	39.1	47	82								
Jet B (Alaska)	53	27.8	30.5	8	61								
Lago	0			12	18								
Lago Treco	0	28.7	19.3	13	19								
Lago Treco	16				4								
Lagomedio	0	28.2	12.4	15	23								
Louisiana	0	25.9	19.6	21	33								
Lucula	0			18	25								
Main Pass Block 306	0	26.9	16.5	26	37								
Main Pass Block 306	12	28.7	18.3	17	29								
Main Pass Block 306	24	30.1	17.4	5	18								
Main Pass Block 306	37	31.2	13.6		4								
Main Pass Block 37	0	24.0	19.7	29	41								
Main Pass Block 37	16	28.0	22.6	18	31								
Main Pass Block 37	30	29.0	23.2	6	20								
Main Pass Block 37	50	31.2	21.7		4								
Malongo	0	28.7	22.1	15	21								
Mars TLP	0	26.2	21.3	11	16								
Mars TLP	8	28.0	21.1	9	15								
Mars TLP	17	29.6	16.2	4	10								
Mars TLP	26	30.8		0	4								

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (C)	Reid VP (kPa)	Density (g/mL)	Pour Point (C)	Viscosity (mPas)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enersperse 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Maui	0				0.8081	11	15		33							
Maui	14		8		0.8340	24	212		28							
Maui	30		66		0.8421	28	1048		10							
Maui	44				0.8640	37			10							
Maya	0	3.00	-9		0.9255	-15	280			0	0	5	38	30	8	16
Maya (1997)	0	3.30	-7		0.9218	-20	288		15				38	31	11	16
Maya (1997)	19	3.65			0.9762	3	99390		13				29	35	14	21
Mississippi Canyon Block 194	0	0.21	-6		0.8483	-40	7		23	15	15	10	71	25	4	0
Mississippi Canyon Block 194	10	0.19	54		0.8655	26	11		22				71	23	6	0
Mississippi Canyon Block 194	21	0.21			0.8762	-22	21		17				68	24	8	0
Mississippi Canyon Block 194	35	0.26			0.8874	18	51		15				67	26	7	0
Mississippi Canyon Block 72	0	0.39	5		0.8649	26	16		31				64	27	7	2
Mississippi Canyon Block 72	9	0.36	41		0.8827	-6	34		24				57	33	8	2
Mississippi Canyon Block 72	18	0.40	82		0.8966	-1	76	7	19				58	32	9	2
Mississippi Canyon Block 72	26	0.48			0.9095	1	195	220	18				52	34	11	3
Mississippi Canyon Block 807	0	2.19			0.8804	-34	41	10	19				47	35	12	6
Mississippi Canyon Block 807	8	2.13	29		0.9167	-33	127	23	17				38	41	13	7
Mississippi Canyon Block 807	16	2.31	75		0.9375	-26	491	54	0				39	41	13	7
Mississippi Canyon Block 807	26	2.51			0.9582	-5	3454	160	0				31	43	18	8
Neptune SPAR	0	0.29	7		0.8687	-1	17		79				65	28	6	1
Neptune SPAR	8	0.32	54		0.8826	9	42		21				63	29	6	2
Neptune SPAR	15	0.27	89		0.8925	17	84	545	16				62	29	7	2
Neptune SPAR	23	0.36			0.8966	19	167	925	14				61	29	8	2
Norman Wells	0	0.37	3	36	0.8320				35		20	65	66	[illegible]	2	0
Odoptu	0	0.33	-10		0.8556	-46	5		54						5	0
Odoptu	14	0.38	36		0.8759	-42	9		40						5	1
Odoptu	29	0.44	75		0.8941	29	18		24						7	1
Odoptu	41	0.52			0.9072	-17	30		15						8	1
Oseberg	0	0.28	-24	26	0.8522	-9	10		15	30	10	20	65	25	8	2
Panuke	0		-30		0.7757	-36					40	85				0
Pitas Point	0	0.61	17	7	0.8341		2		85	42	55	66	80	18	3	0
Pitas Point	24	0.76	46		0.8537		2		80	38	50	58	62	35	2	0
Pitas Point	47				0.8688		4									
Platform Gail	0	4.06	-25		0.9297	-20	406	120	22				38	28	21	12
Platform Gail	7	4.27	32		0.9489	-12	1450	202	4				35	31	21	13
Platform Gail	13	4.42	73		0.9645	-1	7092	338	0				32	28	25	15
Platform Gail	21	4.56			0.9810	13	161500	1210	0				27	28	25	19
Point Arguello Comingled	0	3.64	-5		0.9248	-12	533	780	3	0	0	0	36	25	23	16
Point Arguello Comingled	9	3.64	22		0.9526	7	4988	850	0	0	0	0	31	33	19	17
Point Arguello Comingled	16	3.81	83		0.9666	7	41080	610	0	0	0	0	27	33	21	19
Point Arguello Comingled	22	4.09			0.9853	26	2266000		0	0	0	0	24	33	21	22
Point Arguello Heavy	0	3.44	2		0.9447	4	3250	490	0	0	0	0	32	32	17	19
Point Arguello Heavy	9	3.93	72		0.9706	6	59390		0	0	0	0	26	35	18	20
Point Arguello Heavy	18	4.22			0.9914	30	4953000		0	0	0	0	25	34	21	22
Point Arguello Light	0	1.10	-6		0.8739	-22	22	650	13	10	3	6	57	27	9	7
Point Arguello Light	10	1.16	40		0.8979	-12	76	2290	20				54	30	9	8
Point Arguello Light	19	1.26	87		0.9132	-12	163	3400	13				46	31	12	9
Point Arguello Light	28	1.44			0.9289	8	671	980	4				45	32	12	11
Port Hueneme	0	3.73	-11	9	0.9662	-9	4131	64	12	0	0	0	24	43	20	12
Port Hueneme	4	3.69			0.9745	-9	7833	170	5	0	0	0	23	41	21	14
Port Hueneme	8	3.63			0.9767	0	20990	270	0	0	0	7	23	28	37	13
Prudhoe Bay	0								10				76	10	3	2
Prudhoe Bay (1995)	0	0.96	-17		0.8637	-15	22	6	10				53	34	10	4

Table A1 **Data Used in the Correlation**

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Maui	0	31.1		35	46								
Maui	14			27	39								
Maui	30			13	27								
Maui	44			0	10								
Maya	0	28.2	27.0	13	19								
Maya (1997)	0	28.0	27.3	20	27								
Maya (1997)	19				5								
Mississippi Canyon Block 194	0	27.2	18.1	23	37								
Mississippi Canyon Block 194	10	28.5	19.3	14	29								
Mississippi Canyon Block 194	21	29.6	17.0	4	20								
Mississippi Canyon Block 194	35	30.3	15.8		6								
Mississippi Canyon Block 72	0	27.1	25.5	20	29								
Mississippi Canyon Block 72	9	28.6	29.0	15	25								
Mississippi Canyon Block 72	18	29.7	27.9	7	17								
Mississippi Canyon Block 72	26	30.8	21.8	1	9								
Mississippi Canyon Block 807	0	26.4	23.3	21	28								
Mississippi Canyon Block 807	9	28.5	25.0	15	23								
Mississippi Canyon Block 807	16	30.1	20.5	8	16								
Mississippi Canyon Block 807	26	32.0		1	6								
Neptune SPAR	0	27.8	21.2	11	17								
Neptune SPAR	8	28.9	19.3	8	15								
Neptune SPAR	15	29.6	18.3	4	12								
Neptune SPAR	23	30.1	14.9	1	7								
Norman Wells	0	23.6	16.4	27	38								
Odoptu	0	26.7	23.2	35	49								
Odoptu	14	28.2	25.1	28	44								
Odoptu	29	26.7	24.6	12	31								
Odoptu	41	30.5	22.7	2	18								
Oseberg	0	26.2	20.2	23	33								
Panuke	0			57	71								
Pitas Point	0	26.3	7.3	54	76								
Pitas Point	24	27.1	8.9	40	68								
Pitas Point	47	26.4	3.7										
Platform Gail	0	27.8		15	21								
Platform Gail	7	29.0		11	17								
Platform Gail	13	30.5		6	13								
Platform Gail	21			1	6								
Point Arguello Comingled	0	27.5	28.2	14	20								
Point Arguello Comingled	9	30.2		10	16								
Point Arguello Comingled	16			4	11								
Point Arguello Comingled	22				4								
Point Arguello Heavy	0	23.8	28.4	11	17								
Point Arguello Heavy	9			5	12								
Point Arguello Heavy	18				3								
Point Arguello Light	0	27.1	24.0	22	31								
Point Arguello Light	10	28.9	25.8	14	25								
Point Arguello Light	19	29.9	25.5	6	17								
Point Arguello Light	28	31.0			6								
Port Hueneme	0	30.8	23.2	5	11								
Port Hueneme	4	30.0	28.4	3	8								
Port Hueneme	8	31.1	28.6	1	6								
Prudhoe Bay	0	28.3	9.7	16	24								
Prudhoe Bay (1995)	0	27.6	3.9	22	32								

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (C)	Reid VP (kPa)	Density (g/mL)	Pour Point (C)	Viscosity (mPas)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enerspense 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Prudhoe Bay (1995)	9	1.01	45		0.9048	-9	55	640	19				51	35	10	3
Prudhoe Bay (1995)	18	1.13	87		0.9204	8	148		0				52	32	12	4
Prudhoe Bay (1995)	27	1.24			0.9352	12	623	230	0				43	38	15	5
Rangely	0	0.35	-2		0.8567	17	33			5	15	10	71	21	5	4
Sakhalin	0	0.25	-10		0.8632		4		94	78			61	32	6	1
Sakhalin	25								49	73						
Sakhalin	42	0.39			0.9201	-32	52		31	49			56	32	10	2
Santa Clara	0	2.85	-24	25	0.9202	-3	304	19	6	0	0	5	36	22	29	13
Santa Clara	11	3.22	45		0.9479	6	1055	700	4	0	0	0	32	20	27	13
Santa Clara	22	3.41			0.9672	27	22760	360	0	8	7	7	28	32	23	17
Ship Shoal Block 269	0	0.41	7		0.8309	42	5		36	10	15	10	79	15	6	0
Ship Shoal Block 269	13	0.47	76		0.8517	-19	7		27				71	23	5	0
Ship Shoal Block 269	26	0.45	84		0.8657	-20	18		23				70	24	6	1
Ship Shoal Block 269	39	0.64			0.8796	-2	44						67	26	6	1
Sockeye	0	2.29	-17	21	0.8965	-12	45	8500	24	5	0	5	48	31	13	8
Sockeye	13	2.67	57		0.9166	-3	163	1300	9				44	32	15	9
Sockeye	22	2.87			0.9264	3	628	1400	5				39	34	15	11
Sockeye (2000)	0	4.51	-4		0.9354	-25	761	183	12				50	18	18	15
Sockeye (2000)	7	4.95	35		0.9537	-18	2720	251	10				47	17	19	16
Sockeye (2000)	13	5.19	72		0.9692	2	15100	391	10				45	18	19	18
Sockeye (2000)	20	5.47			0.9839	13	274000	1239	9				42	10	20	20
Sockeye Comingled	0	4.17	-6		0.9350	-24	550	110	0				34	32	21	13
Sockeye Sour	0	4.41			0.9409	-22	821	120	0				38	29	20	13
Sockeye Sour	10	4.71			0.9662	-3	8708	300	0				29	31	22	17
Sockeye Sour	18	5.02			0.9838	16	475200		0				26	30	22	24
Sockeye Sweet	0	1.10	-9		0.8792	-20	20		16				55	31	10	4
Sockeye Sweet	8	1.53	47		0.8945	-14	39		17				56	30	10	4
Sockeye Sweet	17	1.67	83		0.9069	-4	103	31	14				50	32	13	5
Sockeye Sweet	27	1.81			0.9229	5	321	510	15				48	33	14	5
South Louisiana (2001)	0	0.49	-10		0.8562		10		26				81	13	6	1
South Louisiana (2001)	11	0.71	42		0.8770	-19	24		24				80	12	6	1
South Louisiana (2001)	20	0.79	81		0.8906	14	49		16				78	13	8	1
South Louisiana (2001)	28	0.88			0.9018	-11	141		10				77	13	8	2
South Pass Block 60	0	0.28	-4		0.8453	-9	9		29	45	15	10	71	20	8	1
South Pass Block 60	17	0.28	61		0.8709	-3	22		21				67	25	7	1
South Pass Block 33	0	0.43	-7		0.8574	-15	19			25	25	25	73	20	4	3
South Timbalier Block 130	0	0.32	5		0.8487	-27	7		31	10	20	20	78	16	5	0
Statfjord	0	0.26	-12		0.8354	-2	6		40	35	15	15	68	25	6	2
Sumatran Heavy	0	0.18	54		0.9312	18	13300		10				46	30	13	10
Sumatran Heavy	5	0.19			0.9374	22	12900		0				45	32	16	8
Sumatran Light	0	0.07	17		0.8600	36	41480		0				70	15	6	8
Swanson River	0	0.13	-23		0.8420	-23	6	10	36	60		4	65	25	6	5
Swanson River	40	0.13			0.9143	10	152	290	10				56	29	7	7
Synthetic	0	0.23	-21	42	0.8614	-72	5		40		25	65	82	17	1	0
Taching	0	0.11	23		0.8700	38	5138000		9				74	12	9	6
Takula	0	0.18	-7		0.8637	15	110	950	11	5	0	5	65	22	8	2
Takula	11	0.15	41		0.8860	19	844	1200	9				62	24	10	4
Takula	18	0.13			0.8961	26	3148	1200	6				60	25	11	4
Tapis Blend	0	0.06	-26		0.8020	18	8		63				81	15	2	2
Tapis Blend	14	0.03	17		0.8237	28	57		59				77	19	3	1
Tapis Blend	29	0.03	68		0.8396	31	600		56				80	16	3	2
Tapis Blend	43	0.04			0.8552	34	1440		44				79	14	4	3
Terra Nova (1994)	0	0.43	-22		0.8457	5	11		14				62	31	6	2

Table A1 **Data Used in the Correlation**

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Prudhoe Bay (1995)	9	29.5	11.5	15	25								
Prudhoe Bay (1995)	18	30.2	14.2	6	17								
Prudhoe Bay (1995)	27	30.9	15.5		7								
Rangely	0	27.1	21.7	17	26								
Sakhalin	0	24.4	14.0	34	47								
Sakhalin	25												
Sakhalin	42	30.3	11.3	1	16								
Santa Clara	0	28.7	23.3	15	21								
Santa Clara	11	28.0	21.6	9	14								
Santa Clara	22	31.8	31.6	2	7								
Ship Shoal Block 269	0	25.9	15.1	30	43								
Ship Shoal Block 269	13	27.5	20.3	20	35								
Ship Shoal Block 269	26	28.6	20.4	8	24								
Ship Shoal Block 269	39	29.9	16.7		9								
Sockeye	0	27.6	16.8	21	30								
Sockeye	13	29.0	17.2	11	21								
Sockeye	22	29.6	19.6	2	11								
Sockeye (2000)	0	28.8	21.9	14	19	1.14	1.43	1.52	1.19	1.02	0.51	3424	5149
Sockeye (2000)	7	31.3	23.1	9	15								
Sockeye (2000)	13	32.2		4	11								
Sockeye (2000)	20			0	5	0.63	1.52	1.76	1.41	1.20	0.60	4269	6556
Sockeye Comingled	0	28.7	18.2	16	22								
Sockeye Sour	0	28.9	20.1	15	21								
Sockeye Sour	10	30.8		6	13								
Sockeye Sour	19				4								
Sockeye Sweet	0	27.7	15.9	23	34								
Sockeye Sweet	8	28.8	17.9	15	26								
Sockeye Sweet	17	30.0	18.5	7	19								
Sockeye Sweet	27	30.6	16.5		8								
South Louisiana (2001)	0	26.1	16.8	22	32	4.25	3.81	3.48	2.24	1.70	0.72	5353	9037
South Louisiana (2001)	11	28.1	19.4	16	27								
South Louisiana (2001)	20	29.4	22.2	8	19								
South Louisiana (2001)	28	29.8	18.4	2	11	3.81	5.19	4.75	3.11	2.27	1.08	6815	11823
South Pass Block 60	0	26.8	18.7	27	39								
South Pass Block 60	17	28.7	20.4	13	26								
South Pass Block 93	0	28.2	24.7	18	28								
South Timbalier Block 130	0	26.5	18.6	25	39								
Statfjord	0	26.1	23.2	30	39								
Sumatran Heavy	0	27.0	20.0										
Sumatran Heavy	5	27.0	20.0										
Sumatran Light	0			11	19								
Swanson River	0	27.0	23.8	32	42								
Swanson River	40	30.7	19.9		9								
Synthetic	0	25.7	29.0	19	32								
Taching	0			10	15								
Takula	0	30.6	28.1	17	24								
Takula	11			11	19								
Takula	18			4	12								
Tapis Blend	0	27.1	21.2	37	49								
Tapis Blend	14	31.1		28	42								
Tapis Blend	29			14	31								
Tapis Blend	43			1	14								
Terra Nova (1994)	0	26.9	21.5	27	36								

Table A1

Oil Name	Evap'n %	Sulphur (wt%)	Flash Point (C	Reid VP (kPa)	Density (g/mL)	Pour Point (C	Viscosity (mPa s)	Complex modulus (mPa)	Dispersibility % w/Corexit 9500	Dispersibility % w/Corexit 9527	Dispersibility % w/Dasic LTS	Dispersibility % w/Enersperse 700	Saturates (wt%)	Aromatics (wt%)	Resins (wt%)	Asphaltenes (wt%)
Terra Nova (SOCSEX)	0				0.9457		11			5	5	10	62	31	6	2
Thevenard Island	0	0.01			0.7855		1		77	55	20	30	65	13	2	0
Trading Bay	0	0.13	-17		0.8602	-34	10		47	39	5	18	62	26	7	5
Trading Bay	33	0.15			0.9242	2	278	450	9				51	32	9	8
Transmountain Blend	0	0.79	-2	46	0.8550	2	11			15	10	15	81	14	2	4
Udang	0	0.94			0.9701	3	10700	130	7				32	41	24	3
Viosca Knoll Block 826	0	0.29	-2		0.8668	-4	16		24				66	26	6	2
Viosca Knoll Block 826	8	0.28	41		0.8642	6	43		17				61	29	7	3
Viosca Knoll Block 826	17	0.34	86		0.8970	11	132		15				62	29	6	3
Viosca Knoll Block 826	24	0.37			0.9067	16	325	340	17				59	29	8	3
Viosca Knoll Block 990	0	0.22	-17		0.8337	-32	7		41				73	22	4	1
Viosca Knoll Block 990	12	0.26	34		0.8585	-7	12		29				69	25	6	1
Viosca Knoll Block 990	24	0.28	76		0.8752	6	31		22				66	26	8	1
Viosca Knoll Block 990	35	0.26			0.8905	13	91	98	14				62	28	8	2
Waxy Light Heavy Blend	0	1.01	3		0.9311	30	164		9	5	0	40	39	35	21	5
Waxy Light Heavy Blend	12	1.08	80		0.9582	-12	2002	41	0				32	38	24	6
Waxy Light Heavy Blend	20	1.18			0.9749	0	17280	230	0				30	35	28	6
West Delta Block 97	0	0.07			0.7763	-27	1		45	51	18		92	7	1	0
West Delta Block 97	23	0.06	30		0.8020	-18	1						87	12	1	0
West Delta Block 97	48	0.06	72		0.8191	-15	3						87	11	3	0
West Delta Block 97	74	0.12			0.8388	-5	7						85	14	2	0
West Texas (2000)	0	0.86	-10		0.8474		9		28				78	15	6	1
West Texas (2000)	10	1.01	33		0.8665	-12	16		24				79	14	7	1
West Texas (2000)	21	1.11	66		0.8827	1	38	19	13				76	15	8	1
West Texas (2000)	32	1.24			0.8975	7	112	92	13				75	14	10	2
West Texas Intermediate	0	0.48	-17		0.8420	-23	7		15	30	10	40	66	26	8	1
West Texas Sour	0	1.50	-14		0.8743	-27	13		25	25	10	25	51	36	9	5
White Rose	0	-10.00			0.8738	13	30		21							
White Rose	9	46.00			0.8926	23	87		20							
White Rose	15	80.00			0.9026	24	253		16							
White Rose	24				0.9143	30	992		16							
Zaire	0	0.16	-3		0.8720	25	362		0	5	0	5	64	22	9	5

Table A1 **Data Used in the Correlation**

Oil Name	Evap'n %	Surface Tension (mN/m)	Interfacial Tension (mN/m)	BP < 200 (wt%)	BP < 250 (wt%)	n-C12 (mg/g)	n-C14 (mg/g)	n-C16 (mg/g)	n-C18 (mg/g)	n-C20 (mg/g)	n-C26 (mg/g)	Naphthalenes (ppm)	Total PAHs (ppm)
Terra Nova (SOCSEX)	0			27	36								
Thevenard Island	0	23.6	17.2	49	66								
Trading Bay	0	26.5	20.6	27	36								
Trading Bay	33	31.0	16.5		8								
Transmountain Blend	0	25.0	19.3	21	30								
Udang	0	32.2	25.4	3	8								
Viosca Knoll Block 826	0	27.7	23.6	19	29								
Viosca Knoll Block 826	8	29.1	26.5	14	24								
Viosca Knoll Block 826	17	30.1	26.1	6	16								
Viosca Knoll Block 826	24	31.0	21.1	1	8								
Viosca Knoll Block 990	0	22.8	15.0	26	36								
Viosca Knoll Block 990	12	25.0	22.5	19	30								
Viosca Knoll Block 990	24	29.1	22.1	8	20								
Viosca Knoll Block 990	35	30.3	18.4	0	9								
Waxy Light Heavy Blend	0	29.0	17.2	12	19								
Waxy Light Heavy Blend	12	31.4	14.2	5	13								
Waxy Light Heavy Blend	20	33.0			5								
West Delta Block 97	0	24.0	26.9	55	72								
West Delta Block 97	23	25.7	28.2	43	64								
West Delta Block 97	48	26.6	27.3	19	48								
West Delta Block 97	74	28.0	22.0		10								
West Texas (2000)	0	26.0	15.6	26	35	6.72	5.93	5.02	3.39	2.78	1.33	5172	7841
West Texas (2000)	10	27.6	14.6	20	30								
West Texas (2000)	21	28.7	12.6	10	22								
West Texas (2000)	32	29.2	17.3	2	12	6.21	8.10	7.19	4.76	3.87	1.93	6069	9804
West Texas Intermediate	0	26.6	18.9	28	38								
West Texas Sour	0	27.0	17.8	26	36								
White Rose	0	27.7	28.2	17	25								
White Rose	9	29.2	18.4	11	20								
White Rose	15	29.9		6	15								
White Rose	24	28.0		0	7								
Zaire	0			15	22								

Table A2 **Predicted Values for All Oils Using the Models**

Oil Name	Evap'n	**Dispersibility % w/Corexit 9500**	Model Number Prediction 1 High Correlators	**2** Best plus BP<250	**3** Best plus Viscosity	4 Density & Viscosity	5 Density & BP<250	6 SARA & Viscosity	7 SARA & Low HC	8 SARA & VOCs	9 SARA	10 Compos alone
Adgo	0	29				13	11	42		84	72	
Amauligak	0	45				26	26					
ANS (1989)	0	10				22	11					
ANS (1989)	9					16	9					
ANS (1989)	16					12	7					
ANS (Middle Pipeline)	0	46				27	28	20		45	17	
ANS (Middle Pipeline)	31	5				8	6	12		19	13	
ANS (Northern Pipeline)	0	33				28	30	20		40	17	
ANS (Northern Pipeline)	31	6				8	6	13		19	12	
ANS (Southern Pipeline)	0	45				26	27	20		45	18	
ANS (Southern Pipeline)	30	6				8	6	12		17	12	
Arabian Heavy (2000)	0	15				19	24					
Arabian Heavy (2000)	9	14				13	17					
Arabian Heavy (2000)	16	13				9	6					
Arabian Heavy (2000)	24	11				6	5					
Arabian Light	0	21				28	28	24		41	25	
Arabian Light	12	17				21	21	18		34	19	
Arabian Light	24	14				15	13	15		23	15	
Arabian Light (2000)	0	19	20	20	17	29	27	24	15	47	22	22
Arabian Light (2000)	9	14				24	24	21		38	22	
Arabian Light (2000)	18	10				17	16	19		32	21	
Arabian Light (2000)	26	8	5	6	11	12	10	16	10	34	17	10
Arabian Medium	0	23				22	24	19		34	20	
Arabian Medium	13	17				15	16	17		30	19	
Arabian Medium	21	7				11	10	16		24	18	
Arabian Medium	31	6				6	4	15		20	17	
ASMB #3	0					42	41					
ASMB #4	0	40				37	39	30		55	26	
ASMB #5	0	29	27	27	28	39	35	33	27	62	30	31
ASMB #5	13	27				28	28	27		42	31	
ASMB #5	24	17				21	20	22		37	25	
ASMB #5	37	11	10	11	14	15	12	20	19	35	24	12
Avalon	0					19	27	26		58	38	
Barrow Island	0	61				57	51			75	54	
Barrow Island	17	36				42	40			76	54	
Barrow Island	32	27				28	28			67	54	
Barrow Island	48	23				21	15			59	49	
BCF 24	0	12				14	15	12		23	12	
Belridge Heavy	0	4				4	3	5		12	6	
Belridge Heavy	3	7				3	3	5		11	4	
Bent Horn	0	25				29	34					
Bola	0	0				4	4	2		9	2	
Brent Blend	0					40	41	35		66	34	
Bunker C Fuel Oil (Alaska)	0	14				3	3	7		12	7	
Bunker C Fuel Oil (Alaska)	8	6				1	-1	4		8	4	
Bunker C Light Fuel Oil	0	5										
California (API 11)	0	0				2	3					
California (API 15)	0	0				4	4	-1		10	1	
Carpinteria	0	16				13	17	0		19	7	
Carpinteria	10	7				9	12	6		16	5	
Carpinteria	15	7				6	7	5		10	4	
Catalytic Cracking Feed	0	10				10	9	20		31	24	
Chayvo #6	0	41	42	42	48	45	39		49	80	37	44
Chayvo #6	14	45	41	40	35	31	33		44	69	34	49
Chayvo #6	22	29	36	35	31	26	28		31	50	27	32
Chayvo #6	33	24	25	24	26	22	20		30	40	27	29
Cohasset	0						27					
Cold Lake Bitumen	0					1	-1					
Diesel (2002)	0	72	71	72	72	50	54		70	80	43	74
Diesel (2002)	7	71				50	52			55	43	
Diesel (2002)	14	64				50	48			55	43	
Diesel (2002)	22	66	65	65	66	45	44		66	52	37	68
Diesel (Alaska)	0	70				56	53			77	52	
Diesel (Alaska)	37	39				41	31			61	52	
Diesel (Southern U.S.A., 1994)	0	52				42	30			59	43	

Table A2 **Predicted Values for All Oils Using the Models**

Oil Name	Evap'n	**Dispersibility % w/Corexit 9500**	Model Number Prediction 1 High Correlators	2 Best plus BP<250	3 Best plus Viscosity	4 Density & Viscosity	5 Density & BP<250	6 SARA & Viscosity	7 SARA & Low HC	8 SARA & VOCs	9 SARA	10 Compos alone
Diesel (Southern U.S.A., 1994)	8	45				41	25			54	43	
Diesel (Southern U.S.A., 1994)	16	53				39	23			53	43	
Diesel (Southern U.S.A., 1997)	0	36				45	33			73	52	
Diesel (Southern U.S.A., 1997)	8	32				42	29			63	52	
Diesel (Southern U.S.A., 1997)	14	20				39	26			54	43	
Dos Cuadras	0	37				18	22	12		22	9	
Dos Cuadras	11	15				11	13	8		19	6	
Dos Cuadras	20	7				9	9	7		14	6	
Empire	0	31				31	29	27		43	27	
Endicott	0	10				15	14					
Endicott	8					10	6					
Endicott	13					8	5					
Eugene Island Block 32	0	41				34	27	34		60	42	
Eugene Island Block 32	6	30				35	26	35		57	42	
Eugene Island Block 32	13	22				29	22	32		54	42	
Eugene Island Block 32	20	19				27	20	29		49	37	
Eugene Island Block 43	0	22				31	30					
Eugene Island Block 43	7	11				27	25	28		46	33	
Eugene Island Block 43	16	10				23	20	23		39	26	
Eugene Island Block 43	24	13				20	16	24		42	31	
FCC Medium Cycle Oil	0					13	1	22		32	28	
Federated (1994)	0	61				46	43	41		64	37	
Federated (1994)	16	38				32	32	30		55	31	
Federated (1994)	28	22				23	23	22		36	24	
Federated (1994)	42	18				16	13	21		33	24	
Fuel Oil No. 5 (2002)	0	15										
Fuel Oil No. 5 (2002)	7	7										
Garden Banks Block 387	0	27				22	22	21		37	23	
Garden Banks Block 387	7	30				17	18	20		35	21	
Garden Banks Block 387	15	17				13	12	19		32	21	
Garden Banks Block 387	23	0				9	8	16		23	17	
Garden Banks Block 426	0	43				40	40	34		57	31	
Garden Banks Block 426	12	22				30	31	26		51	25	
Garden Banks Block 426	25	16				22	22	21		37	22	
Garden Banks Block 426	38	18				15	12	18		26	18	
Genesis	0	23				23	18	22		41	24	
Genesis	8	13				16	13	19		36	21	
Genesis	15	24				12	10	18		33	22	
Genesis	23	19				9	7	16		25	19	
Granite Point	0	41				46	46	39		56	31	
Granite Point	45	14				16	12	20		31	22	
Green Canyon Block 109	0	20				20	19	22		35	24	
Green Canyon Block 104	0	47				42	39	35		57	28	
Green Canyon Block 184	12	33				31	32	26		52	25	
Green Canyon Block 184	26	25				22	22	23		41	25	
Green Canyon Block 184	36	22				15	12	19		29	21	
Green Canyon Block 65	0	15				11	12	11		16	10	
Gullfaks	0	25				29	28	29		52	31	
Heavy Fuel Oil 6303	0	9										
Hebron M-04	0	10				13	17					
Hebron M-04	9	10				9	12					
Hebron M-04	16	10				7	9					
Hebron M-04	23	10				5	4					
Hibernia (1999)	0	21				30	32					
Hibernia (1999)	10	17				22	25					
Hibernia (1999)	21	15				16	19					
Hibernia (1999)	33	11				11	11					
High Viscosity Fuel Oil	0	0				1	1	3		13	8	
Hondo	0	8				8	13	3		17	2	
Hondo	17	6				4	5	1		9	0	
Hondo	32	4				2	0	1		6	1	
Hout	0	19				28	29	21		40	18	
IFO 180	0	0				5	5	11		17	13	
IFO 180	8	0				3	1	5		11	6	
IFO 300	0	0				3	2	10		16	12	

Table A2 **Predicted Values for All Oils Using the Models**

Oil Name	Evap'n	**Dispersibility % w/Corexit 9500**	Model Number Prediction **1** High Correlators	**2** Best plus BP<250	**3** Best plus Viscosity	**4** Density & Viscosity	**5** Density & BP<250	**6** SARA & Viscosity	**7** SARA & Low HC	**8** SARA & VOCs	**9** SARA	**10** Components alone
IFO 300	5	0				1	-1	-2		6	-1	
Iranian Heavy	0	14				25	25	17		33	14	
Issungnak	0						34					
Jet A/Jet A-1	0	57				60	23					
Jet A/Jet A-1	12	43				59	22					
Jet A/Jet A-1	23	50				59	22					
Jet A/Jet A-1	37					59	21					
Jet B (Alaska)	0	78				60	82					
Jet B (Alaska)	53	33				50	57					
Lago	0	10				15	17	17		32	16	
Lago Treco	0	10				11	14	10		22	9	
Lago Treco	16	10				4	3	7		12	7	
Lagomedio	0					21	23					
Louisiana	0	34				35	32	32		54	34	
Lucula	0	20				22	26	19		33	19	
Main Pass Block 306	0	27				33	33	31		58	31	
Main Pass Block 306	12	23				25	24	24		42	25	
Main Pass Block 306	24	18				17	16	21		32	22	
Main Pass Block 306	37	17				12	8	19		30	21	
Main Pass Block 37	0	33				38	41	32		55	31	
Main Pass Block 37	16	26				28	30	28		50	31	
Main Pass Block 37	30	16				22	21	24		40	28	
Main Pass Block 37	50	14				16	13	20		32	22	
Malongo	0	15				20	22	18		31	18	
Mars TLP	0	36				21	17	17		34	17	
Mars TLP	8	34				15	13	15		30	15	
Mars TLP	17	18				10	8	12		22	12	
Mars TLP	26	2				6	4	9		14	9	
Maui	0	33				33	48					
Maui	14	25				19	39					
Maui	30	10				16	30					
Maui	44	10					18					
Maya	0					11	13	12		26	15	
Maya (1997)	0	15				11	18	9		26	11	
Maya (1997)	19	13				3	2	5		12	7	
Mississippi Canyon Block 194	0	29				37	35					
Mississippi Canyon Block 194	10	22				31	27					
Mississippi Canyon Block 194	21	17				25	20					
Mississippi Canyon Block 194	35	15				19	13					
Mississippi Canyon Block 72	0	31				28	27	24		42	24	
Mississippi Canyon Block 72	9	24				21	22	21		39	22	
Mississippi Canyon Block 72	18	19				17	16	20		32	21	
Mississippi Canyon Block 72	26	18				13	11	16		24	17	
Mississippi Canyon Block 807	0	19				20	23	15		28	13	
Mississippi Canyon Block 807	9	17				13	16	12		25	12	
Mississippi Canyon Block 807	16	0				9	10	12		22	12	
Mississippi Canyon Block 807	26	0				6	4	8		12	8	
Neptune SPAR	0	29				27	20	26		56	29	
Neptune SPAR	8	21				20	17	23		46	26	
Neptune SPAR	15	16				17	15	21		35	24	
Neptune SPAR	23	14				14	12	20		31	22	
Norman Wells	0	35					38					
Odoptu	0	54				40	43					
Odoptu	14	40				32	36	8		54	41	
Odoptu	29	24				24	25	-13		50	37	
Odoptu	41	18				19	15	-15		46	35	
Oseberg	0	15				33	32	25		44	22	
Panuke	0						77					
Pitas Point	0	85				58	72					
Pitas Point	24	66				56	61					
Pitas Point	47					42	14					
Platform Gail	0	22				10	14	5		19	4	
Platform Gail	7	4				7	10	4		19	4	
Platform Gail	13	0				5	6	1		12	1	
Platform Gail	21	0				3	2	0		7	1	

Table A2 **Predicted Values for All Oils Using the Models**

Oil Name	Evap'n	**Dispersibility % w/Corexit 9500**	Model Number Prediction 1 High Correlators	**2** Best plus BP<250	**3** Best plus Viscosity	**4** Density & Viscosity	**5** Density & BP<250	**6** SARA & Viscosity	**7** SARA & Low HC	**8** SARA & VOCs	**9** SARA	**10** Compos alone
Point Arguello Comingled	0	3				10	14	2		16	2	
Point Arguello Comingled	9	0				6	9	4		15	4	
Point Arguello Comingled	16	0				4	5	2		10	3	
Point Arguello Comingled	22	0				2	1	0		8	2	
Point Arguello Heavy	0	0				7	10	4		17	5	
Point Arguello Heavy	9	0				4	5	3		12	4	
Point Arguello Heavy	16	0				2	0	1		7	2	
Point Arguello Light	0	13				25	27	17		32	16	
Point Arguello Light	10	20				16	20	15		30	15	
Point Arguello Light	19	13				13	14	12		20	11	
Point Arguello Light	28	4				9	8	11		17	11	
Port Hueneme	0	12				5	5	5		10	5	
Port Hueneme	4	5				1	3	3		6	4	
Port Hueneme	8	0				3	2	-3		4	-3	
Prudhoe Bay	0	10								55	34	
Prudhoe Bay (1995)	0	10				24	27	19		46	17	
Prudhoe Bay (1995)	9	18				17	19	18		41	18	
Prudhoe Bay (1995)	18	0				13	13	15		27	14	
Prudhoe Bay (1995)	27	0				9	7	12		17	11	
Rangely	0					24	27	22		42	25	
Sakhalin	0	84				43	41	38		85	29	
Sakhalin	25	49										
Sakhalin	42	31				16	13	10		26	10	
Santa Clara	0	6				11	15	0		12	0	
Santa Clara	11	4				7	8	1		10	1	
Santa Clara	22	0				1	4	1		8	2	
Ship Shoal Block 269	0	36				42	42					
Ship Shoal Block 269	13	27				36	33					
Ship Shoal Block 269	26	23				27	24	26		41	28	
Ship Shoal Block 269	39					20	15	24		30	29	
Sockeye	0	24				19	24	13		29	11	
Sockeye	13	9				13	16	10		23	9	
Sockeye	22	5				10	10	8		15	6	
Sockeye (2000)	0	12	14	14	8	9	12	5	4	24	4	15
Sockeye (2000)	7	10				6	8	3		13	4	
Sockeye (2000)	13	10				4	5	3		13	3	
Sockeye (2000)	20	9	6	7	10	3	1	1	13	12	3	30
Sockeye Comingled	0	0				9	14	4		19	4	
Sockeye Sour	0	0				8	13	5		19	4	
Sockeye Sour	10	0				4	6	2		13	2	
Sockeye Sour	19	0				2	1	0		7	1	
Sockeye Sweet	0	16				25	29	19		41	17	
Sockeye Sweet	8	17				20	21	18		39	17	
Sockeye Sweet	17	14				15	16	14		24	13	
Sockeye Sweet	27	15				11	9	12		18	11	
South Louisiana (2001)	0	26	24	25	21	32	30	28	21	54	28	27
South Louisiana (2001)	11	24				24	24	24		41	28	
South Louisiana (2001)	20	16				19	18	21		38	25	
South Louisiana (2001)	28	10	11	11	13	14	13	19	14	34	22	13
South Pass Block 60	0	28				34	37	27		47	25	
South Pass Block 60	17	21				25	25	25		43	26	
South Pass Block 93	0					27	28	26		45	29	
South Timbalier Block 130	0	31				37	37					
Statfjord	0	40				40	39	32		52	25	
Sumatran Heavy	0	10				7	6	10		18	10	
Sumatran Heavy	5	0				7	5	10		16	6	
Sumatran Light	0	0				13	22	16		33	20	
Swanson River	0	36				39	40	29		45	22	
Swanson River	40	10				13	10	17		26	19	
Synthetic	0	40				40	30					
Taching	0	9				12	19	14		29	16	
Takula	0	11				18	24	19		36	22	
Takula	11	9				13	19	16		29	16	
Takula	18	6				11	14	15		25	15	
Tapis Blend	0	63				40	52	34		62	39	

Table A2 **Predicted Values for All Oils Using the Models**

			Model Number Prediction									
			1	2	3	4	5	6	7	8	9	10
Oil Name	Evap'n	**Dispersibility % w/Corexit 9500**	High Correlators	Best plus BP<250	Best plus Viscosity	Density & Viscosity	Density & BP<250	SARA & Viscosity	SARA & Low HC	SARA & VOCs	SARA	Compos alone
Tapis Blend	14	69				24	43	28		79	37	
Tapis Blend	29	56				17	32	25		59	34	
Tapis Blend	43	44				15	21	22		40	29	
Terra Nova (1994)	0	14				32	35	27		51	26	
Terra Nova (SODSEX)	0					24	21	27		53	26	
Thevenard Island	0	77				80	70					
Trading Bay	0	47				32	33	24		38	20	
Trading Bay	33	9				11	9	14		22	15	
Transmountain Blend	0					32	29	30		54	37	
Udang	0	7				4	4	0		14	8	
Viosca Knoll Block 826	0	24				27	27	25		49	26	
Viosca Knoll Block 826	8	17				20	22	2[illegible]		43	22	
Viosca Knoll Block 826	17	15				15	16	2[illegible]		36	24	
Viosca Knoll Block 826	24	17				12	11	18		29	21	
Viosca Knoll Block 990	0	41				38	37	34		64	34	
Viosca Knoll Block 990	12	29				30	29	28		56	28	
Viosca Knoll Block 990	24	22				22	21	25		45	29	
Viosca Knoll Block 990	35	14				17	13	20		31	22	
Waxy Light Heavy Blend	0	9				11	13	9		16	7	
Waxy Light Heavy Blend	12	0				6	7	6		13	5	
Waxy Light Heavy Blend	20	0				4	2	4		10	3	
West Delta Block 97	0	48				81	77					
West Delta Block 97	23					76	65					
West Delta Block 97	48					51	48					
West Delta Block 97	74					36	21					
West Texas (2000)	0	29	30	30	26	34	34	29	24	63	20	30
West Texas (2000)	10	24				27	28	25		39	26	
West Texas (2000)	21	13				21	20	22		37	25	
West Texas (2000)	32	13	15	15	20	15	14	18	11	32	19	16
West Texas Intermediate	0	15				37	37	3[illegible]		49	29	
West Texas Sour	0	25				28	31	2[illegible]		43	17	
White Rose	0	21				23	24					
White Rose	9	20				16	18					
White Rose	15	16				13	14					
White Rose	24	16				10	10					
Zaire	0	0				15	22	16		33	17	
		Std. Deviation (average)	1.6	1.3	2.4	4.6	5	4.9	6.7	11.8	6	2.6
		Maximum Dev	5	6	9	32	30	34	18	42	39	15

Abbreviations

SARA – Saturates, Aromatics, Resins, Asphaltenes
BP<250 = fraction having boiling point less than 250 °C
Compos = composition elements
Physic – physical properties

VOCs - Volatile Organic Compounds
Low HC - low hydrocarbons
ap - as is possible
PP - pour point