

# **Measurement of Biodiesel Speed of Sound and Its Impact on Injection Timing**

**Final Report**  
**Report 4 in a series of 6**

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**Abstract.**

Biodiesel, an alternative diesel fuel consisting of the alkyl monoesters of fatty acids from vegetable oils and animal fats, can be used in existing diesel engines without modifications. However, property changes associated with the differences in chemical structure between biodiesel and petroleum-based diesel fuel may change the engine's injection timing. These injection timing changes can cause different exhaust emissions and performance than the optimized settings chosen by the engine manufacturer. The properties that will have the greatest effect on the fuel injection timing are the speed of sound, the isentropic bulk modulus, and the viscosity. The objective of this study was to measure the isentropic bulk modulus and speed of sound of biodiesel and the pure esters that are the constituents of biodiesel at temperatures from 20°C to 100°C and at pressures from atmospheric to 34.5 MPa. Future work to identify the effect of viscosity is anticipated. The measured values of density, speed of sound, and isentropic bulk modulus are shown and correlations showing the dependence of pressure at each temperature are provided. A simple analysis using measured values of biodiesel and diesel fuel properties indicates that property changes could cause approximately 1° of injection timing advance. Since NO<sub>x</sub> emissions increase with advanced timing, this effect may be partially responsible for the increase in NO<sub>x</sub> sometimes observed in the exhaust of biodiesel fueled engines.

## **1. Introduction**

Biodiesel, an alternative to diesel fuel consisting of the alkyl monoesters of fatty acids from vegetable oils and animal fats, can be used in existing diesel engines without modifications. However, property changes associated with the differences in chemical structure between biodiesel and petroleum-based diesel fuel may change the engine's injection timing. These injection timing changes can cause different exhaust emissions and performance than the optimized settings chosen by the engine manufacturer. The properties that will have the greatest effect on the fuel injection timing are the speed of sound, the isentropic bulk modulus, and the viscosity.

Figure 1 shows recently obtained data for the fuel injection line pressure from an engine being used for an unrelated project [1]. The two fuels designated HPVB and LPVB are soybean-based biodiesels. Data is shown for the two biodiesel fuels, 20% blends of the fuels in No. 2 diesel fuel, and the No. 2 diesel fuel itself. These data show that for fixed injection pump timing, the injection pressure pulse for the biodiesel was  $1.5^\circ - 2.0^\circ$  advanced from the diesel fuel baseline. The injection timing advance is probably due to differences in the fuel properties such as the bulk modulus and speed of sound. The higher viscosity of the biodiesel may also have an effect. Since NO<sub>x</sub> emissions increase with advanced timing, this effect may be partially responsible for the increase in NO<sub>x</sub> observed with biodiesel. The engine used for this testing was a John Deere 4276T, 4 cylinder, diesel engine equipped with a distributor-type injection pump.

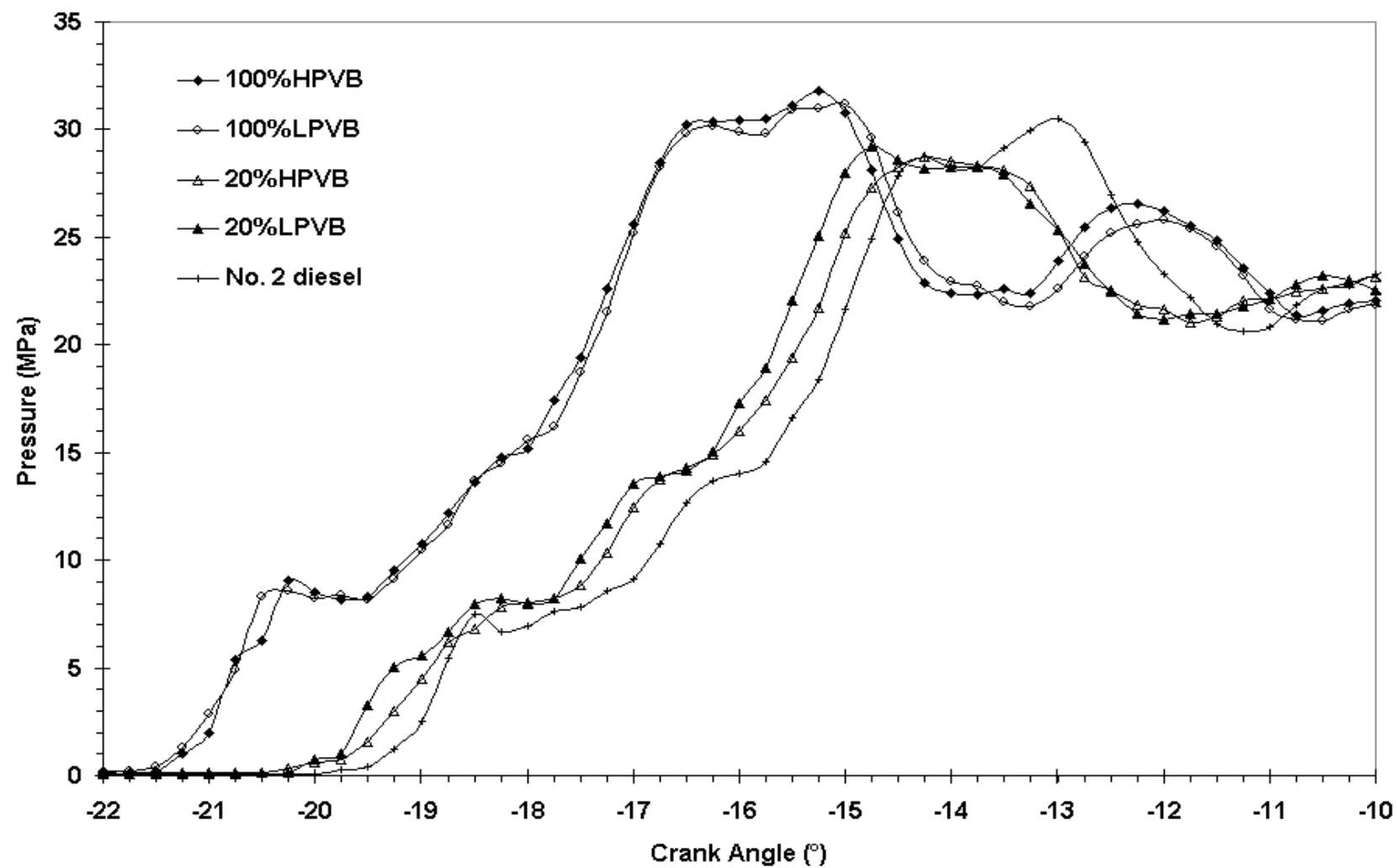


Figure 1. Injection line pressure for biodiesel and No. 2 diesel fuel.

The objective of the current project was to measure the isentropic bulk modulus and speed of sound of biodiesel at temperatures from 20°C to 100°C and at pressures from atmospheric to 5,000 psi. These ranges should cover many of the commonly encountered injection timing characteristics since many engines have nozzle opening pressures below 5,000 psi. In addition to measuring the properties of biodiesel made from soybean oil, we will be measuring the properties of the pure ester constituents of biodiesel.

This report presents the results of measurements of these properties for 21 pure esters and ester blends. These compounds are listed in Table 1. Samples of the compounds shown in Table 1 were provided by Michael Graboski, Robert McCormick, and Teresa Alleman of the Colorado Institute for Fuels and High-Altitude Engine Research at the Colorado School of Mines. Tables B-1 through B-4 in Appendix B provide chemical analyses and property data for the different esters that were tested.

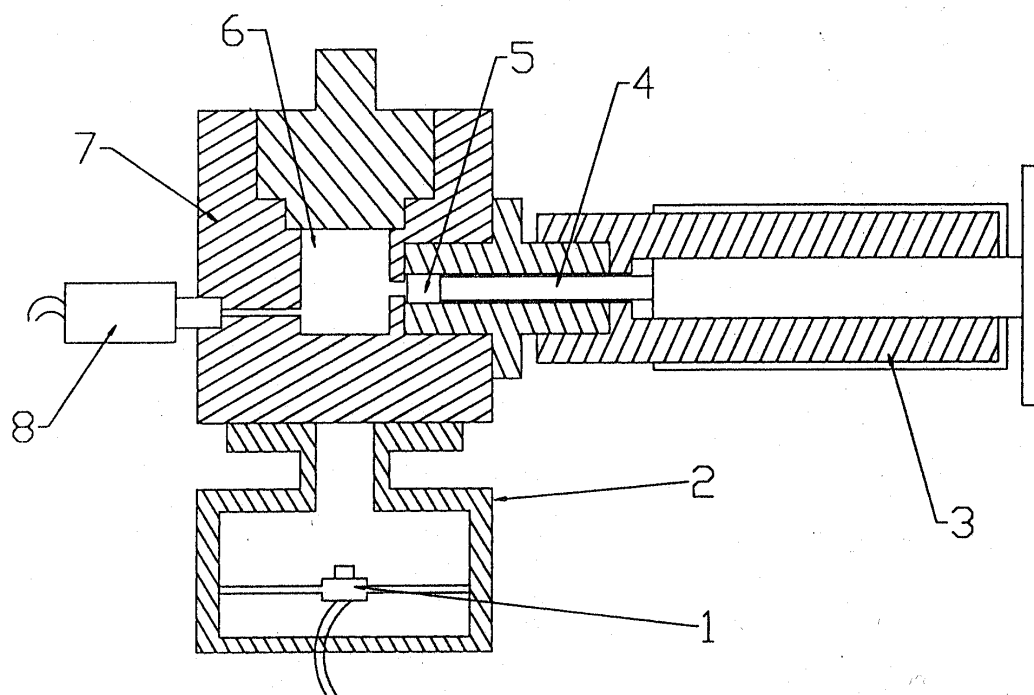
## **2. Equipment and procedure**

The ultrasonic pulse echo technique was used to measure the speed of sound in the esters from 20°C to 100°C and from atmospheric pressure to 34.5 MPa [2-6]. A pressure vessel with a piston and cylinder assembly for raising the pressure was fabricated and an ultrasonic transducer was located at the bottom of the vessel as shown in Figure 2. A Panametrics Model 5072 PR general purpose ultrasonic pulser/receiver and a Panametrics 10 MHz videoscanner immersion transducer (Waltham, MA) were used.

Table 1. Fuel Samples

Methyl Laurate	Methyl Linoleate	Methyl Lard
Methyl Palmitate	Methyl Linolenate	Methyl Canola
Methyl Stearate	Methyl Oxidized Soy	Methyl Soy Gold
Methyl Oleate	Methyl Tallow	Methyl Yellow Grease
Certified D-2	Ethyl Stearate	Ethyl Linoleate
Methyl Hydrogenated Soy	Ethyl Hydrogenated Soy	Ethyl Oxidized Soy
2:1 Methyl Stearate, Methyl Linseed	Ethyl Linseed	N- Octadecane
2:1 Methyl Linseed, Methyl Stearate		Ethyl Soy Ester





1. 10 MHz ultrasonic transducer.
2. cooled chamber for transducer.
3. pressure screw
4. plunger
5. piston
6. sample chamber
7. pressure vessel
8. pressure transducer

Figure 2. Cross section of the Pressure Vessel.

Signals were captured with a Hewlett Packard Model 54601A 100 MHz, 4 channel digital oscilloscope (Colorado Springs, CO). System pressure was measured using a Sensotec Model 2 Z/1108-04Z9 pressure transducer (Columbus, OH). To obtain elevated temperatures the entire pressure vessel was submerged in a temperature controlled bath.

The speed of sound was determined by measuring the time difference between the ultrasound echo reflected back to the transducer from the interface where the signal passed from the pressure vessel into the sample fluid, called the first echo and from the reflection when the signal left the sample and reentered the vessel wall, called the second echo. A diagram showing the echoes is given in Figure 3. The distance traveled by the sound wave during this time period, which is two times the sample thickness, was divided by the elapsed time to give the speed of sound in the fluid.

The first echo was a stationary echo with a fixed time delay from the zero trigger event. It was identified using calculations based on the speed of sound in water and stainless steel. The second echo was found from observation and was the only echo that moved with pressure fluctuations in the cell. After finding the second echo, the elapsed time was recorded starting with the atmospheric pressure level. Then, the pressure level in the cell was raised to 5,000 psi and lowered to atmospheric pressure in 1,000 psi steps.

Density measurements were taken simultaneously with the speed of sound measurements by using a vernier to show the piston location in the cylinder. To determine the density of the sample at elevated pressures, the sample density was initially measured at atmospheric pressure using a specific gravity balance. As the sample pressure was raised using the piston and cylinder, the piston position was used to calculate the volume change. Since the sample mass was constant, the volume change was used to determine the density change. The density change could be combined with the initial density measurement, to give the density at the elevated pressure. For each temperature increment a known amount of sample was discharged starting at 20°C and the density was calculated from the volume change at the higher temperature level. A correction was calculated for the expansion of the vessel at high pressure and high temperature, although this was small for all of the data presented here.

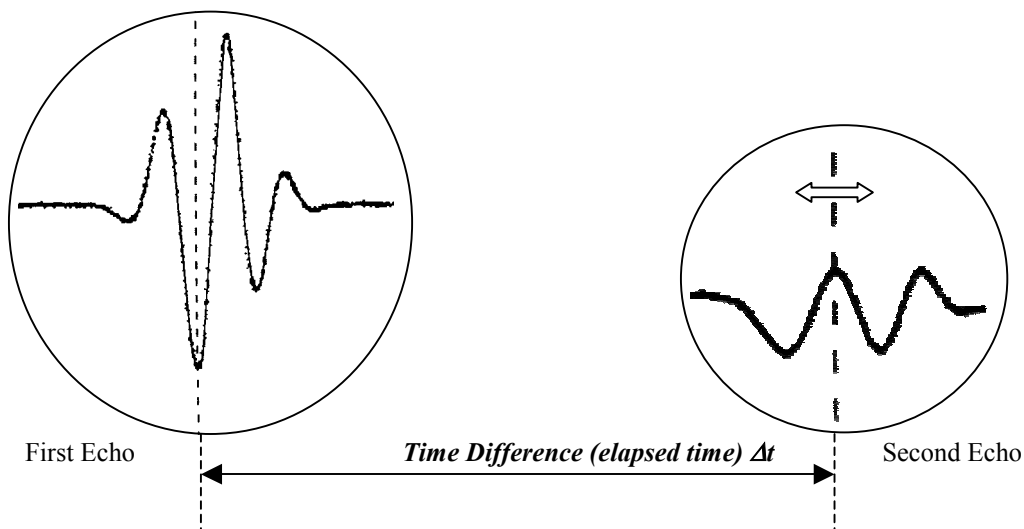


Figure 3. Ultrasonic Signals

Figure 4 shows the complete experimental setup. The screw adjustment for raising the sample pressure is visible extending from the right side of the stainless steel pressure vessel. The metal housing on top of the pressure vessel contains the ultrasonic transducer and provides the cooling the transducer needs to stay below 50°C. Figure 4 shows an end view of this housing looking into the transducer. The adjustable supports for the transducer are visible in this view. They allow the transducer to be aligned for maximum signal strength.



Figure 4. Experimental apparatus for ultrasound measurements.

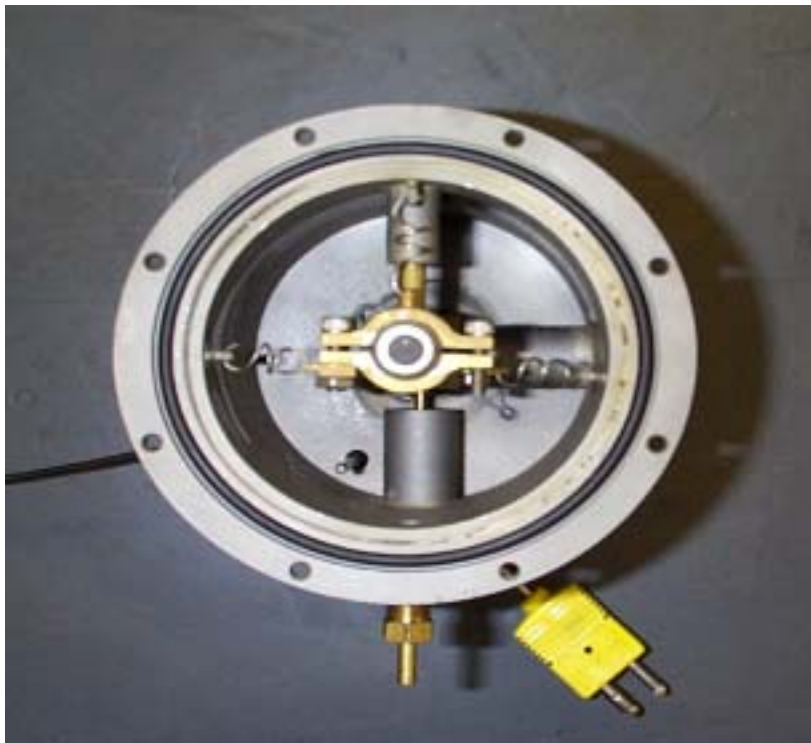


Figure 5. End view of ultrasonic transducer showing alignment screws.

The isentropic bulk modulus was calculated from the measured density and speed of sound using the following equation [5, 7].

$$\beta = c^2 \times \rho \quad (1)$$

where  $\beta$  is the isentropic bulk modulus,  $c$  is the speed of sound in the sample, and  $\rho$  is the density.

The two primary concerns with the use of the pressure vessel technique for density measurement were ensuring that air bubbles were eliminated from inside the vessel and that no fluid leaked from the vessel during the test. If air bubbles were present, their presence was expected to cause variations in measurements as the pressure vessel was filled, emptied, and refilled again. Thus, the pressure vessel was filled with the sample fluid two times and each time two sets of data were collected as the pressure was varied. Half of the measurements were collected while increasing the pressure and half while decreasing the pressure. This was to identify leakage from the chamber or any other hysteresis effects. Thus, a total of four data points were collected for each pressure and temperature level. Subsequent analysis showed no statistically significant difference between the measurements associated with different filling operations or with measurements taken while increasing or decreasing the pressure. Therefore, all 4 measurements were averaged and included in the confidence limit calculations. All measurements were taken from 20°C to 100°C except for methyl palmitate, methyl stearate, 2:1 methyl stearate methyl linseed, methyl hydrogenated soy, ethyl hydrogenated soy, ethyl stearate, and n-octadecane which were solid at 20°C. The lowest temperature at which measurements were taken for these esters was 40°C.

### **3. Results**

The density, speed of sound and isentropic bulk modulus of the fuel samples showed linear relationships at fixed temperature as the pressure was varied. The linear regression coefficients at the five temperatures for each fuel are provided in Tables A-1 through A-23 in Appendix A. The actual raw data on which the correlations are based is provided in Appendix C. The following discussion focuses on identifying common trends as the esters with different levels of saturation or chain length are compared.

Figures 6, 7, and 8 show the effect of temperature on the density, speed of sound, and isentropic bulk modulus for fuels with different levels of saturation. All three properties tend to increase as the degree of unsaturation increases.

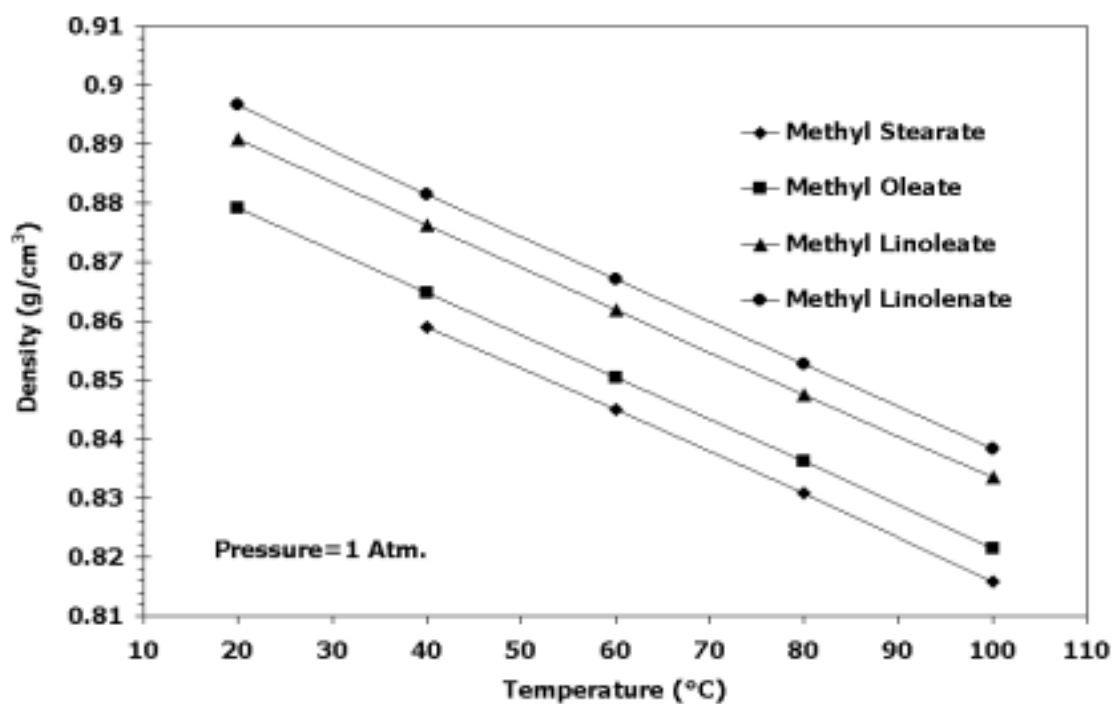


Figure 6. Temperature dependent saturation effect on density at atmospheric pressure.

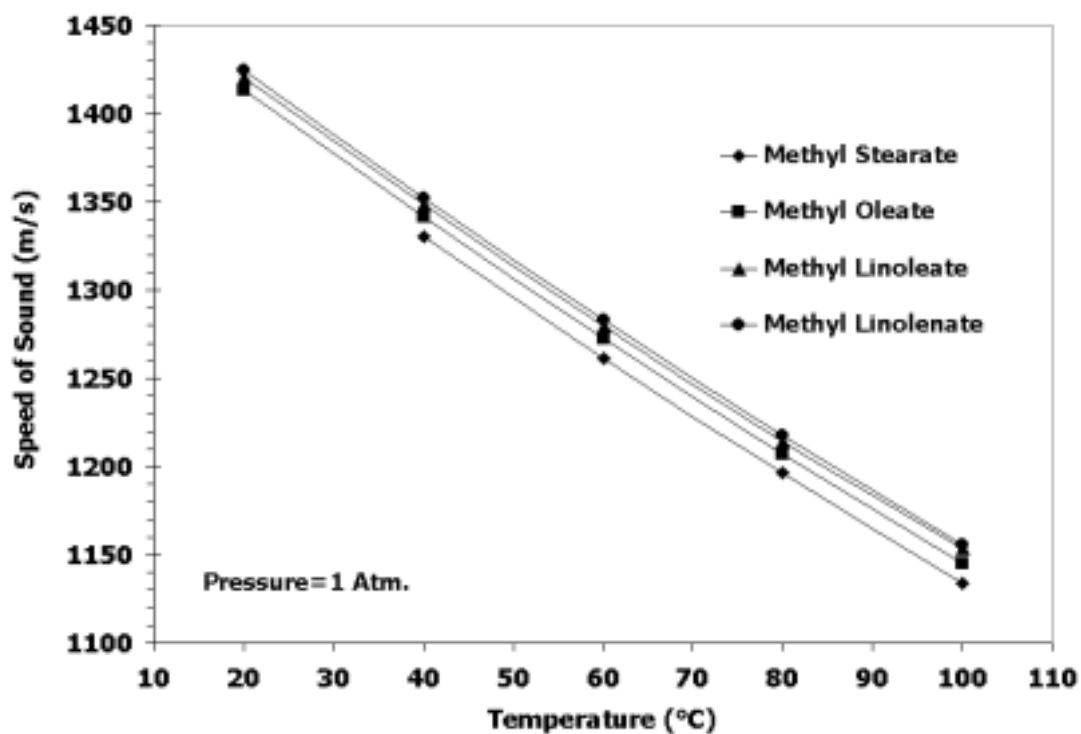


Figure 7. Temperature dependent saturation effect on speed of sound at atmospheric pressure.

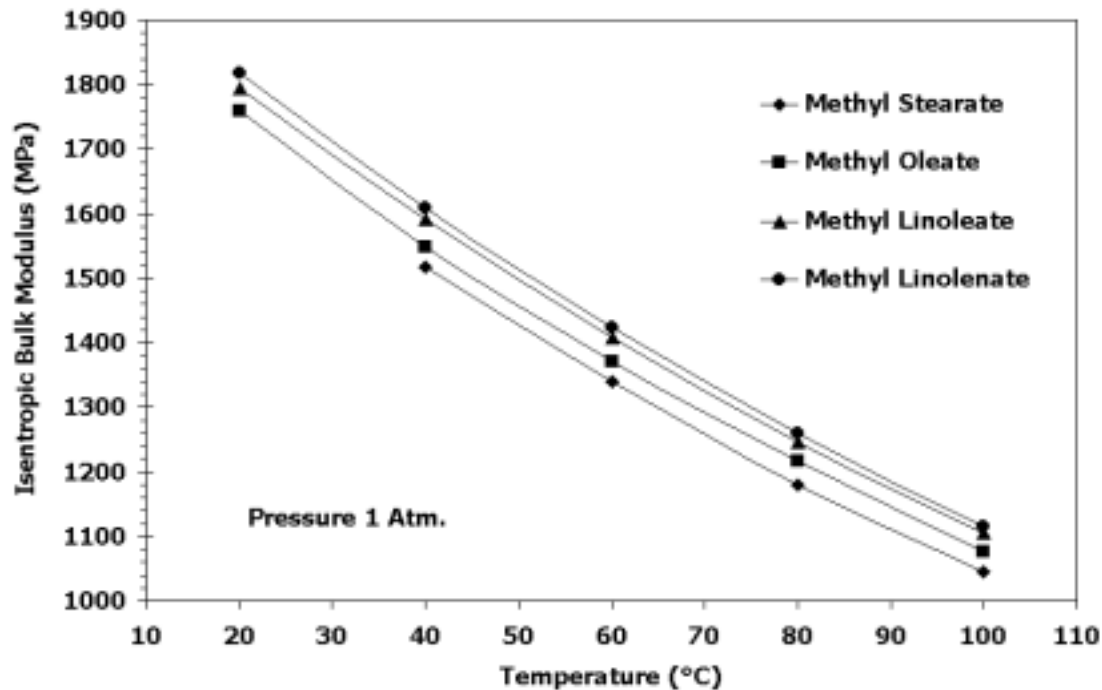


Figure 8. Temperature dependent saturation effect on isentropic bulk modulus at atmospheric pressure.

Methyl stearate has the lowest density, speed of sound, and isentropic bulk modulus and methyl linolenate has the highest. All of the compounds appear to have approximately the same property variation with temperature as indicated by similar slopes of lines on these figures.

The variations in the three properties as the pressure increases are shown in Figures 9, 10, and 11 for the four levels of saturation. The temperature for these data was 40°C. A complete comparison could not be made at 20°C because methyl stearate is a solid at this temperature. Again, the density, speed of sound, and isentropic bulk modulus are higher for the more unsaturated esters. Figures 6 through 11 indicate that the increase in properties is not uniform as each double bond is added. The change in density from oleate to linoleate is much greater than from stearate to oleate or linoleate to linolenate.

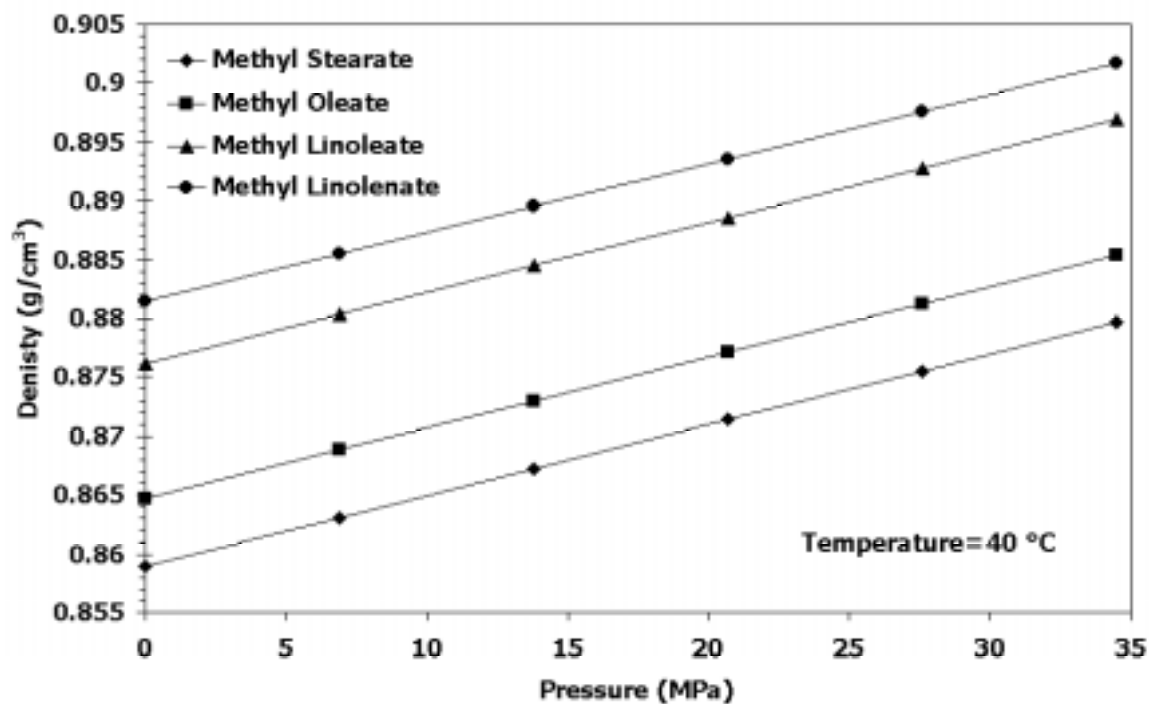


Figure 9. Saturation effect on density at elevated pressures and 40 °C temperature.

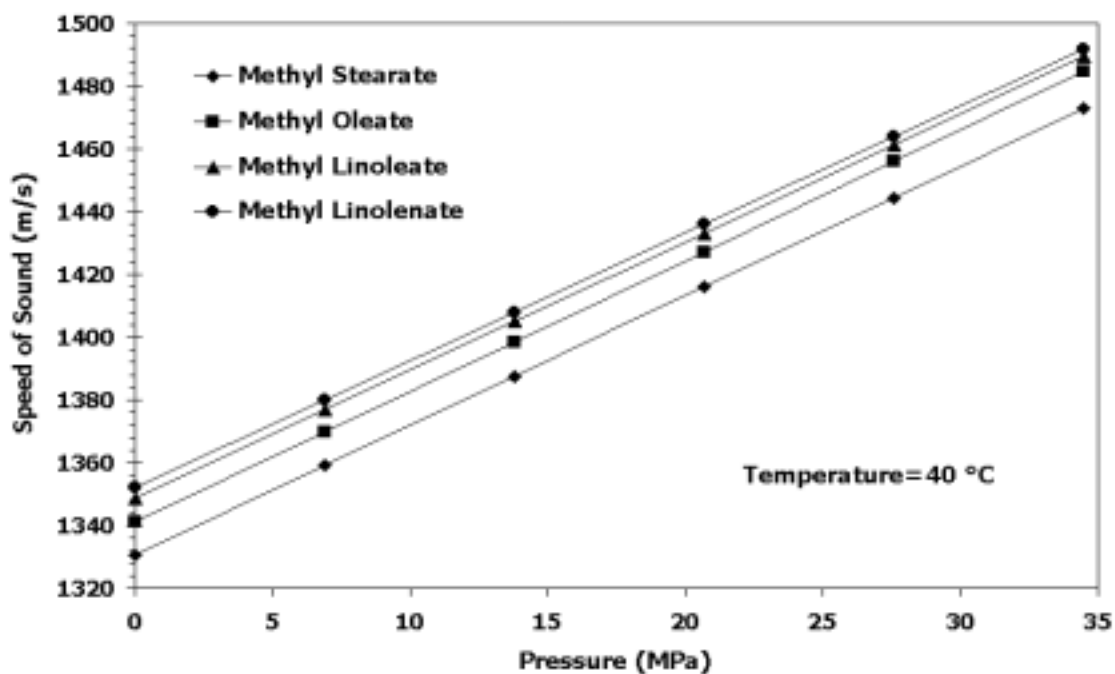


Figure 10. Saturation effect on speed of sound at elevated pressures and 40 °C temperature.

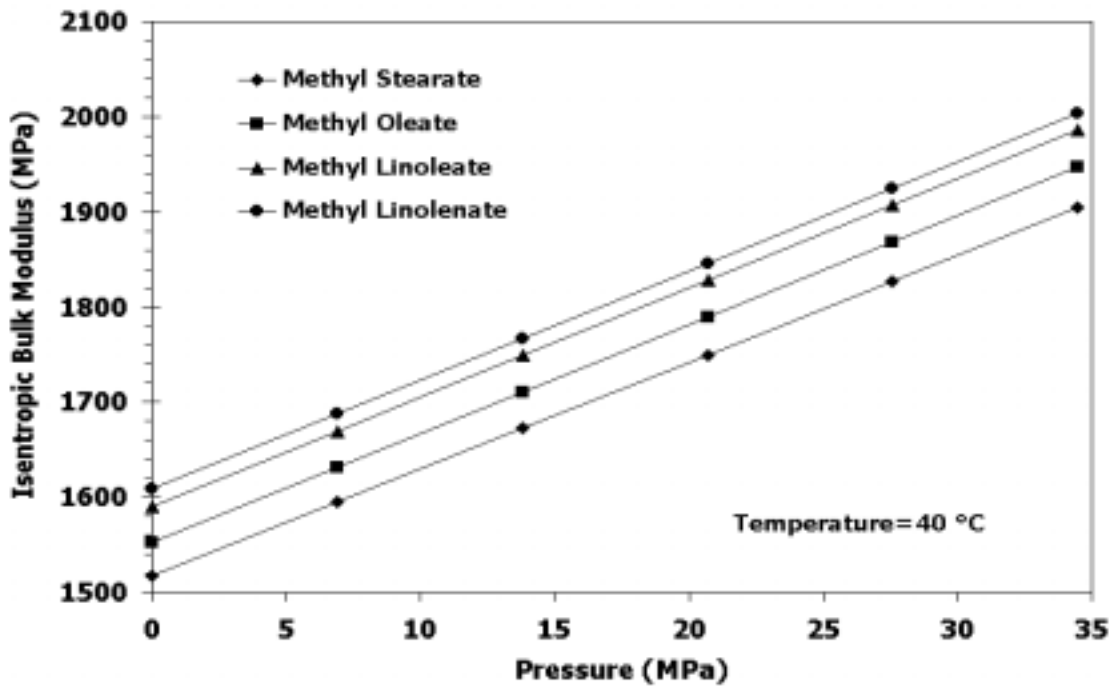


Figure 11. Saturation effect on isentropic bulk modulus at elevated pressures and 40 °C temperature.

The property data for methyl laurate, methyl palmitate, and methyl stearate are provided in Figures 12-14 to show the effect of fatty acid chain length. These data demonstrate that the density, speed of sound, and isentropic bulk modulus increase as the chain length increases which confirms the conclusions drawn for hydrocarbons in reference [7].

Methyl soy ester, ethyl soy ester, and emissions certification grade No.2 diesel fuel (Cert D2) are compared with each other in Figures 15-17. It can be seen that the methyl soy ester is approximately 0.5% more dense than ethyl soy ester and 5% more dense than the certification D2. The speed of sound in the methyl soy ester is about 0.7% and 2.8% faster than that of ethyl soy ester and Certified D2, respectively. The isentropic bulk modulus of the methyl soy ester was 1% higher than that of the ethyl soy ester and 10% higher than the Certified D2.

Figures 18-20 show a comparison of oxidized soy methyl ester and unoxidized soy methyl ester. The sample of oxidized soy methyl ester was provided by the Colorado School of Mines. The extent of oxidation and the method used to oxidize the fuel were not known. Oxidation increased the density slightly but did not increase the speed of sound significantly. As a result of the density increase, the isentropic bulk modulus of the oxidized soy ester is slightly higher than for the methyl isentropic bulk modulus soy ester.

Hydrogenated soy ester and methyl soy ester were compared to see the effect of hydrogenation on the properties. These results are presented in Figures 21-23. Hydrogenation lowers the values of all the three properties as was expected based on the effects of varying saturation observed in Figures 6-11.



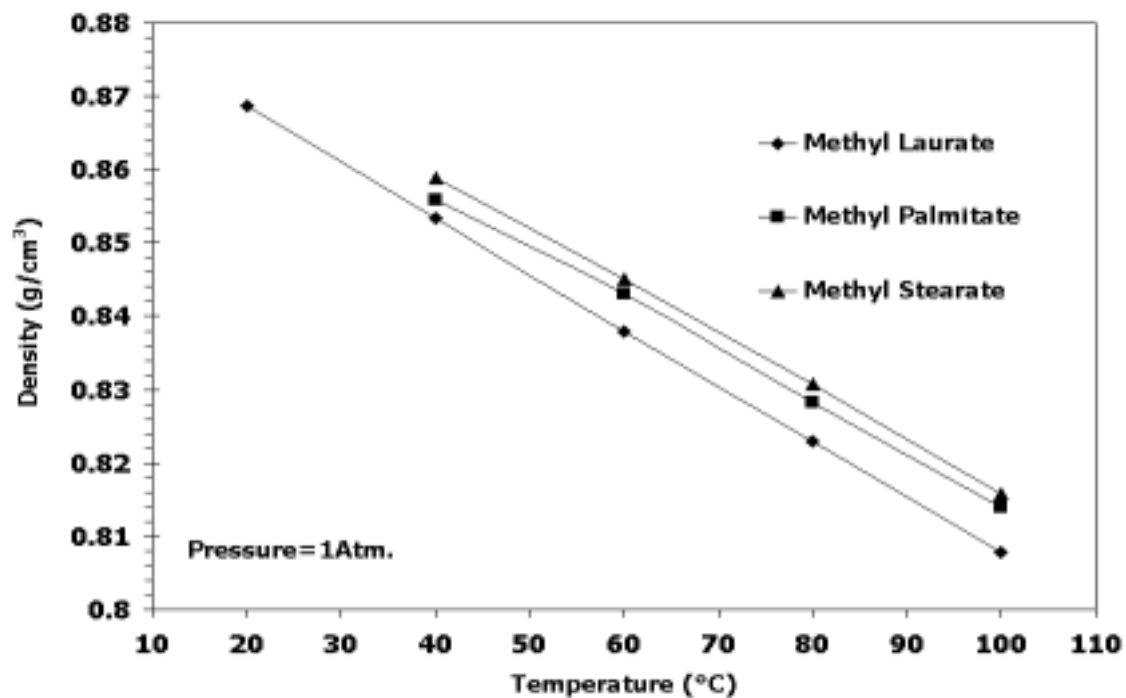


Figure 12. Temperature dependent chain length effect on density at atmospheric pressure.

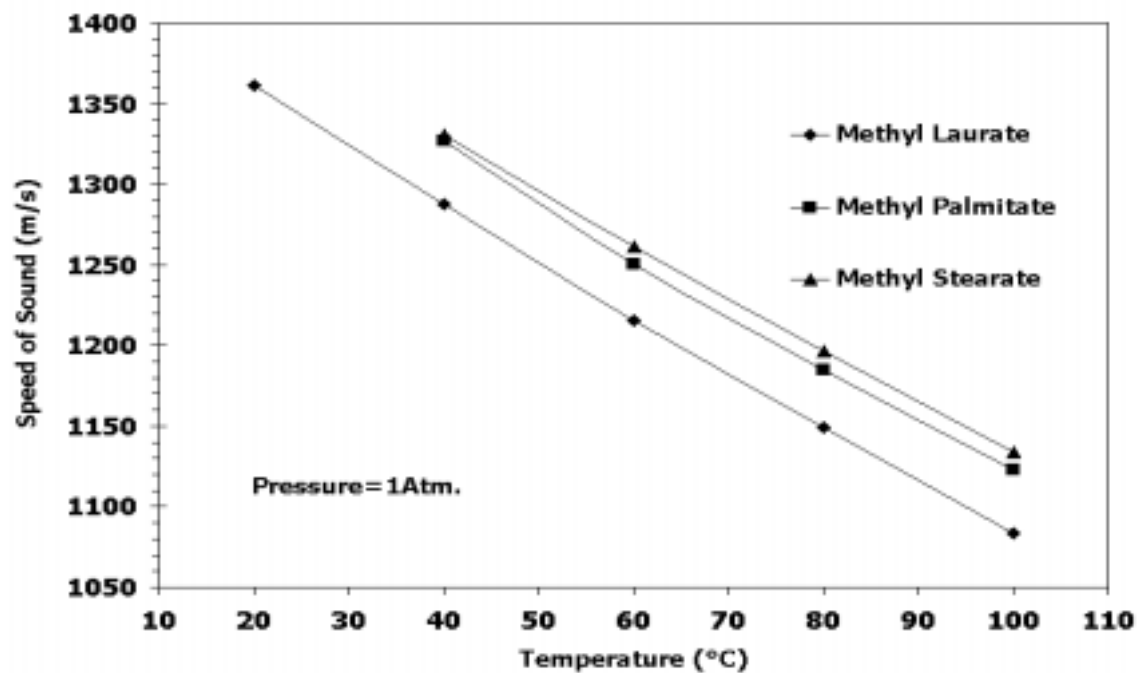


Figure 13. Temperature dependent chain length effect on speed of sound at atmospheric pressure.

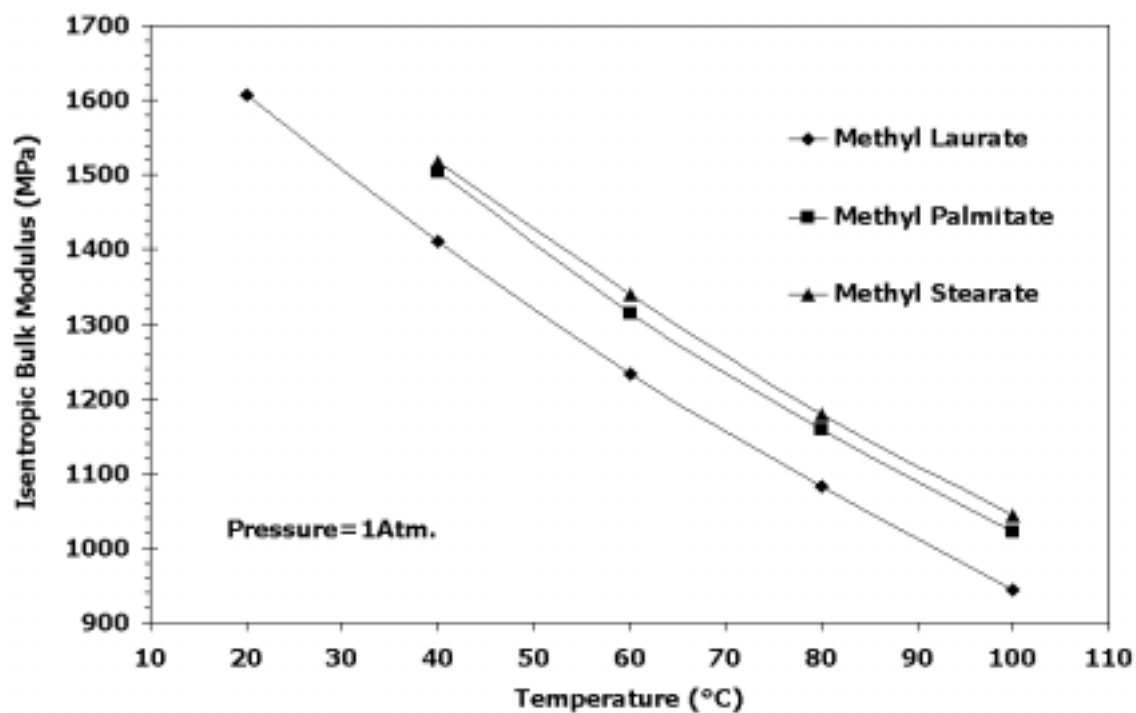


Figure 14. Temperature dependent chain length effect on isentropic bulk modulus at atmospheric pressure.

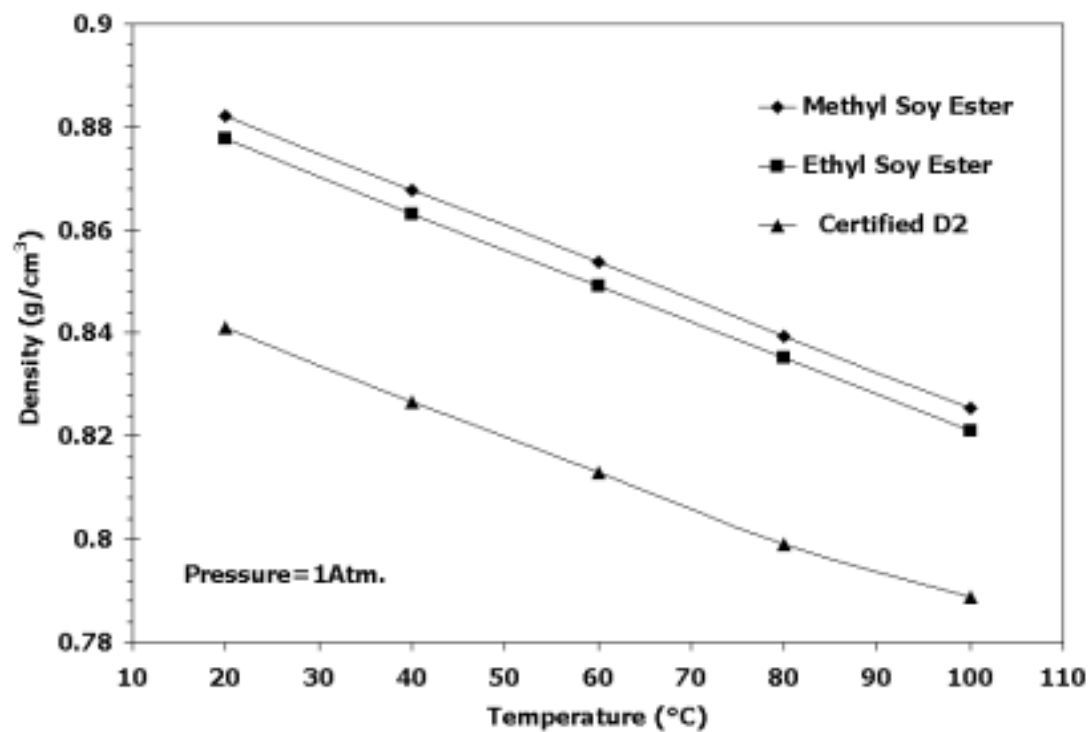


Figure 15. The density comparison of methyl, ethyl and No. 2 diesel fuel.

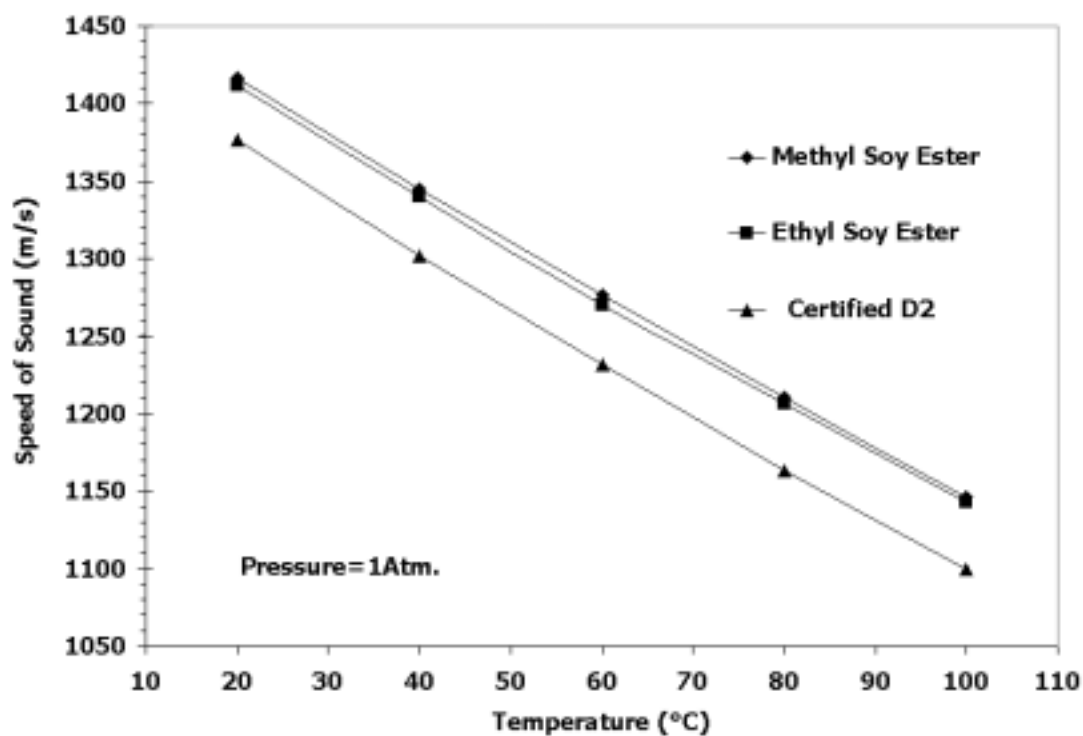


Figure 16. The speed of sound comparison of methyl, ethyl and No. 2 diesel fuel.

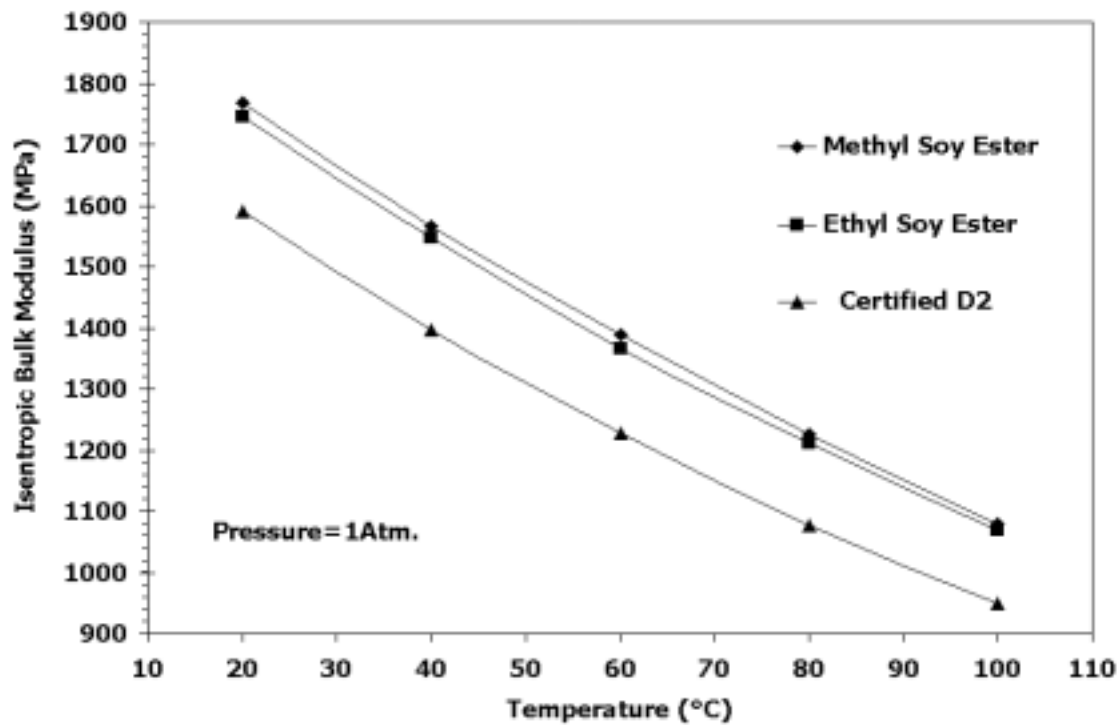


Figure 17. The isentropic bulk modulus comparison of methyl, ethyl and No. 2 diesel fuel.

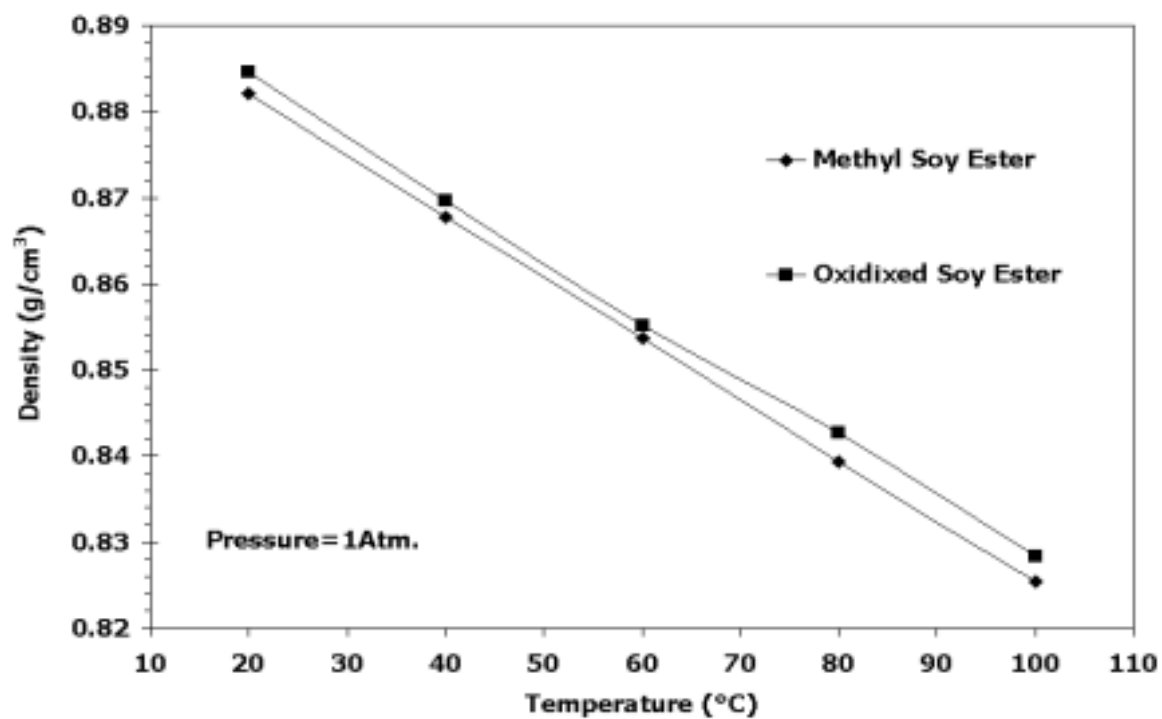


Figure 18. Oxidation effect on density of methyl ester.

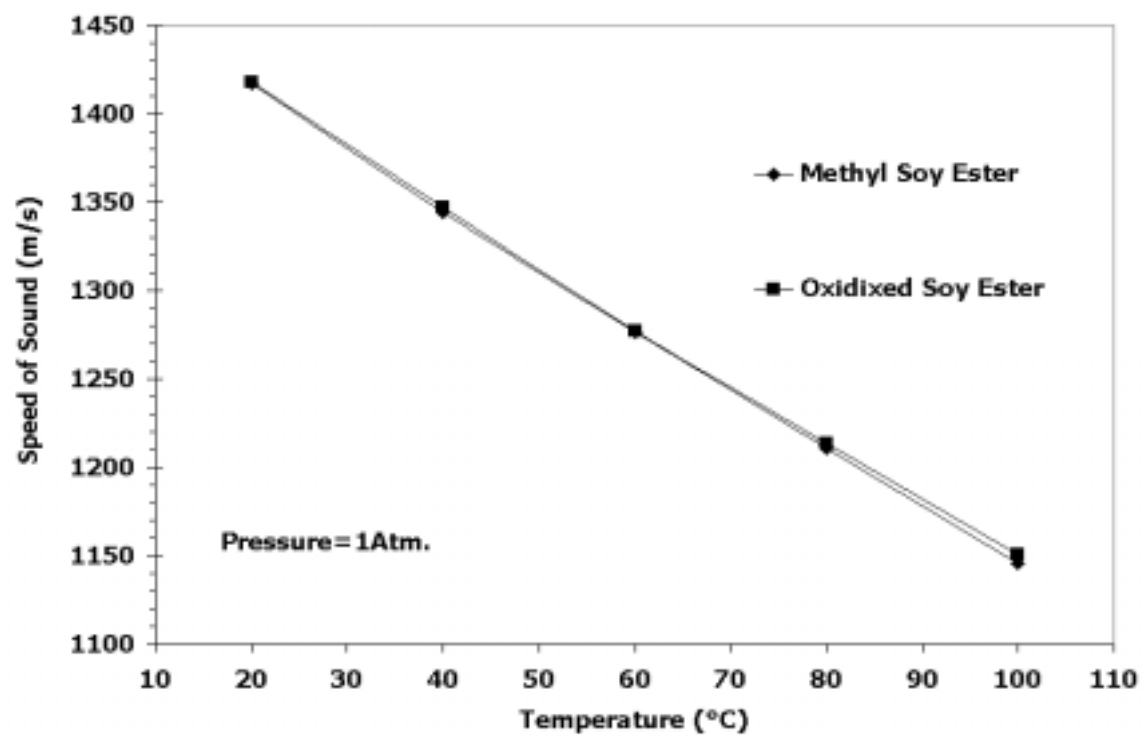


Figure 19. Oxidation effect on speed of sound of methyl ester.

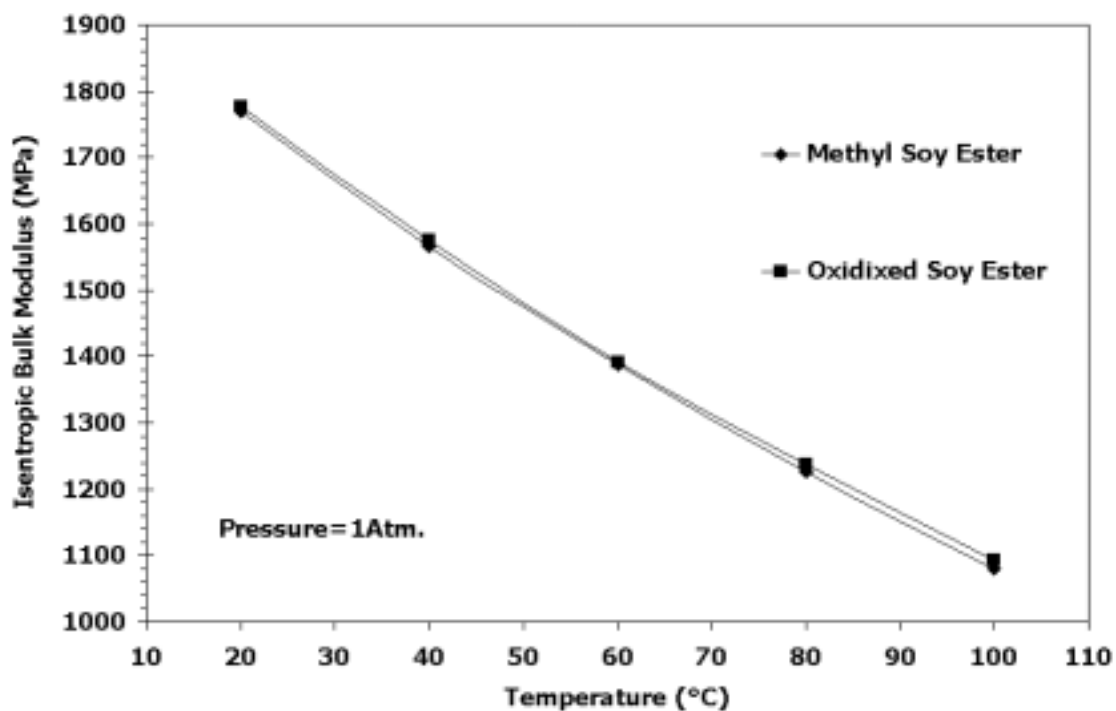


Figure 20. Oxidation effect on isentropic bulk modulus of methyl ester.

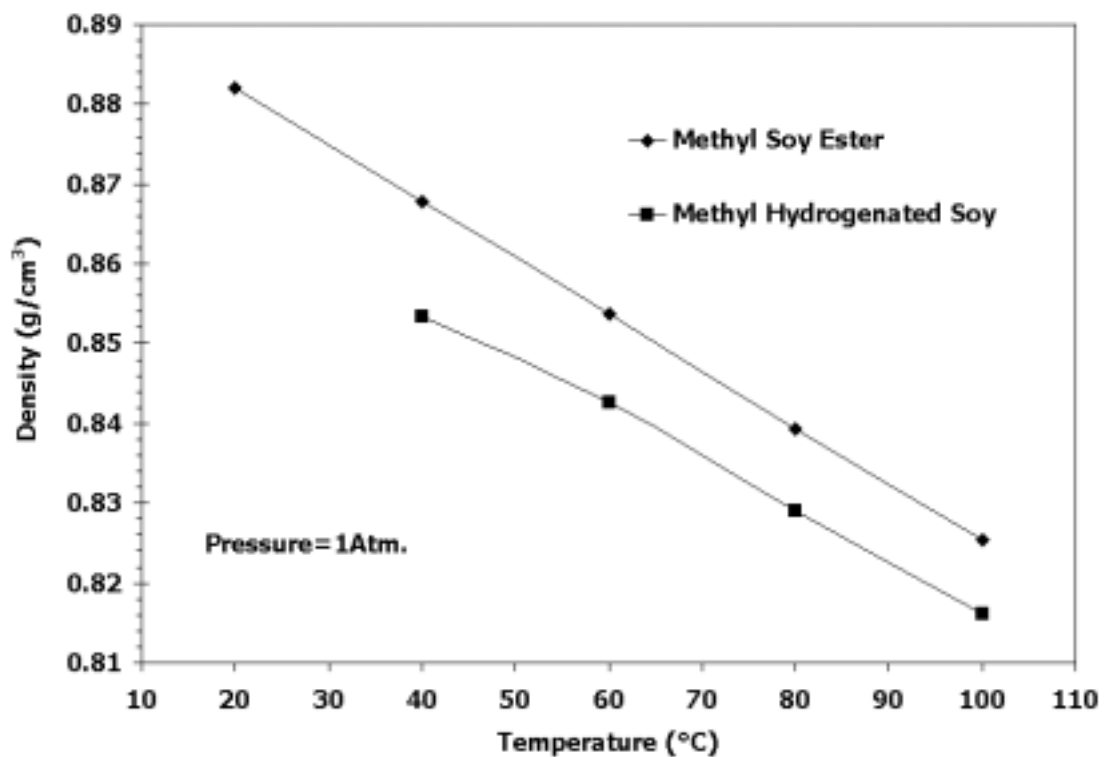


Figure 21. Hydrogenation effect on density of methyl ester.

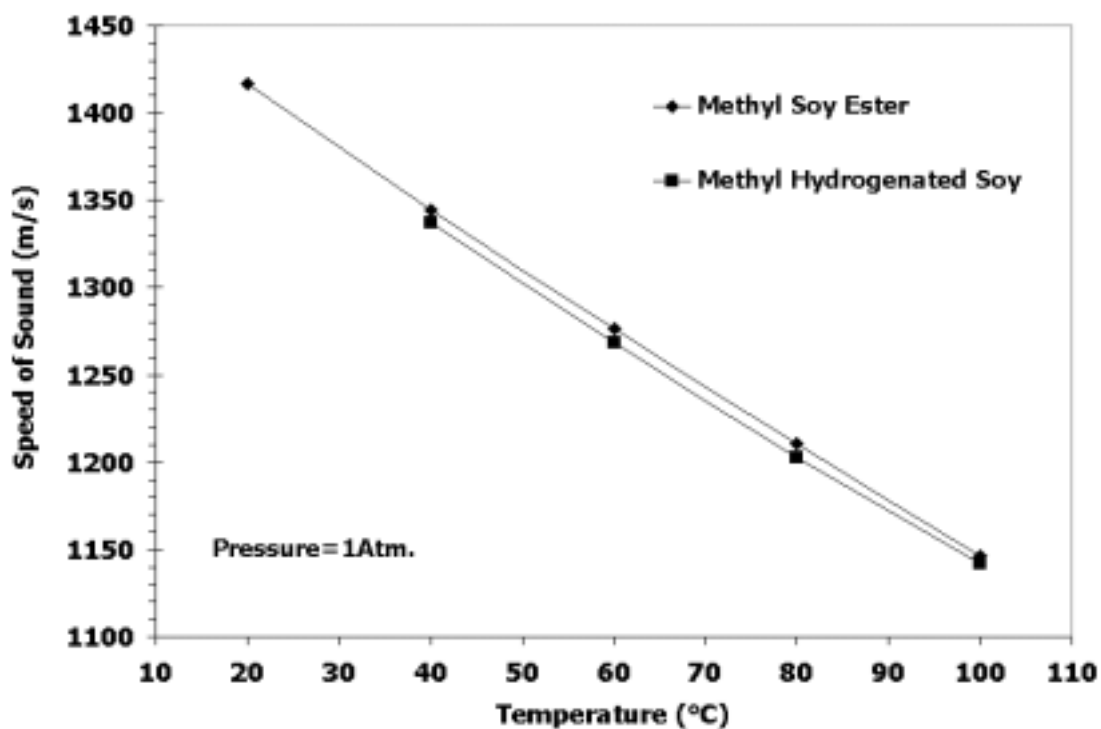


Figure 22. Hydrogenation effect on speed of sound of methyl ester.

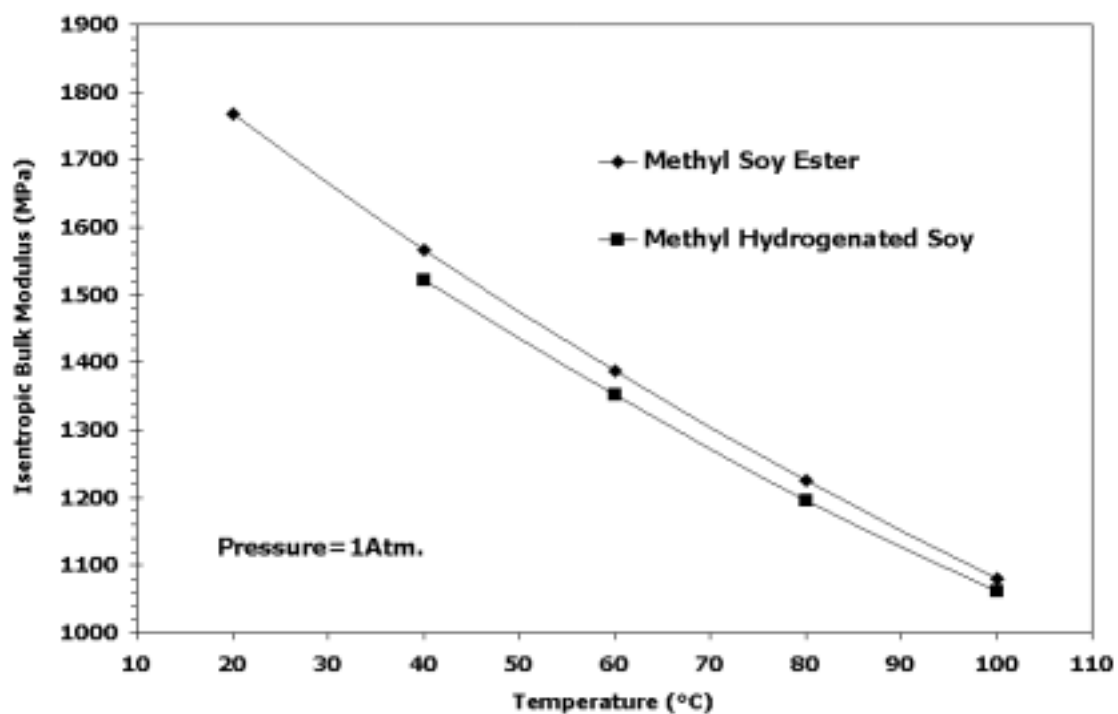


Figure 23. Hydrogenation effect on the isentropic bulk modulus of methyl ester.

The density of the hydrogenated soy ester was 2% lower than that of methyl soy ester, the speed of sound was 0.7% lower, and the isentropic bulk modulus was 2.5% lower than that of methyl soy ester at 40°C.

#### **4. Review of Current Diesel Fuel Injection Equipment**

The purpose of the diesel fuel injection system is to introduce the proper amount of fuel into the cylinder with sufficient kinetic energy to encourage good mixing between the fuel and air. The timing of this process is particularly important because early injection timing produces the high in-cylinder temperatures that cause NO<sub>x</sub> formation. Engine manufacturers are currently striving to control timing to within 0.1° of crankshaft rotation to minimize engine-to-engine variation in emissions. This section reviews the common equipment used for diesel fuel injection and is followed by sections which estimate the impact of fuel property changes on the injection timing.

There are three basic types of diesel fuel injection systems in common use: pump-line-nozzle systems, unit injector systems, and common rail systems. Only the first two are in common use in the United States. Figure 24 shows a typical pump-line-nozzle (PLN) system. The pump, in this case an inline style pump, supplies pulses of pressurized fuel to the fuel injectors through heavy-walled tubing. Figure 25 shows a section view of the inline pump that displays the individual pumping elements. Figure 26 shows an enlarged view of the pumping element from an inline pump.

The eight major components are:

1. Fuel Tank
2. Primary Fuel Filter
3. Fuel Supply Pump
4. Secondary Filter
5. Injection Pump
6. High Pressure Fuel Lines
7. Injection Nozzles
8. Governor

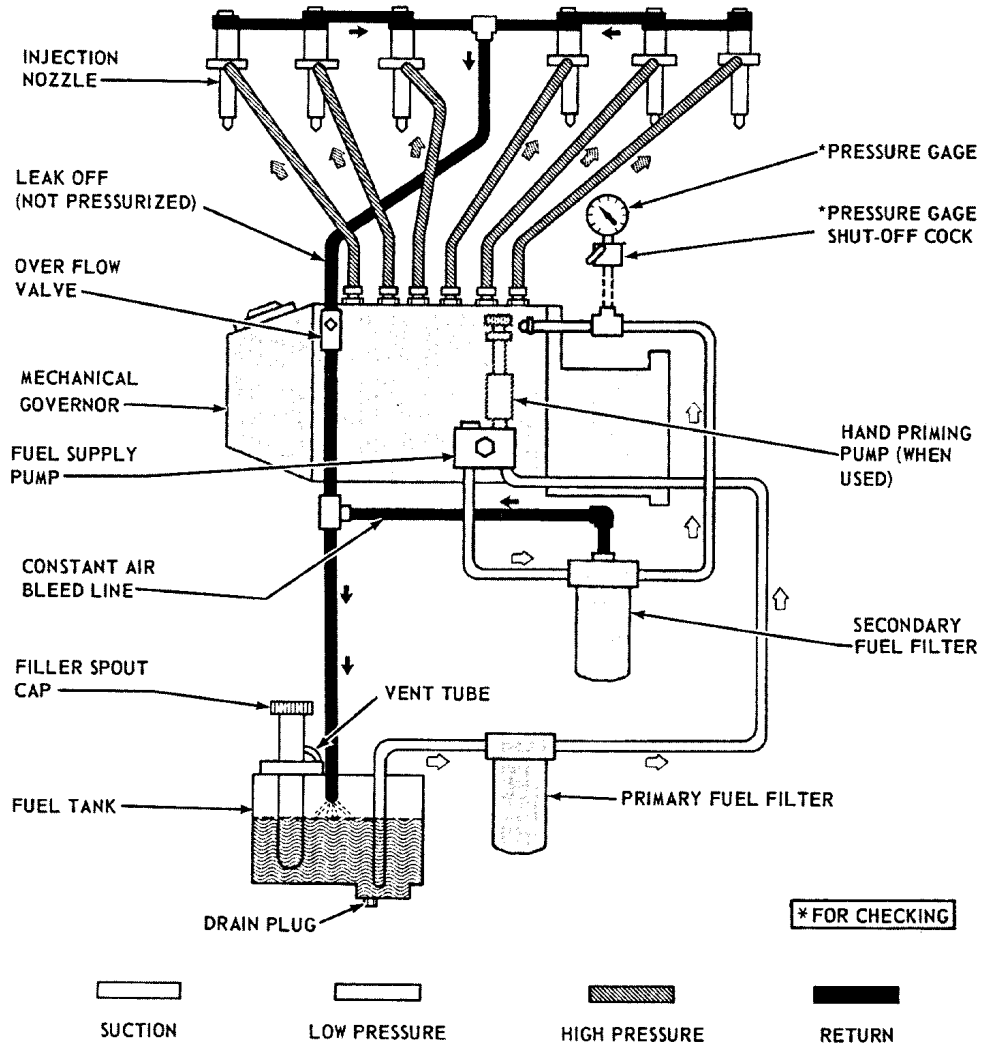


Figure 24. Pump-line-nozzle injection system.

Ref: Brady, R.N. *Modern Diesel Technology*, Prentice-Hall, New Jersey, 1996



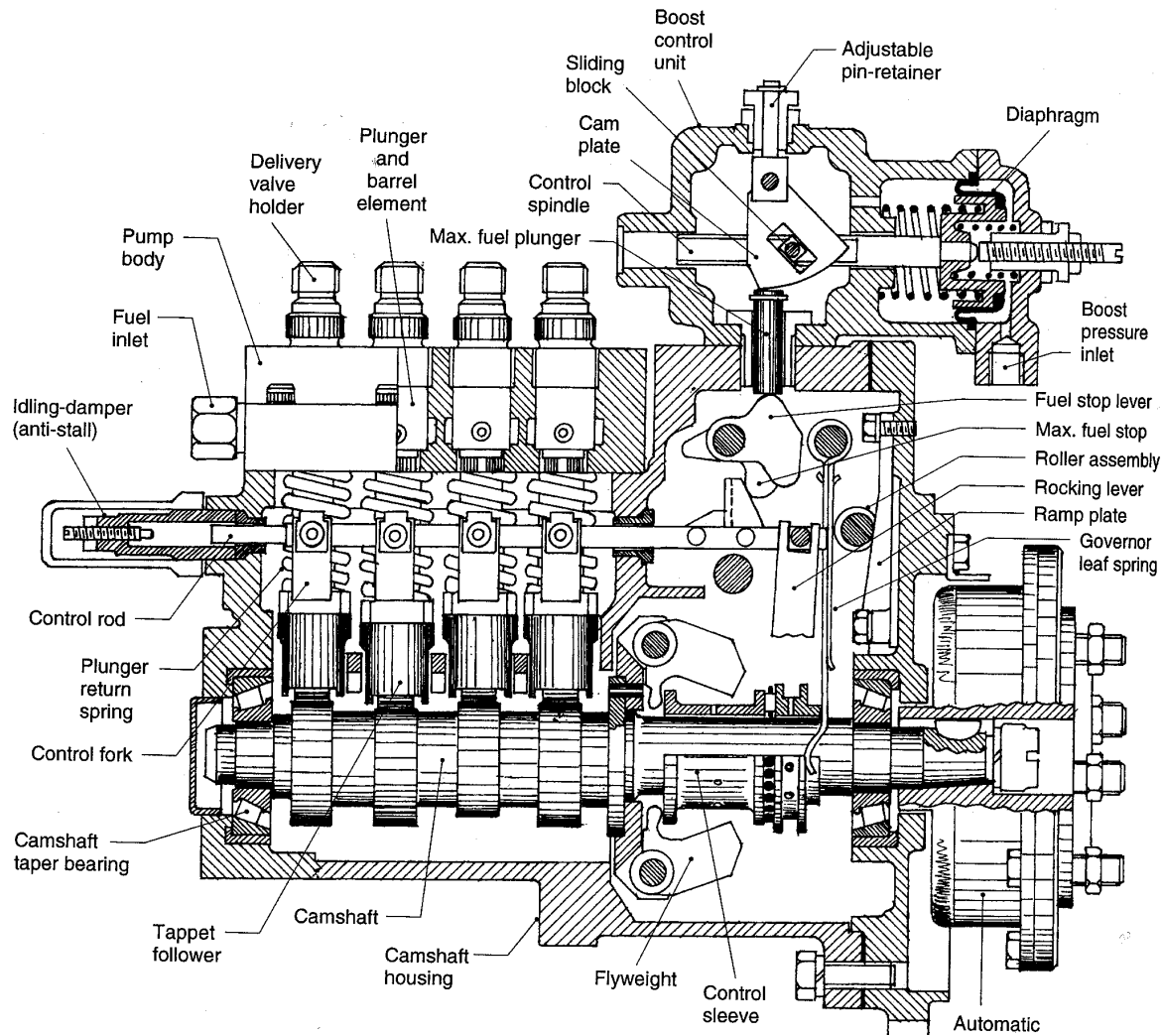


Figure 25. Section View of In-Line Fuel Injection Pump.

From: Heisler, H., *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

The pumping element initiates an injection event when the pump cam pushes the plunger up. When the plunger reaches the point where the feed port is covered by the plunger, the pressure of the fluid starts to rise. The pressure will continue to rise until it reaches the nozzle opening pressure and injection begins. Injection continues until the spill port of the plunger is uncovered which drops the pressure and halts the injection.

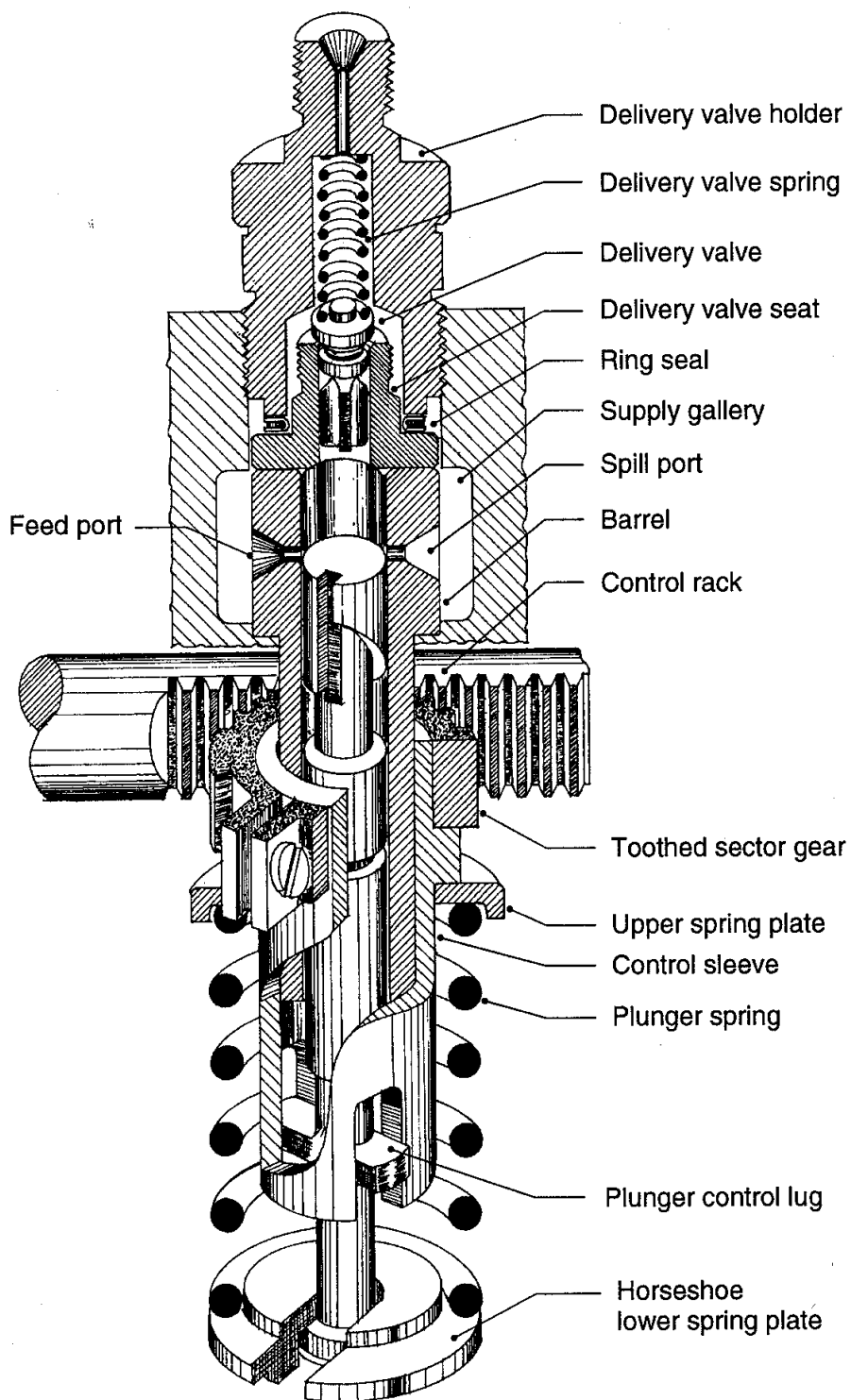


Figure 26. Pumping Element from In-Line Pump.

From: Heisler, H., *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

Figure 27 shows a section view of a typical fuel injector for a PLN system. The injector contains a long drilled passage from the fuel inlet at the top to the needle valve at the bottom. The fuel pressure pushes on the underside of the needle and when it reaches a value that can overcome the spring force (the Nozzle Opening Pressure), the needle lifts and injection starts.

The two fluid properties that will most affect this injection process are the speed of sound and the isentropic bulk modulus. The speed of sound is important because it affects the time required for the pressure rise at the injection pump to travel along the line to the injector nozzle. The isentropic bulk modulus is important because it affects the amount of pressure rise that will result from a sudden change in the volume of the fluid.

The key system variables that will affect the injection timing are the rate of volume change, the volume of pressurized fluid, the nozzle opening pressure, and the length of the fuel injection line. The PLN system has a long fuel injection line which maximizes the impact of changes in the speed of sound. It also has a considerable volume of pressurized fluid, including the volume above the plunger in the pump, the volume of fluid in the injection line, and in the injector itself. The impact of changing to a fuel with a higher speed of sound and less compressible bulk modulus, such as biodiesel, will be to have a faster pressure rise and earlier injection timing.

Figure 28 shows a variation of the high pressure pump used in the PLN system. This style of pump is known as a distributor pump and is most widely used on lower priced and lower power engines.

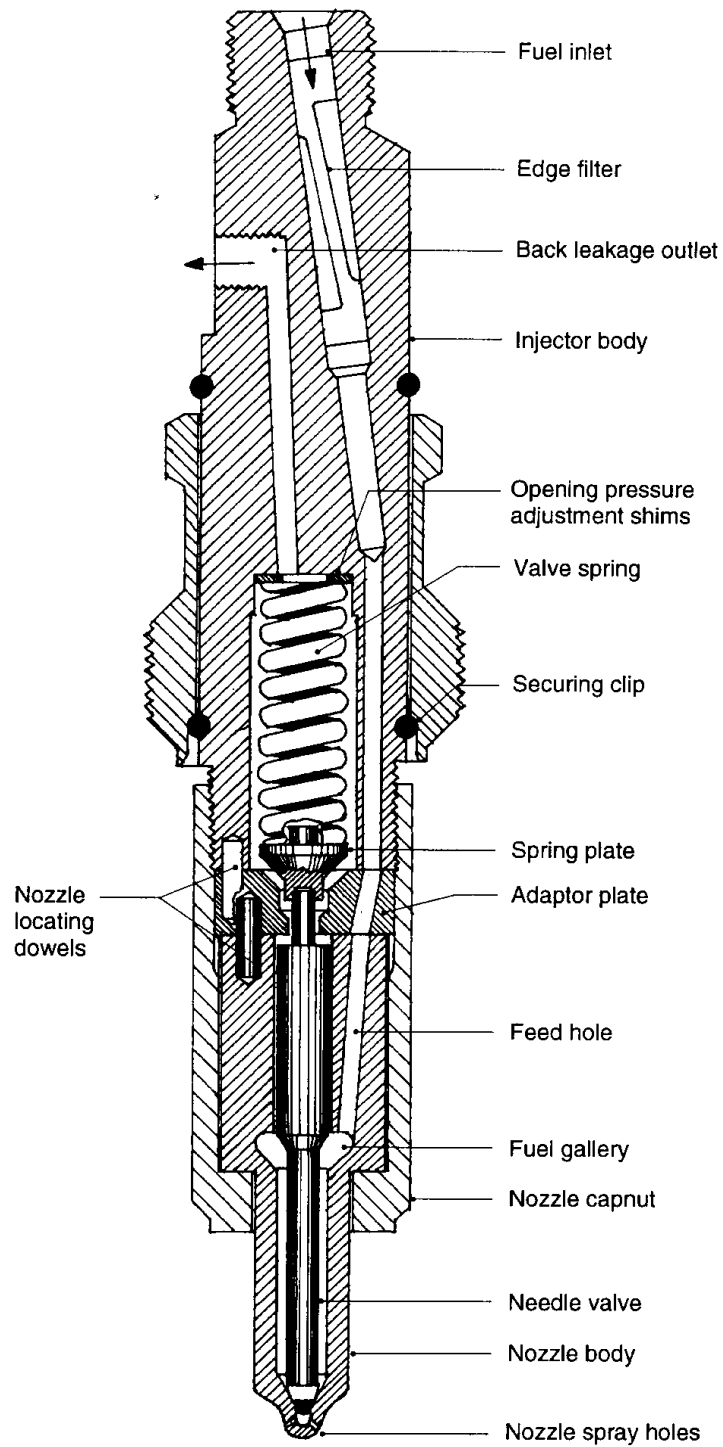


Figure 27. Section View of Fuel Injector.

Ref: Heisler, H. *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

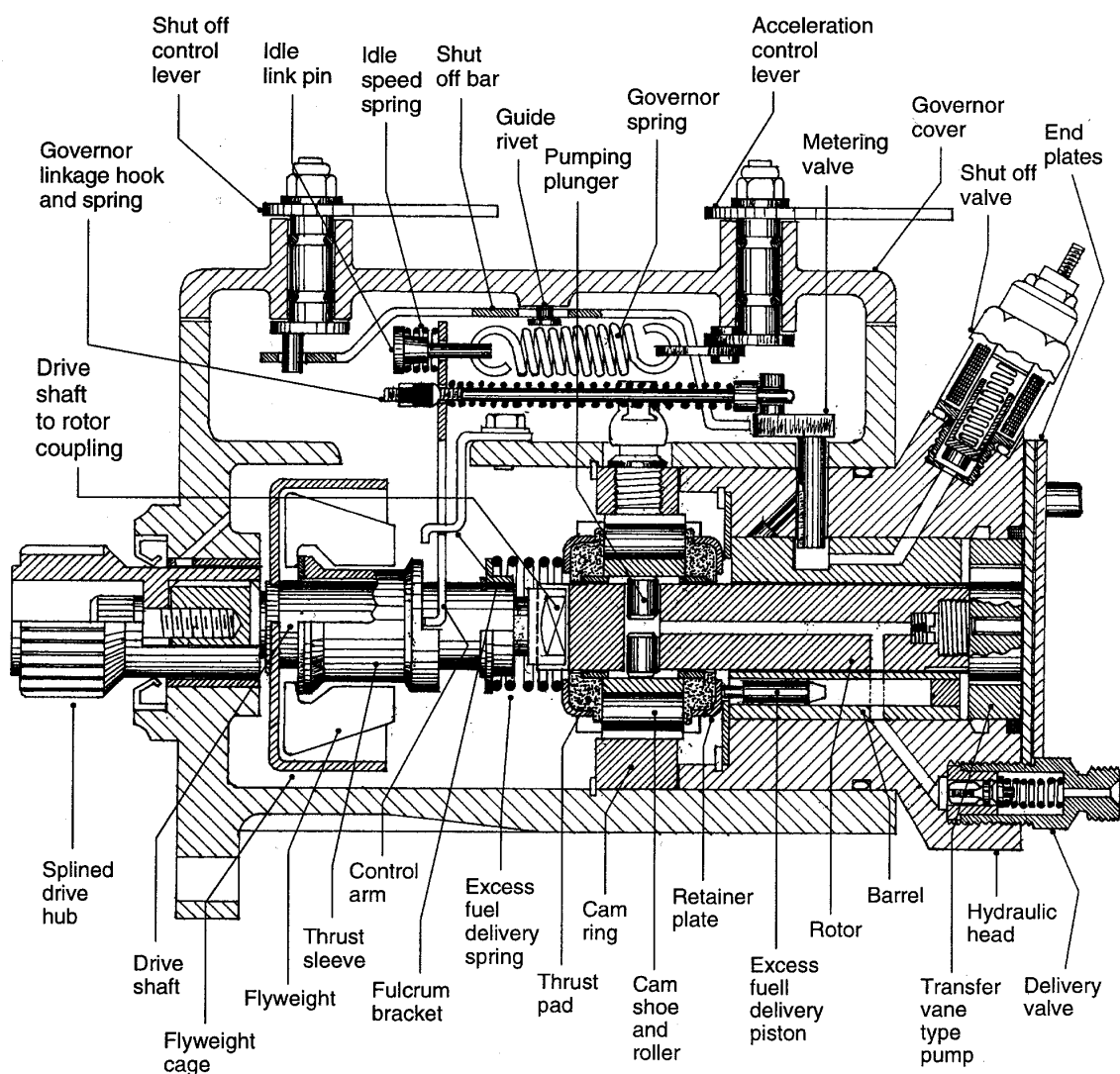


Figure 28. Section View of Distributor-Type Fuel Injection Pump.

Ref: Heisler, H. *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

Figure 29 shows the pumping elements for this style of pump. Distributor pumps use only a single pumping element for the entire engine. The compressed volume for this style of pump will be slightly greater than for the in-line pump due to the distributor section.

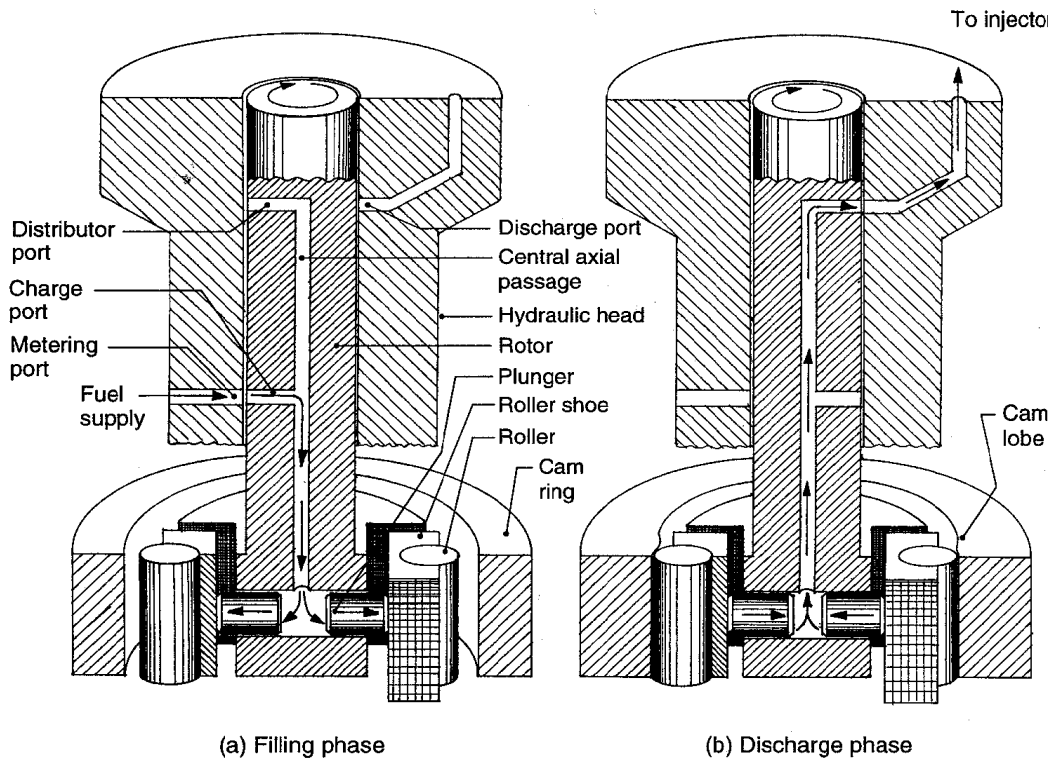


Figure 29. Pumping and Distribution Element of Distributor Pump.

From: Heisler, H., *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

Figure 30 shows a section view of a mechanical unit injector. This style of injector does not use external high pressure lines. The pumping element has been integrated into the injector. The plunger is very close to the nozzle so it would be expected to be much less sensitive to the speed of sound than a PLN system. However, these injectors still have a considerable amount of compressed fuel volume so they will be sensitive to the isentropic bulk modulus.

Figure 31 shows another style of mechanical unit injector used on older Cummins engines. This type of injector has a minimum amount of compressed fuel volume (essentially equal to the fuel injected) and would have the least sensitivity to changes in fuel compressibility and almost no sensitivity to the speed of sound apart from this property's effect on compressibility.

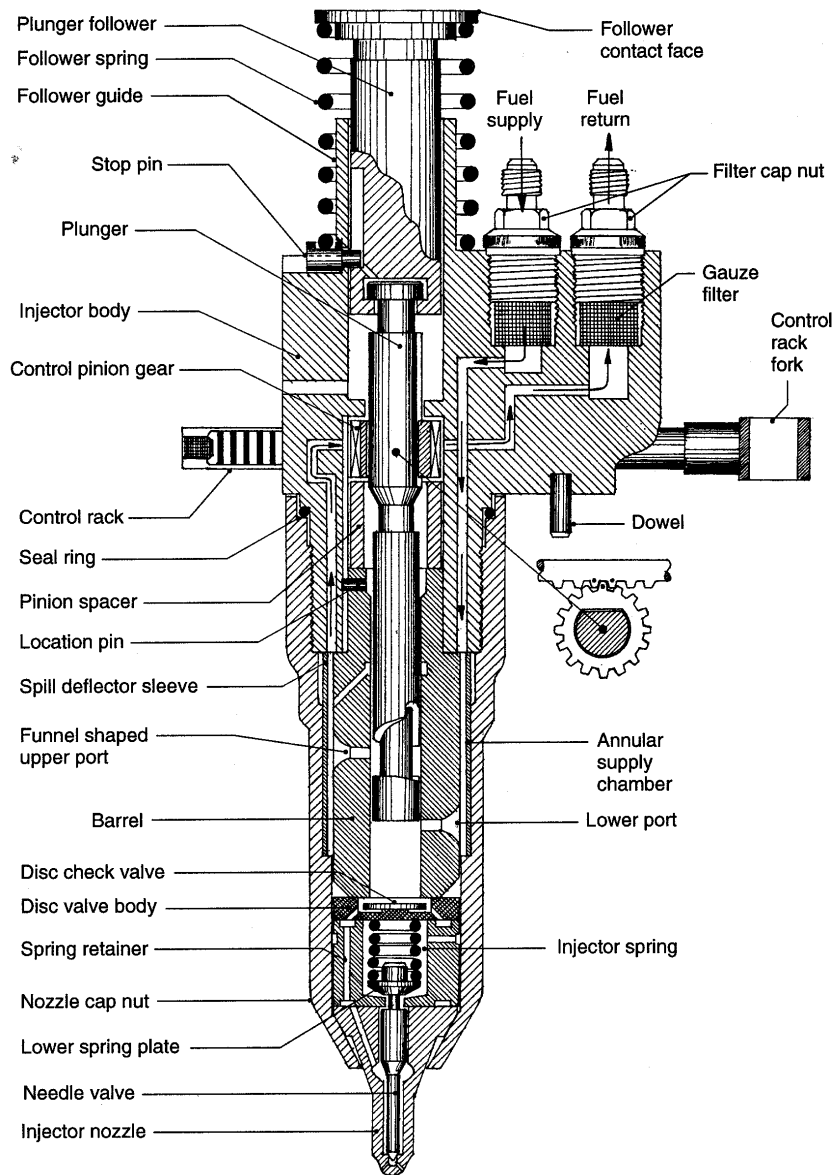


Figure 30. DDC Mechanical Unit Injector.

Ref: Heisler, H. *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

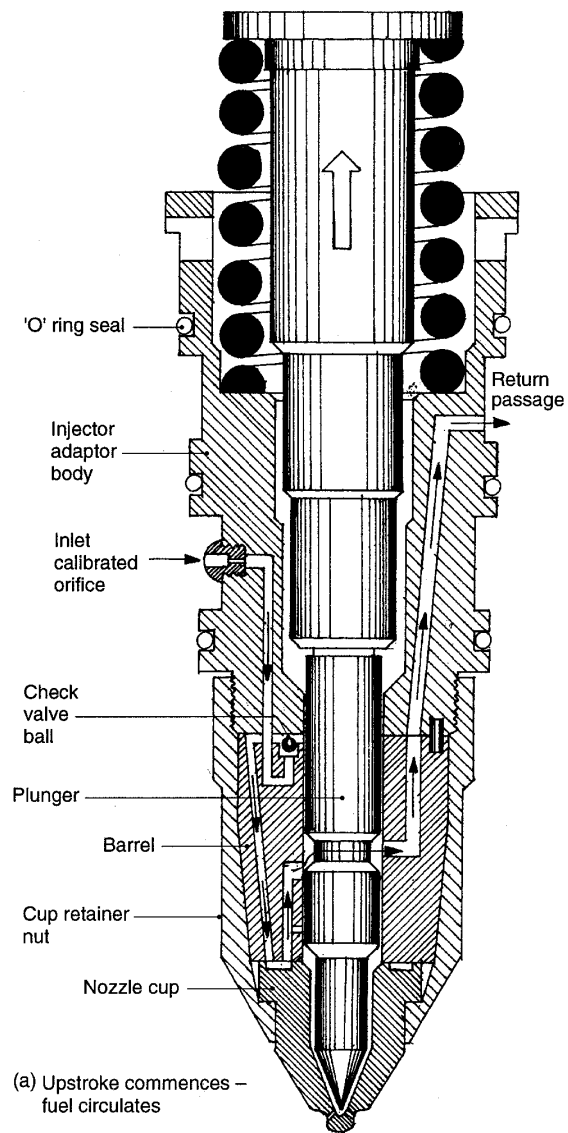


Figure 31. Cummins PT Mechanical Unit Injector

Ref: Heisler, H. *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.



Figure 32 shows a state-of-the-art electronic unit injector. This injector is typical of the injectors currently used on most on-highway trucks. Because of the addition of the solenoid, the compressed fuel volume is larger than the mechanical injector and would thus be more sensitive to fuel compressibility. These injectors still do not use external high pressure lines so they would have minimal sensitivity to changes in the speed of sound.

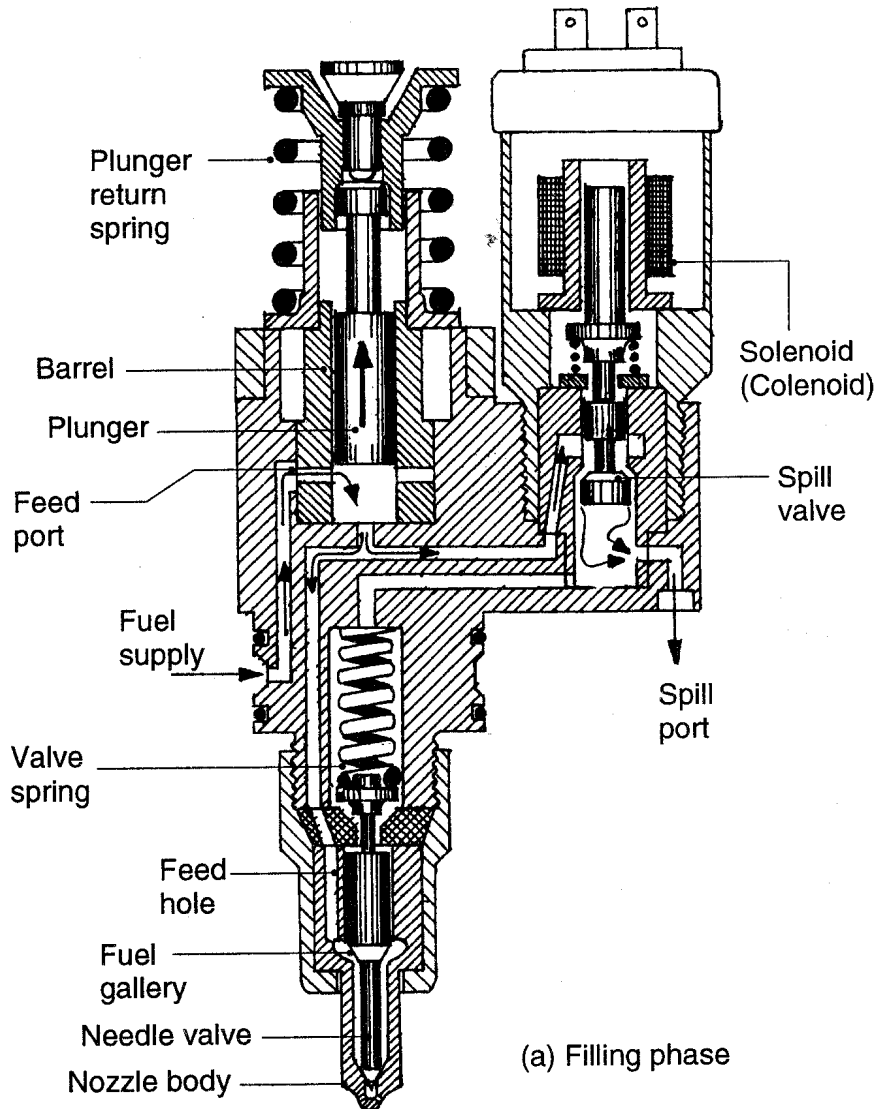


Figure 32. Lucas Electronic Unit Injector.

Ref: Heisler, H. *Advanced Engine Technology*, Society of Automotive Engineers, Warrendale, PA, 1995.

## **5. The Effect of Fuel Viscosity**

All of the injection systems described here have some sensitivity to fuel viscosity and the viscosity of biodiesel is greater than for No. 2 diesel fuel. The most direct impact of a viscosity increase is to decrease the amount of fuel leakage that occurs past the plungers that develop the pressure in the injection system. This reduced leakage will allow the pressure to develop faster and could contribute to earlier injection timing. The effect of viscosity on timing is not currently known

but it should add to the effect of the speed of sound and the bulk modulus. Future work is planned in this area.

## **6. Estimation of the Impact of Fuel Properties on Injection Timing**

It is difficult to estimate the exact impact of the changes in fuel properties on the injection timing without a complete simulation of the injection system. Such a simulation was beyond the scope of this study.

The impact of a change in the speed of sound can be estimated for a Pump-Line-Nozzle (PLN) system as follows. The John Deere 4276T engine that was the source for the injection pressure data shown in Figure 1 has injection lines that are 0.76 m long. If the fuel supplied to the engine is at 40°C, the speed of sound for No.2 diesel fuel and soy methyl ester are 1302 m/s and 1345 m/s, respectively (at atmospheric pressure). A pressure wave moving through diesel fuel in the injection line will take 0.584 ms to propagate from the pump to the nozzle. This corresponds to 7.4 degrees of crankshaft rotation at 2100 rpm, the engine's rated speed. With the biodiesel the pressure wave would arrive 0.24 degrees sooner.

The impact of the isentropic bulk modulus can be estimated by a simple model for fuel compression. If the rate of volume change produced by the injection pump or the unit injector plunger is set equal to the rate of fuel compression, an equation can be developed to predict the time to reach the Nozzle Opening Pressure (NOP).

$$V_{\theta} A_p = \frac{V_f}{B} \times \frac{dP}{d\theta} \quad (2)$$

where

$V_{\theta}$  = plunger velocity  
 $A_p$  = plunger area  
 $V_f$  = volume of compressed fuel  
 $B$  = isentropic bulk modulus  
 $P$  = injection pressure  
 $\theta$  = crank angle

If all the variables in the equation can be assumed constant, the equation can be integrated to give an expression for the pressure as a function of crank angle.

$$P(\theta) = \frac{B V_{\theta} A_p}{V_f} \theta + P_o \quad (3)$$

where  $P_o$  is the initial system pressure. The crankshaft rotation required to reach the NOP will be:

$$\theta = \frac{(NOP - P_o) V_f}{B V_{\theta} A_p} \quad (4)$$

For most injectors the value of  $(NOP - P_o)$  will be 20-35 MPa. For a sample case, a mean value of 27.5 MPa can be assumed. The values of  $V_f$ ,  $V_{\theta}$ , and  $A_p$  depend on the individual injector design.

For a Lucas EUI like that shown in Figure 31, the following values are estimated:

$V_f = 2000 \text{ mm}^3$   
 $A_p = 64 \text{ mm}^2$  (9 mm plunger)  
 $V_{\theta} = 0.15 \text{ mm/degree}$

At 40 °C, the isentropic bulk moduli are 1398.2 MPa and 1566.9 MPa for No. 2 diesel fuel and soy methyl ester, respectively. For this injector, the estimated time to reach the NOP will be 4.10 degrees of crankshaft rotation for No. 2 diesel fuel and 3.65 degrees for soy methyl ester. This corresponds to a 0.45 ° injection timing advance for biodiesel.

A similar calculation can be performed for a PLN injection system. The values of the parameters will be essentially the same except that the compressed fuel volume will be larger due to the line and the external pump. Using values estimated for the John Deere 4276T engine ( $V_f=3100 \text{ mm}^3$ ), the time to reach NOP will be 6.35 degrees for No. 2 diesel and 5.67 degrees for biodiesel for an estimated injection timing advance of 0.68 degrees. Combined with the advance due to the difference in the speed of sound, this gives approximately 1° of timing advance. This is less than the advance noted in Figure 1. The difference may be due to differences between the actual and estimated values of the injection system parameters, or to viscosity effects. However, it is clear that the changes in the speed of sound and bulk modulus should have a significant effect on the injection timing.

## **7. Conclusion**

Data for the density, speed of sound, and isentropic bulk modulus have been collected for 21 esters or ester blends from 20 °C to 100 °C and from atmospheric pressure to 34.5 MPa. The results are presented as correlations at each temperature for the effect of pressure. Simple calculations estimating the impact of fuel property changes on the injection timing indicate a possible injection timing advance of approximately 1 degree.

## **8. References**

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## Appendix A

Tables of linear regression coefficients for the density, speed of sound, and isentropic bulk modulus as a function of temperature and pressure.

Table A-1. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of 2:1 Methyl Linseed Methyl Stearate.

Table A-2. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of 2:1 Methyl Stearate Methyl Linseed.

Table A-3. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Certified D2.

Table A-4. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Hydrogenated Soy.

Table A-5. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Linoleate.

Table A-6. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Linseed.

Table A-7. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Oxidized Soy.

Table A-8. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Soy Ester.

Table A-9. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Stearate.

Table A-10. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Canola.

Table A-11. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Hydrogenated Soy.

Table A-12. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Lard.

Table A-13. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Laurate.

Table A-14. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Linoleate.

- Table A-15. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Linolenate.
- Table A-16. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Oleate.
- Table A-17. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Oxidized Soy.
- Table A-18. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Palmitate.
- Table A-19. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Soy Ester.
- Table A-20. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Stearate.
- Table A-21. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Tallow.
- Table A-22. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Yellow Grease.
- Table A-23. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of N-Octadecane.

Table A-1. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of 2:1 Methyl Linseed Methyl Stearate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.3255E-04	1.7452E-05	8.8545E-01	3.6430E-04	9.9906E-01
40	5.8391E-04	1.5151E-05	8.7092E-01	3.1628E-04	9.9941E-01
60	6.3747E-04	2.2557E-05	8.5654E-01	4.7087E-04	9.9890E-01
80	7.0323E-04	2.7416E-05	8.4217E-01	5.7230E-04	9.9866E-01
100	7.7261E-04	3.4826E-05	8.2822E-01	7.2700E-04	9.9822E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.7238E+00	1.1152E-01	1.4202E+03	2.3280E+00	9.9921E-01
40	3.9870E+00	1.0778E-01	1.3486E+03	2.2499E+00	9.9936E-01
60	4.2990E+00	1.5988E-01	1.2787E+03	3.3375E+00	9.9878E-01
80	4.6030E+00	1.6689E-01	1.2111E+03	3.4839E+00	9.9885E-01
100	4.8785E+00	1.7890E-01	1.1510E+03	3.7345E+00	9.9882E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1056E+01	1.8653E-01	1.7832E+03	3.8939E+00	9.9975E-01
40	1.1121E+01	9.2354E-02	1.5808E+03	1.9279E+00	9.9994E-01
60	1.1244E+01	1.8379E-01	1.3970E+03	3.8366E+00	9.9878E-01
80	1.1306E+01	1.7633E-01	1.2314E+03	3.6809E+00	9.9885E-01
100	1.1303E+01	1.6256E-01	1.0929E+03	3.3934E+00	9.9882E-01

Table A-2. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of 2:1 Methyl Stearate Methyl Linseed.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	5.9694E-04	2.3801E-05	8.6460E-01	4.9685E-04	9.9860E-01
60	6.5615E-04	3.5676E-05	8.5035E-01	7.4474E-04	9.9741E-01
80	7.1181E-04	2.9985E-05	8.3606E-01	6.2595E-04	9.9844E-01
100	7.7930E-04	3.5253E-05	8.2189E-01	7.3591E-04	9.9820E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.1020E+00	1.5416E-01	1.3390E+03	3.2180E+00	9.9876E-01
60	4.3714E+00	1.9929E-01	1.2705E+03	4.1601E+00	9.9817E-01
80	4.6727E+00	2.0140E-01	1.2056E+03	4.2043E+00	9.9837E-01
100	4.9728E+00	2.4865E-01	1.1462E+03	5.1906E+00	9.9780E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1292E+01	2.0016E-01	1.5471E+03	4.1783E+00	9.9972E-01
60	1.1308E+01	2.6808E-01	1.3691E+03	5.5962E+00	9.9951E-01
80	1.1355E+01	1.9809E-01	1.2112E+03	4.1351E+00	9.9973E-01
100	1.1394E+01	2.5562E-01	1.0755E+03	5.3362E+00	9.9956E-01

Table A-3. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Certified D2.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.7534E-04	2.8259E-05	8.4116E-01	5.8991E-04	9.9788E-01
40	6.6294E-04	1.7037E-05	8.2675E-01	3.5565E-04	9.9942E-01
60	6.9493E-04	3.1563E-05	8.1306E-01	6.5889E-04	9.9819E-01
80	7.5559E-04	3.4198E-05	7.9896E-01	7.1388E-04	9.9820E-01
100	8.2077E-04	3.7657E-05	7.8891E-01	7.8608E-04	9.9815E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	4.3136E+00	2.2944E-01	1.3769E+03	4.7896E+00	9.9752E-01
40	4.6153E+00	1.9075E-01	1.3017E+03	3.9818E+00	9.9850E-01
60	4.9162E+00	2.1012E-01	1.2313E+03	4.3862E+00	9.9840E-01
80	5.2322E+00	2.5365E-01	1.1636E+03	5.2949E+00	9.9794E-01
100	5.5777E+00	2.8230E-01	1.0995E+03	5.8930E+00	9.9780E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1848E+01	3.7868E-01	1.5915E+03	7.9051E+00	9.9910E-01
40	1.1935E+01	1.9329E-01	1.3970E+03	4.0349E+00	9.9977E-01
60	1.1860E+01	2.0260E-01	1.2286E+03	4.2293E+00	9.9974E-01
80	1.1816E+01	2.2748E-01	1.0771E+03	4.7486E+00	9.9974E-01
100	1.1856E+01	2.0628E-01	9.4857E+02	4.3061E+00	9.9973E-01

Table A-4. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Hydrogenated Soy.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	5.9190E-04	2.6301E-05	8.4855E-01	5.4903E-04	9.9827E-01
60	6.4016E-04	3.0083E-05	8.3452E-01	6.2799E-04	9.9806E-01
80	7.0388E-04	3.6893E-05	8.2139E-01	7.7015E-04	9.9759E-01
100	7.6907E-04	4.0811E-05	8.0758E-01	8.5194E-04	9.9753E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.2040E+00	1.8567E-01	1.3288E+03	3.8759E+00	9.9829E-01
60	4.4802E+00	1.7838E-01	1.2593E+03	3.7236E+00	9.9861E-01
80	4.7721E+00	2.2220E-01	1.1946E+03	4.6384E+00	9.9810E-01
100	5.0997E+00	2.6718E-01	1.1318E+03	5.5775E+00	9.9759E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1264E+01	2.7259E-01	1.4951E+03	5.6904E+00	9.9949E-01
60	1.1254E+01	1.9116E-01	1.3199E+03	3.9904E+00	9.9975E-01
80	1.1285E+01	2.3914E-01	1.1683E+03	4.9921E+00	9.9961E-01
100	1.1330E+01	2.7881E-01	1.0301E+03	5.8203E+00	9.9947E-01

Table A-5. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Linoleate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.4821E-04	2.0723E-05	8.8442E-01	4.3260E-04	9.9874E-01
40	6.1850E-04	6.4433E-06	8.7323E-01	1.3450E-04	9.9991E-01
60	6.4710E-04	2.1658E-05	8.5903E-01	4.5210E-04	9.9902E-01
80	7.0639E-04	1.2979E-05	8.4449E-01	2.7094E-04	9.9970E-01
100	7.7321E-04	2.4672E-05	8.3127E-01	5.1503E-04	9.9911E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8214E+00	1.3486E-01	1.4118E+03	2.8153E+00	9.9891E-01
40	4.0931E+00	1.6578E-01	1.3403E+03	3.4606E+00	9.9856E-01
60	4.3561E+00	1.5527E-01	1.2728E+03	3.2412E+00	9.9888E-01
80	4.5996E+00	1.7731E-01	1.2071E+03	3.7014E+00	9.9869E-01
100	4.9362E+00	1.9911E-01	1.1446E+03	4.1564E+00	9.9857E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1282E+01	2.3593E-01	1.7601E+03	4.9250E+00	9.9962E-01
40	1.1428E+01	2.1102E-01	1.5654E+03	4.4050E+00	9.9970E-01
60	1.1382E+01	1.7116E-01	1.3882E+03	3.5729E+00	9.9980E-01
80	1.1292E+01	1.3031E-01	1.2265E+03	2.7202E+00	9.9988E-01
100	1.1405E+01	1.6246E-01	1.0846E+03	3.3914E+00	9.9982E-01

Table A-6. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Linseed.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5931E-04	2.5348E-05	8.9269E-01	5.2915E-04	9.9820E-01
40	5.8782E-04	1.4732E-05	8.7900E-01	3.0754E-04	9.9945E-01
60	6.4056E-04	2.5033E-05	8.6485E-01	5.2257E-04	9.9866E-01
80	7.0362E-04	2.5111E-05	8.5063E-01	5.2420E-04	9.9888E-01
100	7.5728E-04	2.3106E-05	8.3610E-01	4.8234E-04	9.9918E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8262E+00	1.0549E-01	1.4178E+03	2.2022E+00	9.9933E-01
40	4.0469E+00	1.4984E-01	1.3466E+03	3.1279E+00	9.9880E-01
60	4.3346E+00	1.3925E-01	1.2783E+03	2.9069E+00	9.9909E-01
80	4.6111E+00	1.5947E-01	1.2147E+03	3.3290E+00	9.9895E-01
100	4.8441E+00	1.5918E-01	1.1515E+03	3.3229E+00	9.9905E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1468E+01	1.2807E-01	1.7917E+03	2.6735E+00	9.9989E-01
40	1.1360E+01	1.9478E-01	1.5907E+03	4.0661E+00	9.9974E-01
60	1.1436E+01	1.5604E-01	1.4098E+03	3.2574E+00	9.9984E-01
80	1.1452E+01	1.1827E-01	1.0824E+03	2.4689E+00	9.9914E-01
100	1.1376E+01	1.3954E-01	9.4420E+02	2.9129E+00	9.9947E-01



Table A-7. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Oxidized Soy.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5184E-04	1.7146E-05	8.8205E-01	3.5792E-04	9.9915E-01
40	6.0869E-04	2.0526E-05	8.6748E-01	4.2848E-04	9.9900E-01
60	6.5199E-04	1.7982E-05	8.5337E-01	3.7537E-04	9.9933E-01
80	7.1350E-04	2.9648E-05	8.3921E-01	6.1890E-04	9.9848E-01
100	7.7553E-04	3.9577E-05	8.2359E-01	8.2617E-04	9.9771E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8567E+00	1.3271E-01	1.4098E+03	2.7702E+00	9.9896E-01
40	4.1652E+00	1.5739E-01	1.3374E+03	3.2856E+00	9.9875E-01
60	4.4122E+00	1.7002E-01	1.2709E+03	3.5493E+00	9.9870E-01
80	4.7060E+00	2.0164E-01	1.2063E+03	4.2092E+00	9.9839E-01
100	4.9738E+00	2.4233E-01	1.1440E+03	5.0586E+00	9.9792E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1344E+01	1.7979E-01	1.7501E+03	3.7532E+00	9.9978E-01
40	1.1503E+01	1.9544E-01	1.5484E+03	4.0797E+00	9.9975E-01
60	1.1446E+01	1.7455E-01	1.3748E+03	3.6437E+00	9.9980E-01
80	1.1482E+01	2.0309E-01	1.2171E+03	4.2394E+00	9.9972E-01
100	1.1388E+01	2.3848E-01	1.0736E+03	4.9784E+00	9.9961E-01

Table A-8. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Soy Ester.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5090E-04	2.5186E-05	8.7771E-01	5.2576E-04	9.9816E-01
40	5.9330E-04	2.2974E-05	8.6319E-01	4.7957E-04	9.9868E-01
60	6.4345E-04	2.5314E-05	8.4923E-01	5.2842E-04	9.9864E-01
80	6.9760E-04	2.9936E-05	8.3522E-01	6.2491E-04	9.9838E-01
100	7.8115E-04	3.3127E-05	8.2108E-01	6.9152E-04	9.9842E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8474E+00	1.3000E-01	1.4116E+03	2.7137E+00	9.9900E-01
40	4.0941E+00	1.4089E-01	1.3401E+03	2.9411E+00	9.9896E-01
60	4.3700E+00	1.6964E-01	1.2703E+03	3.5413E+00	9.9868E-01
80	4.6519E+00	2.0390E-01	1.2061E+03	4.2564E+00	9.9831E-01
100	4.9943E+00	1.9479E-01	1.1431E+03	4.0663E+00	9.9866E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1282E+01	1.9150E-01	1.7462E+03	3.9975E+00	9.9975E-01
40	1.1258E+01	1.6603E-01	1.5471E+03	3.4659E+00	9.9981E-01
60	1.1269E+01	1.8841E-01	1.3669E+03	3.9331E+00	9.9975E-01
80	1.1275E+01	2.1581E-01	1.2112E+03	4.5050E+00	9.9968E-01
100	1.1409E+01	1.5577E-01	1.0684E+03	3.2516E+00	9.9984E-01

Table A-9. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Ethyl Stearate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	6.2349E-04	3.1285E-05	8.4877E-01	6.5307E-04	9.9779E-01
60	6.7227E-04	2.4096E-05	8.3489E-01	5.0301E-04	9.9887E-01
80	8.2439E-04	4.1411E-05	8.1984E-01	8.6446E-04	9.9778E-01
100	8.0834E-04	2.6640E-05	8.0741E-01	5.5611E-04	9.9905E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.2929E+00	2.0202E-01	1.3183E+03	4.2172E+00	9.9806E-01
60	4.5293E+00	1.3696E-01	1.2520E+03	2.8591E+00	9.9920E-01
80	4.9302E+00	2.3121E-01	1.1841E+03	4.8265E+00	9.9807E-01
100	5.0888E+00	2.4827E-01	1.1305E+03	5.1826E+00	9.9791E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1465E+01	2.9413E-01	1.4718E+03	6.1400E+00	9.9942E-01
60	1.1376E+01	8.8061E-02	1.3048E+03	1.8383E+00	9.9995E-01
80	1.1748E+01	1.5472E-01	1.1450E+03	3.2297E+00	9.9985E-01
100	1.1361E+01	2.0680E-01	1.0274E+03	4.3169E+00	9.9971E-01

Table A-10. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Canola.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5250E-04	2.1462E-05	8.7986E-01	4.4803E-04	9.9867E-01
40	5.9280E-04	1.9479E-05	8.6582E-01	4.0662E-04	9.9905E-01
60	6.4574E-04	2.5719E-05	8.5028E-01	5.3688E-04	9.9861E-01
80	7.0390E-04	2.6119E-05	8.3604E-01	5.4523E-04	9.9879E-01
100	7.6572E-04	3.2782E-05	8.2103E-01	6.8432E-04	9.9839E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8598E+00	1.1584E-01	1.4165E+03	2.4182E+00	9.9921E-01
40	4.0973E+00	1.4577E-01	1.3453E+03	3.0430E+00	9.9889E-01
60	4.3831E+00	1.7418E-01	1.2773E+03	3.6359E+00	9.9861E-01
80	4.6444E+00	1.9641E-01	1.2126E+03	4.1001E+00	9.9843E-01
100	4.9654E+00	1.9281E-01	1.1493E+03	4.0250E+00	9.9867E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1388E+01	1.6389E-01	1.7625E+03	3.4213E+00	9.9982E-01
40	1.1341E+01	1.7815E-01	1.5639E+03	3.7188E+00	9.9978E-01
60	1.1383E+01	2.0074E-01	1.3837E+03	4.1904E+00	9.9973E-01
80	1.1343E+01	1.8720E-01	1.2255E+03	3.9077E+00	9.9976E-01
100	1.1380E+01	1.2605E-01	1.0801E+03	2.6314E+00	9.9989E-01

Table A-11. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Hydrogenated Soy.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	6.0461E-04	3.9909E-05	8.5337E-01	8.3309E-04	9.9618E-01
60	6.4010E-04	2.6352E-05	8.4259E-01	5.5009E-04	9.9851E-01
80	7.0554E-04	3.2394E-05	8.2897E-01	6.7622E-04	9.9815E-01
100	7.5033E-04	5.0342E-05	8.1619E-01	1.0509E-03	9.9605E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.2680E+00	2.4601E-01	1.3370E+03	5.1354E+00	9.9709E-01
60	4.3982E+00	1.7637E-01	1.2687E+03	3.6817E+00	9.9859E-01
80	4.7162E+00	1.8995E-01	1.2027E+03	3.9651E+00	9.9858E-01
100	4.7634E+00	4.6396E-01	1.1423E+03	9.6852E+00	9.9172E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1582E+01	4.4948E-01	1.5222E+03	9.3829E+00	9.9868E-01
60	1.1237E+01	2.0405E-01	1.3526E+03	4.2595E+00	9.9971E-01
80	1.1333E+01	1.7422E-01	1.1951E+03	3.6368E+00	9.9979E-01
100	1.0754E+01	7.4996E-01	1.0615E+03	1.5656E+01	9.9574E-01

Table A-12. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Lard.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.4950E-04	1.8793E-05	8.7489E-01	3.9230E-04	9.9897E-01
40	5.9506E-04	1.7324E-05	8.6014E-01	3.6164E-04	9.9926E-01
60	6.5178E-04	2.4801E-05	8.4581E-01	5.1773E-04	9.9873E-01
80	7.0550E-04	3.4910E-05	8.3159E-01	7.2874E-04	9.9785E-01
100	7.6164E-04	3.6800E-05	8.1792E-01	7.6820E-04	9.9795E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8911E+00	1.2674E-01	1.4089E+03	2.6457E+00	9.9907E-01
40	4.1318E+00	1.0836E-01	1.3355E+03	2.2620E+00	9.9940E-01
60	4.4216E+00	1.7309E-01	1.2686E+03	3.6132E+00	9.9865E-01
80	4.6913E+00	2.1460E-01	1.2030E+03	4.4798E+00	9.9816E-01
100	4.9353E+00	2.3375E-01	1.1411E+03	4.8795E+00	9.9803E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1346E+01	1.7910E-01	1.7338E+03	3.7387E+00	9.9978E-01
40	1.1287E+01	9.5573E-02	1.5309E+03	1.9951E+00	9.9994E-01
60	1.1356E+01	1.8772E-01	1.3577E+03	3.9186E+00	9.9976E-01
80	1.1307E+01	2.3380E-01	1.1996E+03	4.8805E+00	9.9962E-01
100	1.1181E+01	2.2220E-01	1.0608E+03	4.6384E+00	9.9965E-01

Table A-13. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Laurate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.9075E-04	2.1596E-05	8.6872E-01	4.5083E-04	9.9883E-01
40	6.3879E-04	2.5567E-05	8.5333E-01	5.3372E-04	9.9859E-01
60	7.1183E-04	3.1947E-05	8.3787E-01	6.6691E-04	9.9823E-01
80	7.7752E-04	4.2967E-05	8.2298E-01	8.9694E-04	9.9732E-01
100	8.5679E-04	5.4278E-05	8.0774E-01	1.1331E-03	9.9648E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	4.0327E+00	1.3591E-01	1.3612E+03	2.8372E+00	9.9900E-01
40	4.3032E+00	1.6697E-01	1.2876E+03	3.4855E+00	9.9868E-01
60	4.6729E+00	2.1571E-01	1.2152E+03	4.5029E+00	9.9813E-01
80	4.9838E+00	3.0052E-01	1.1491E+03	6.2734E+00	9.9681E-01
100	5.2889E+00	2.8965E-01	1.0839E+03	6.0465E+00	9.9737E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1340E+01	1.6293E-01	1.6065E+03	3.4012E+00	9.9982E-01
40	1.1300E+01	2.0314E-01	1.4112E+03	4.2406E+00	9.9972E-01
60	1.1470E+01	2.3810E-01	1.2333E+03	4.9703E+00	9.9962E-01
80	1.1452E+01	3.5918E-01	1.0824E+03	7.4980E+00	9.9914E-01
100	1.1376E+01	2.7838E-01	9.4420E+02	5.8112E+00	9.9947E-01

Table A-14. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Linoleate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5557E-04	2.5663E-05	8.9079E-01	5.3572E-04	9.9813E-01
40	6.0086E-04	1.7549E-05	8.7620E-01	3.6634E-04	9.9925E-01
60	6.5035E-04	2.3330E-05	8.6193E-01	4.8702E-04	9.9887E-01
80	7.0971E-04	2.0058E-05	8.4757E-01	4.1871E-04	9.9930E-01
100	7.6963E-04	3.3403E-05	8.3354E-01	6.9728E-04	9.9835E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8034E+00	1.4155E-01	1.4205E+03	2.9548E+00	9.9878E-01
40	4.0796E+00	1.5849E-01	1.3487E+03	3.3085E+00	9.9867E-01
60	4.3429E+00	1.8182E-01	1.2798E+03	3.7956E+00	9.9846E-01
80	4.6283E+00	1.5405E-01	1.2144E+03	3.2158E+00	9.9903E-01
100	4.8877E+00	2.1542E-01	1.1538E+03	4.4969E+00	9.9829E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1393E+01	2.3340E-01	1.7947E+03	4.8723E+00	9.9963E-01
40	1.1462E+01	2.1979E-01	1.5907E+03	4.5881E+00	9.9968E-01
60	1.1452E+01	2.3783E-01	1.4082E+03	4.9648E+00	9.9962E-01
80	1.1476E+01	8.8490E-02	1.2460E+03	1.8472E+00	9.9995E-01
100	1.1409E+01	2.0264E-01	1.1055E+03	4.2302E+00	9.9972E-01

Table A-15. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Linolenate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.3923E-04	3.0108E-05	8.9673E-01	6.2850E-04	9.9726E-01
40	5.8654E-04	2.3507E-05	8.8145E-01	4.9070E-04	9.9859E-01
60	6.4353E-04	2.6125E-05	8.6708E-01	5.4535E-04	9.9855E-01
80	7.0048E-04	2.6297E-05	8.5261E-01	5.4895E-04	9.9876E-01
100	7.5435E-04	2.9318E-05	8.3834E-01	6.1201E-04	9.9867E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.7324E+00	1.6687E-01	1.4246E+03	3.4835E+00	9.9824E-01
40	4.0473E+00	1.4956E-01	1.3522E+03	3.1222E+00	9.9880E-01
60	4.3141E+00	1.2337E-01	1.2830E+03	2.5753E+00	9.9928E-01
80	4.5617E+00	1.6313E-01	1.2178E+03	3.4053E+00	9.9888E-01
100	4.8439E+00	1.3680E-01	1.1555E+03	2.8557E+00	9.9930E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1251E+01	3.1842E-01	1.8173E+03	6.6470E+00	9.9930E-01
40	1.1436E+01	2.1239E-01	1.6087E+03	4.4337E+00	9.9970E-01
60	1.1461E+01	1.7306E-01	1.4236E+03	3.6125E+00	9.9980E-01
80	1.1391E+01	1.5226E-01	1.2606E+03	3.1785E+00	9.9984E-01
100	1.1367E+01	1.7961E-01	1.1150E+03	3.7494E+00	9.9978E-01

Table A-16. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Oleate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.4666E-04	1.8593E-05	8.7919E-01	3.8813E-04	9.9898E-01
40	5.9887E-04	1.8435E-05	8.6471E-01	3.8482E-04	9.9917E-01
60	6.4935E-04	1.6773E-05	8.5051E-01	3.5014E-04	9.9941E-01
80	7.0202E-04	2.6815E-05	8.3629E-01	5.5977E-04	9.9872E-01
100	7.6965E-04	3.7300E-05	8.2137E-01	7.7863E-04	9.9794E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8845E+00	1.3739E-01	1.4135E+03	2.8681E+00	9.9890E-01
40	4.1586E+00	1.5160E-01	1.3412E+03	3.1646E+00	9.9883E-01
60	4.4333E+00	1.5663E-01	1.2727E+03	3.2697E+00	9.9890E-01
80	4.6687E+00	2.1367E-01	1.2070E+03	4.4604E+00	9.9816E-01
100	4.9806E+00	2.5106E-01	1.1450E+03	5.2408E+00	9.9777E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1408E+01	1.9436E-01	1.7538E+03	4.0573E+00	9.9976E-01
40	1.1467E+01	1.9094E-01	1.5523E+03	3.9858E+00	9.9976E-01
60	1.1477E+01	1.3253E-01	1.3741E+03	2.7665E+00	9.9988E-01
80	1.1344E+01	2.2201E-01	1.2145E+03	4.6345E+00	9.9966E-01
100	1.1375E+01	2.6032E-01	1.0725E+03	5.4341E+00	9.9954E-01

Table A-17. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Oxidized Soy.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.3752E-04	1.4044E-05	8.8457E-01	2.9317E-04	9.9940E-01
40	5.7849E-04	1.8600E-05	8.6960E-01	3.8828E-04	9.9909E-01
60	6.4045E-04	2.1792E-05	8.5517E-01	4.5491E-04	9.9898E-01
80	6.9984E-04	2.8816E-05	8.4270E-01	6.0154E-04	9.9851E-01
100	7.6636E-04	3.7770E-05	8.2839E-01	7.8845E-04	9.9787E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.7981E+00	1.2838E-01	1.4181E+03	2.6799E+00	9.9900E-01
40	4.0168E+00	1.2531E-01	1.3474E+03	2.6158E+00	9.9914E-01
60	4.3456E+00	1.8257E-01	1.2774E+03	3.8113E+00	9.9845E-01
80	4.6077E+00	2.0377E-01	1.2139E+03	4.2536E+00	9.9828E-01
100	4.9212E+00	2.3975E-01	1.1506E+03	5.0047E+00	9.9792E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1247E+01	1.8078E-01	1.7762E+03	3.7739E+00	9.9977E-01
40	1.1161E+01	1.3680E-01	1.5756E+03	2.8558E+00	9.9987E-01
60	1.1337E+01	2.1488E-01	1.3920E+03	4.4857E+00	9.9968E-01
80	1.1340E+01	2.1398E-01	1.2380E+03	4.4669E+00	9.9969E-01
100	1.1380E+01	2.4178E-01	1.0925E+03	5.0471E+00	9.9960E-01

Table A-18. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Palmitate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	6.2051E-04	2.7490E-05	8.5582E-01	5.7386E-04	9.9828E-01
60	6.7274E-04	2.9760E-05	8.4303E-01	6.2124E-04	9.9828E-01
80	7.3908E-04	4.2535E-05	8.2830E-01	8.8792E-04	9.9709E-01
100	7.9295E-04	4.0834E-05	8.1400E-01	8.5241E-04	9.9767E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	3.9373E+00	2.6361E-01	1.3270E+03	5.5030E+00	9.9607E-01
60	4.4751E+00	1.7813E-01	1.2507E+03	3.7184E+00	9.9861E-01
80	4.8000E+00	2.1854E-01	1.1846E+03	4.5620E+00	9.9818E-01
100	5.0123E+00	2.6488E-01	1.1231E+03	5.5293E+00	9.9755E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.0724E+01	7.1189E-01	1.5039E+03	1.4861E+01	9.9614E-01
60	1.1327E+01	1.9158E-01	1.3150E+03	3.9993E+00	9.9975E-01
80	1.1398E+01	2.2725E-01	1.1582E+03	4.7439E+00	9.9965E-01
100	1.1170E+01	2.6870E-01	1.0224E+03	5.6091E+00	9.9949E-01

Table A-19. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Soy Ester.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.4324E-04	2.0052E-05	8.8206E-01	4.1859E-04	9.9880E-01
40	5.9268E-04	1.8117E-05	8.6779E-01	3.7819E-04	9.9918E-01
60	6.4549E-04	2.5985E-05	8.5371E-01	5.4244E-04	9.9858E-01
80	7.0490E-04	2.8996E-05	8.3927E-01	6.0528E-04	9.9851E-01
100	7.6459E-04	2.8265E-05	8.2547E-01	5.9003E-04	9.9880E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8404E+00	1.5757E-01	1.4170E+03	3.2892E+00	9.9852E-01
40	4.0814E+00	1.6895E-01	1.3446E+03	3.5268E+00	9.9849E-01
60	4.3551E+00	1.8899E-01	1.2767E+03	3.9452E+00	9.9835E-01
80	4.6510E+00	2.1451E-01	1.2105E+03	4.4779E+00	9.9813E-01
100	4.9796E+00	2.2144E-01	1.1460E+03	4.6227E+00	9.9826E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1338E+01	2.5924E-01	1.7684E+03	5.4117E+00	9.9954E-01
40	1.1314E+01	2.2590E-01	1.5658E+03	4.7156E+00	9.9965E-01
60	1.1346E+01	2.4025E-01	1.3881E+03	5.0152E+00	9.9961E-01
80	1.1377E+01	2.4110E-01	1.2260E+03	5.0329E+00	9.9960E-01
100	1.1425E+01	2.0877E-01	1.0793E+03	4.3582E+00	9.9971E-01

Table A-20. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Stearate.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	6.0029E-04	1.6933E-05	8.5894E-01	3.5347E-04	9.9930E-01
60	6.7958E-04	1.9479E-05	8.4499E-01	4.0663E-04	9.9928E-01
80	7.2382E-04	3.7610E-05	8.3080E-01	7.8511E-04	9.9763E-01
100	8.2439E-04	3.9394E-04	8.1586E-01	8.2236E-03	9.9902E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.1266E+00	1.2464E-01	1.3306E+03	2.6018E+00	9.9920E-01
60	4.4594E+00	2.0762E-01	1.2612E+03	4.3341E+00	9.9810E-01
80	4.7944E+00	2.4608E-01	1.1967E+03	5.1369E+00	9.9769E-01
100	5.1211E+00	2.3378E-01	1.1339E+03	4.8803E+00	9.9817E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1227E+01	1.3648E-01	1.5176E+03	2.8489E+00	9.9987E-01
60	1.1424E+01	2.4345E-01	1.3405E+03	5.0820E+00	9.9960E-01
80	1.1446E+01	7.2038E-01	1.1796E+03	1.5038E+01	9.9942E-01
100	1.1602E+01	1.6818E-01	1.0443E+03	3.5107E+00	9.9982E-01

Table A-21. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Tallow.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.5683E-04	2.0348E-05	8.7107E-01	4.2476E-04	9.9883E-01
40	6.0835E-04	2.0820E-05	8.5642E-01	4.3461E-04	9.9897E-01
60	6.5287E-04	1.7451E-05	8.4186E-01	3.6430E-04	9.9937E-01
80	7.1570E-04	3.2475E-05	8.2795E-01	6.7791E-04	9.9819E-01
100	7.8391E-04	3.3238E-05	8.1369E-01	6.9384E-04	9.9842E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8363E+00	1.2923E-01	1.4149E+03	2.6978E+00	9.9900E-01
40	4.2304E+00	1.3875E-01	1.3324E+03	2.8965E+00	9.9905E-01
60	4.4419E+00	1.2489E-01	1.2631E+03	2.6071E+00	9.9931E-01
80	4.7670E+00	2.0530E-01	1.1994E+03	4.2856E+00	9.9837E-01
100	5.0307E+00	2.1813E-01	1.1370E+03	4.5534E+00	9.9835E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1218E+01	1.8369E-01	1.7411E+03	3.8345E+00	9.9976E-01
40	1.1498E+01	1.6013E-01	1.5171E+03	3.3428E+00	9.9983E-01
60	1.1316E+01	1.4184E-01	1.3394E+03	2.9609E+00	9.9986E-01
80	1.1424E+01	1.9657E-01	1.1871E+03	4.1035E+00	9.9974E-01
100	1.1339E+01	1.6781E-01	1.0475E+03	3.5030E+00	9.9981E-01

Table A-22. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of Methyl Yellow Grease.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	5.4732E-04	1.8119E-05	8.7435E-01	3.7823E-04	9.9904E-01
40	5.9798E-04	1.9209E-05	8.5965E-01	4.0100E-04	9.9909E-01
60	6.4636E-04	2.2516E-05	8.4538E-01	4.7002E-04	9.9893E-01
80	7.0504E-04	3.2167E-05	8.3151E-01	6.7148E-04	9.9817E-01
100	7.7724E-04	4.2834E-05	8.1741E-01	8.9417E-04	9.9733E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	3.8887E+00	1.0706E-01	1.4111E+03	2.2349E+00	9.9933E-01
40	4.1799E+00	1.3166E-01	1.3390E+03	2.7484E+00	9.9913E-01
60	4.4211E+00	1.8042E-01	1.2709E+03	3.7662E+00	9.9854E-01
80	4.7003E+00	2.1988E-01	1.2074E+03	4.5900E+00	9.9808E-01
100	4.9950E+00	2.4191E-01	1.1455E+03	5.0500E+00	9.9794E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20	1.1347E+01	1.1386E-01	1.7381E+03	2.3769E+00	9.9991E-01
40	1.1442E+01	1.3753E-01	1.5379E+03	2.8710E+00	9.9987E-01
60	1.1360E+01	2.1527E-01	1.3618E+03	4.4938E+00	9.9968E-01
80	1.1369E+01	2.4166E-01	1.2083E+03	5.0447E+00	9.9960E-01
100	1.1377E+01	2.3658E-01	1.0683E+03	4.9385E+00	9.9962E-01



Table A-23. Temperature and pressure dependent density, speed of sound and isentropic bulk modulus of N-Octadecane.

Density (g/cm <sup>3</sup> ) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	6.6535E-04	9.2628E-05	7.7359E-01	1.9336E-03	9.8323E-01
60	6.7972E-04	3.9957E-05	7.6361E-01	8.3411E-04	9.9697E-01
80	7.4276E-04	4.2805E-05	7.5110E-01	8.9356E-04	9.9709E-01
100	7.8029E-04	7.2633E-05	7.3955E-01	1.5162E-03	9.9243E-01
Speed of Sound (m/s) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	4.6847E+00	2.2179E-01	1.3093E+03	4.6298E+00	9.9803E-01
60	5.0694E+00	2.5440E-01	1.2380E+03	5.3107E+00	9.9779E-01
80	5.1080E+00	2.3771E-01	1.1723E+03	4.9623E+00	9.9810E-01
100	5.5773E+00	4.1295E-01	1.1100E+03	8.6203E+00	9.9520E-01
Isentropic Bulk Modulus (MPa) = [A ± tS <sub>A</sub> ]*P(MPa) + [B ± tS <sub>B</sub> ]					
Temperature, °C	A	± tS <sub>A</sub>	B	± tS <sub>B</sub>	R <sup>2</sup>
20					
40	1.1484E+01	3.6518E-01	1.3225E+03	7.6232E+00	9.9911E-01
60	1.1589E+01	2.9029E-01	1.1663E+03	6.0598E+00	9.9945E-01
80	1.1004E+01	3.5516E-01	1.0278E+03	7.4139E+00	9.9908E-01
100	1.1225E+01	5.0852E-01	9.0666E+02	1.0615E+01	9.9820E-01

## **Appendix B**

### Fuel properties and analysis.

Table B-1. Fuel analysis results.

Table B-2. Fatty acid composition of fuels tested (M=methyl ester, E=ethyl ester).

Table B-3. Chemical properties of some samples.

Table B-4. Distillation results of some samples.

Table B-1. Fuel analysis results.

Fuel	Acid Number	Iodine Number	Peroxides	Water And Sediment	Glycerol, wt%		Glycerides			Total Glycerin
Ester	Mg KOH/g	Cg I2/g	mg/kg	vol%	Free	Bound	Mono-	Di-	Tri-	
1. Methyl Laurate	0.06	0.3	62	0	0	0.003	0.004	0	0.016	0.003
2. Methyl Palmitate	0.16	0.5	77	0	0	0.011	0.003	0	0.098	0.011
3. Methyl Stearate	9.13	0.5	74	0	0	0.016	0.058	0.004	0	0.016
4. Ethyl Stearate	0.01	1.0	58	0	0	0.024	0.055	0.012	0.073	0.025
5. Methyl Oleate	0.13	90	162	0	0	0.022	0.073	0.017	0.004	0.022
6. Ethyl Oleate	0.19	79	185	0	0	0.035	0.094	0.024	0.069	0.035
7. Methyl Linoleate	0.41	151	148	0	0.001	0.126	0.078	0.153	0.792	0.126
8. Ethyl Linoleate	0.81	140	655	0	0	0.089	0.326	0.03	0	0.089
9. Methyl Linolenate	0.23	165	544	0	0	0.089	0.085	0.133	0.452	0.089
10. Ethyl Linseed	6.1	157	21	0	0	0.041	0.098	0.025	0.112	0.041
11. Methyl Soy	0.15	121	340	0	0.007	0.223	0.684	0.216	0.063	0.223
12. Methyl Hydrogenated Soy	4.66	6	188	0	0.001	0.099	0.278	0.075	0.143	0.099
13. Ethyl Soy	3.02	122	123	0	0.003	0.031	0.083	0.036	0.013	0.031
14. Ethyl Hydrogenated soy	3.94	6	111	0	0	0.097	0.361	0.023	0	0.097
15. 2:1 Methyl Stearate: Methyl Linseed	1.62	116	295	0	0	0.032	0.084	0.023	3.105	0.024
16. 1:2 Methyl Stearate: Methyl Linseed	2.5	66	387	0	0	0.024	0.85	0.033	0.01	0.062
17. Oxidized Methyl Soy	0.6	131	1861	0	0.001	0.012	0.018	0.036	0.011	0.012
18. Oxidized Ethyl Soy	3.81	118	210	0	0.001					
19. High Acid Number Methyl Oleate	10.1	84	369	0	0	0.023	0.063	0.013	0.045	0.023
20. High Glyceride Ethyl Soy	6.3	117	125	0	0	1.045	2.489	1.035	2.357	1.045

Table B-2. Fatty acid composition of fuels tested (M=methyl ester, E=ethyl ester).

	Lauric	Myristic	Palmitic	Palmitoleic	Margaric	Stearic	Oleic	<u>Linoleic</u>	Linolenic
Ester	C12:0	C14:0	C16:0	C16:1	C17:0	C18:0	C18:1	<b>C18:2</b>	C18:3
1. Methyl Laurate	99.2 M	0	0	0	0	0	0.6 M	0.2 M	0
2. Methyl Palmitate	0.2 M	4.6 M	88.2 M	0	0.4 M	6.3 M	0	0	0
3. Methyl Stearate	0	1.3 M	42.1 M	0	1.0 M	52.6 M	0.9 M	2 M	0
4. Ethyl Stearate	0	2.2 E	43.6 E	0	2.4 E	49.8 E	0.2 E	0.1 E	0
5. Methyl Oleate	0	3.0 M	6.5 M	4.1 M	1.5 M	1.9 M	64.5 M	9.1 M	<b><u>9 M</u></b>
6. Ethyl Oleate	0	3.1E	6.7 E	4.2 E	4.6 E	2.5 E	58.1 E	9.1 E	9.1 E
7. Methyl Linoleate	0	0	1.4 M	0	0	0.7 M	5.2 M	86.5 M	6.2 M
8. Ethyl Linoleate	0	0	2.7 E	0	0	2.4 E	6.4 E	88.5 E	0
9. Methyl Linolenate	0	0	7.4 M	0	0	3.7 M	24.8 M	2.9 M	61.2 M
10. Ethyl Linseed	0	2.5 E	7.6 E	0	3.3 E	2.8 E	22.3 E	11.2 E	50.3 E
11. Methyl Soy	0	0	16.3 M	0	0	6 M	53.4 M	24.3	0
12. Methyl Hydrogenated	0	0	11.3 M	0	0	88.7 M	0	0	0
13. Ethyl Soy	0	0	5.2 M	0	0	2.9 M	18.6 M	10.6 M	0
			8.8 E			6.1 E	34.1 E	13.7 E	
14. Ethyl Hydrogenated soy	0	0	11.9 E	0	0	88.1 E	0	0	0
15. 2:1 Methyl Stearate: Methyl Linseed	0	0	38.6 M	0	0	44.1 M	4.8 M	2.4 M	10.1 M
16. 1:2 Methyl Stearate: Methyl Linseed	0	0	20.8 M	0	0	28 M	15.2 M	7.6 M	27.8 M
17. Oxidized Methyl Soy	0	0	15.2 M	0	0	5.3 M	57 M	22.5 M	0
18. Oxidized Ethyl Soy	0	0	4.9 M	0	0	2.5M	18.2 M	7.8 M	0
			10.1 E			4.5 E	37.1 E	14.8 E	
19. High Acid Number Methyl Oleate	0	4.2 E	43.6 M	0	0	3.4 M	73.1 M	7.4 M	7.4 M

Table B-3. Chemical properties of some ester samples.

Test Identification	Description	Methyl Soy Ester	Methyl Lard	Methyl Canola	Methyl Tallow
D93	Flash, Pensky Martens, °F	333	263	326	344
D97	Pour Point, °F	25	55	25	60
D130	Corrosion	1A	1A	1A	1A
D240	Heat of Combustion/Gross Calorific Value,	17153	17165	17241	17144
D445	Kinematic Viscosity, cSt @ 40 °C	4.546			4.908
D445	Kinematic Viscosity, cSt @ 100 °C		4.850	4.63	
D482	Ash from Petroleum Products, %	0.00	0.000	0.003	0.001
D524	Carbon Residue, Ramsbottom, 100% as 10%	0.008%	0.04	0.04	
D613	Cetane Number	59.0	xxxxxx	53.9	64.8
D664	Acid Number by Potentiometric Titration, mg KOH/g	0.32	0.76	0.13	0.32
D971	Interfacial Tension of Oil Against Water, mN/m	11.32	12.19	15.52	31.74
D1094	H2O RX & Rating I.R.=Interface Rating	2 I.R.	2 I.R.	2 I.R.	3 I.R.
	V.C.=Volume Change	1.0 mL V.C.	-1.0 mL V.C.	-2.0 mL V.C.	0.5 mL V.C.
D1298	Specific Gravity @ 74 °F, g/ml	0.8877	0.8762	0.8811	0.8708
D1322	Smoke Point	N/A-would not burn	N/A	N/A	N/A-wick burned
D1796	Sediment, %	0.00	0.60	0.00	0.05
D1959	Iodine, ppm	2.98	53	66	4.68
D2500	Cloud Point, °F	38	56	26	66
D2622	Sulfur, wt%	0.000	0.0000	0.0000	0.000
D2624	Conductivity of Aviation Fuels, pS/m	181	122	147	809
D3241	Thermal Oxidation Stability	1 mm Hg; 1 Tube Rating	0 mm Hg; 1 Tube Rating	0 mm Hg; 1 Tube Rating	2 mm Hg; 4P0 Tube Rating
D3242	Neutralization Number, mg KOH/g	0.322	0.760	0.120	0.350
D4629	Total Nitrogen, ppm	3.0	3.0	<1.0	77.0

Table B-3. Continued

Test ID		Methyl Soy Ester	Methyl Lard	Methyl Canola	Methyl Tallow
D3241	Thermal Oxidation Stability	1 mm Hg; 1 Tupe Rating	0 mm Hg; 1 Tupe Rating	0 mm Hg; 1 Tupe Rating	2 mm Hg; 4P Tupe Rating
D3242	Neutralization Number, mg KOH/g	0.322	0.76	0.120	0.350
D4629	Total Nitrogen, ppm	3.0	3.0	<1.0	77.0
D5191	Vapor Pressure of Petroleum Products	Could not perform pour too high			Could not perform pour too high
D5291	CH				
D5291	Carbon, wt%	77.95	77.36	77.68	77.07
D5291	Hydrogen, wt%	11.98	12.5	12.25	12.05
D5452	Particulate Matter, Volume, Pad Rating	1.10 L; 78 min	789.00 mg/L;B6;0.17L;1 8 min	11.00 mg/L; B5; 0.5L; 49 min	73.6 ml/L; B4; 1.0L; 301 min
IP309	Cold Filter Plugging Point, °F	28	52	24	
C. Plank	Impurities in Biodiesel Methyl Esters				
C. Plank	Free glycerin, wt%	0.001	0.000	0.001	0.000
C. Plank	Monoglycerides, wt%	0.870	0.563	0.738	0.320
C. Plank	Diglycerides, wt%	1.358	0.093	0.020	0.120
C. Plank	Triglycerides, wt%	3.542	0.005	0.010	0.014
C. Plank	Total glycerides, wt%	0.798	0.160	0.196	0.102
GCMS-OXY	Free Alcohols				41
	Methanol, ppm	79			<10
	Other Alcohol, ppm	<10			
	Propanal, ppm	28			54
	Acetaldehyde, ppm		85	95	
	Ethanol, ppm		8	14	
	Propanol, ppm		104	226	
	Formic Acid, ppm		28	16	
	Acetic Acid, ppm		59	57	
	Butanal, ppm		20	50	
	Pentanal, ppm		68	37	8
	2-Pentanal, ppm		10		
	Hexanal, ppm		198	110	7
	Butanol, ppm			81	

Table B-4. Distillation results of some samples.

Test Identification	Description	Methyl Soy Ester	Methyl Lard	Methyl Canola	Methyl Tallow
D86	Distillation Points, °F				
D86	IBP, °F	613.2	580	600	616
D86	10%, °F	643.2	612	615	534
D86	20%, °F	649.2	616	628	637
D86	50%, °F	654.3	624	636	646
D86	90%, °F	669.3	638	645	665
D86	EP, °F	673.3	670	671	682
D86	Recovery, mL	98.2	98.5	99	98.2
D86	Residue, mL	1.1	0.5	0.5	1.8
D86	Loss, mL	0.7	1.0	0.5	0.0
D1160	Vacuum Distillation				
D1160	IBP, °F	658	629	658	628
D1160	5%, °F	662	648	662	646
D1160	10%, °F	663	650	663	648
D1160	20%, °F	665	652	663	652
D1160	30%, °F	666	653	663	656
D1160	40%, °F	667	655	664	660
D1160	50%, °F	669	659	664	662
D1160	60%, °F	670	661	664	666
D1160	70%, °F	671	664	666	669
D1160	80%, °F	674	669	668	674
D1160	90%, °F	687	672	672	680
D1160	95%, °F	849	679	685	689
D1160	EP, °F	883	768	814	793
D1160	Recovery, %	97	99	99	98
D1160	Residue, %	3	1	1	2

## Appendix C

### Raw Data

Table C-1. Raw density, speed of sound and isentropic bulk modulus data for 2:1 Methyl Linseed Methyl Stearate

Table C-2. Raw density, speed of sound and isentropic bulk modulus data for 2:1 Methyl Stearate Methyl Linseed

Table C-3. Raw density, speed of sound and isentropic bulk modulus data for Certified D2

Table C-4. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Hydrogenated Soy

Table C-5. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Linoleate

Table C-6. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Linseed

Table C-7. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Oxidized Soy

Table C-8. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Soy Ester

Table C-9. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Stearate

Table C-10. Raw density, speed of sound and isentropic bulk modulus data for Methyl Canola

Table C-11. Raw density, speed of sound and isentropic bulk modulus data for Methyl Hydrogenated Soy

Table C-12. Raw density, speed of sound and isentropic bulk modulus data for Methyl Lard

Table C-13. Raw density, speed of sound and isentropic bulk modulus data for Methyl Laurate

Table C-14. Raw density, speed of sound and isentropic bulk modulus data for Methyl Linoleate



- Table C-15. Raw density, speed of sound and isentropic bulk modulus data for Methyl Linolenate
- Table C-16. Raw density, speed of sound and isentropic bulk modulus data for Methyl Oleate
- Table C-17. Raw density, speed of sound and isentropic bulk modulus data for Methyl Oxidized Soy
- Table C-18. Raw density, speed of sound and isentropic bulk modulus data for Methyl Palmitate
- Table C-19. Raw density, speed of sound and isentropic bulk modulus data for Methyl Soy Ester
- Table C-20. Raw density, speed of sound and isentropic bulk modulus data for Methyl Stearate
- Table C-21. Raw density, speed of sound and isentropic bulk modulus data for Methyl Tallow
- Table C-22. Raw density, speed of sound and isentropic bulk modulus data for Methyl Yellow Grease
- Table C-23. Raw density, speed of sound and isentropic bulk modulus data for N-Octadecane

Table C-1. Raw density, speed of sound and isentropic bulk modulus data for 2:1 Methyl Linseed Methyl Stearate

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8853	0.8853	0.8853	0.8853	0.8853
6.89	0.8889	0.8891	0.8895	0.8890	0.8891
13.79	0.8927	0.8931	0.8931	0.8928	0.8929
20.68	0.8964	0.8968	0.8968	0.8964	0.8966
27.58	0.9001	0.9004	0.9008	0.9001	0.9004
34.5	0.9037	0.9032	0.9041	0.9030	0.9035
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1418.4	1420.4	1416.2	1421.0	1419.0
6.89	1444.6	1447.5	1443.2	1448.1	1445.9
13.79	1471.2	1475.2	1468.8	1474.2	1472.4
20.68	1497.4	1501.2	1495.0	1499.9	1498.4
27.58	1523.2	1525.1	1523.9	1524.4	1524.2
34.5	1547.6	1547.6	1545.5	1545.5	1546.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1781.0	1786.0	1775.6	1787.5	1782.5
6.89	1855.0	1862.9	1852.6	1864.4	1858.7
13.79	1932.2	1943.6	1926.9	1940.2	1935.7
20.68	2009.9	2020.9	2004.4	2016.6	2013.0
27.58	2088.4	2094.1	2092.1	2091.7	2091.6
34.5	2164.3	2163.3	2159.5	2156.8	2161.0
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8707	0.8707	0.8707	0.8707	0.8707
6.89	0.8747	0.8752	0.8746	0.8753	0.8750
13.79	0.8788	0.8794	0.8789	0.8796	0.8792
20.68	0.8829	0.8834	0.8829	0.8834	0.8832
27.58	0.8870	0.8871	0.8870	0.8872	0.8871
34.5	0.8910	0.8906	0.8909	0.8908	0.8908
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1346.1	1348.0	1347.1	1346.8	1347.0
6.89	1373.3	1378.2	1374.8	1378.2	1376.1
13.79	1401.8	1407.6	1404.3	1407.4	1405.3
20.68	1429.8	1434.6	1430.4	1433.6	1432.1
27.58	1457.7	1459.6	1457.0	1459.8	1458.5
34.5	1484.7	1484.7	1484.5	1484.5	1484.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1577.6	1582.2	1580.1	1579.3	1579.8
6.89	1649.8	1662.3	1653.2	1662.6	1657.0
13.79	1726.7	1742.4	1733.2	1742.3	1736.2
20.68	1805.0	1818.1	1806.5	1815.7	1811.3
27.58	1884.7	1889.8	1883.0	1890.6	1887.0
34.5	1964.2	1963.1	1963.4	1963.1	1963.5

Table C-1. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8563	0.8563	0.8563	0.8563	0.8563
6.89	0.8607	0.8608	0.8608	0.8611	0.8609
13.79	0.8654	0.8656	0.8656	0.8657	0.8656
20.68	0.8699	0.8699	0.8700	0.8704	0.8701
27.58	0.8742	0.8739	0.8744	0.8745	0.8742
34.5	0.8782	0.8775	0.8787	0.8782	0.8781
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1277.0	1276.7	1275.3	1277.7	1276.7
6.89	1306.9	1311.0	1305.4	1309.4	1308.2
13.79	1338.1	1342.8	1337.5	1340.5	1339.8
20.68	1368.5	1371.5	1367.6	1371.5	1369.8
27.58	1396.9	1398.3	1396.8	1399.3	1397.8
34.5	1423.8	1423.8	1425.0	1425.0	1424.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1396.5	1395.8	1392.6	1397.9	1395.7
6.89	1470.2	1479.4	1466.9	1476.4	1473.2
13.79	1549.4	1560.9	1548.5	1555.8	1553.7
20.68	1629.3	1636.4	1627.2	1637.1	1632.5
27.58	1706.0	1708.7	1705.9	1712.1	1708.2
34.5	1780.2	1778.9	1784.1	1783.2	1781.6
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8419	0.8419	0.8419	0.8419	0.8419
6.89	0.8469	0.8472	0.8467	0.8471	0.8470
13.79	0.8521	0.8525	0.8516	0.8522	0.8521
20.68	0.8573	0.8574	0.8566	0.8572	0.8571
27.58	0.8620	0.8618	0.8613	0.8617	0.8617
34.5	0.8665	0.8658	0.8658	0.8657	0.8660
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1208.1	1210.2	1208.9	1209.8	1209.3
6.89	1240.1	1244.9	1241.1	1243.6	1242.4
13.79	1274.5	1279.9	1273.5	1277.0	1276.2
20.68	1308.1	1311.1	1306.4	1309.4	1308.8
27.58	1338.8	1340.4	1337.2	1339.1	1338.9
34.5	1367.8	1367.8	1366.3	1366.3	1367.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1228.7	1233.1	1230.4	1232.2	1231.1
6.89	1302.4	1313.0	1304.3	1310.0	1307.4
13.79	1384.0	1396.6	1381.1	1389.8	1387.9
20.68	1467.0	1473.9	1462.1	1469.8	1468.2
27.58	1545.0	1548.3	1540.1	1545.3	1544.7
34.5	1621.2	1619.9	1616.3	1616.1	1618.4

Table C-1. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8278	0.8278	0.8278	0.8278	0.8278
6.89	0.8332	0.8348	0.8332	0.8331	0.8336
13.79	0.8390	0.8406	0.8387	0.8387	0.8393
20.68	0.8443	0.8459	0.8442	0.8442	0.8447
27.58	0.8492	0.8508	0.8495	0.8491	0.8497
34.5	0.8544	0.8553	0.8542	0.8534	0.8543
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1148.5	1151.1	1146.5	1150.0	1149.0
6.89	1183.3	1187.3	1181.4	1184.1	1184.0
13.79	1220.4	1222.3	1217.1	1220.7	1220.1
20.68	1253.5	1256.8	1252.2	1255.3	1254.4
27.58	1284.6	1288.7	1285.6	1286.6	1286.4
34.5	1317.6	1317.6	1315.0	1314.7	1316.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1091.9	1096.9	1088.0	1094.7	1092.9
6.89	1166.6	1176.9	1162.9	1168.2	1168.6
13.79	1249.6	1255.9	1242.3	1249.8	1249.4
20.68	1326.7	1336.1	1323.7	1330.2	1329.2
27.58	1401.3	1412.9	1404.1	1405.5	1405.9
34.5	1483.2	1484.8	1477.2	1475.1	1480.1

Table C-2. Raw density, speed of sound and isentropic bulk modulus data for 2:1 Methyl Stearate Methyl Linseed.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8642	0.8642	0.8642	0.8642	0.8642
6.89	0.8685	0.8690	0.8686	0.8691	0.8688
13.79	0.8729	0.8733	0.8728	0.8734	0.8731
20.68	0.8774	0.8774	0.8766	0.8776	0.8772
27.58	0.8812	0.8811	0.8810	0.8813	0.8812
34.5	0.8852	0.8846	0.8848	0.8847	0.8848
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1336.0	1338.1	1335.6	1337.7	1336.8
6.89	1366.0	1369.6	1366.0	1369.1	1367.7
13.79	1395.6	1399.8	1395.0	1398.7	1397.3
20.68	1425.4	1427.4	1423.2	1427.0	1425.7
27.58	1452.9	1453.7	1451.6	1453.1	1452.8
34.5	1479.3	1479.3	1476.7	1476.7	1478.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1542.5	1547.4	1541.7	1546.6	1544.5
6.89	1620.6	1630.1	1620.7	1629.0	1625.1
13.79	1700.1	1711.3	1698.5	1708.6	1704.6
20.68	1782.5	1787.5	1775.5	1786.9	1783.1
27.58	1860.1	1862.1	1856.4	1860.9	1859.9
34.5	1937.1	1935.8	1929.6	1929.3	1933.0
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8498	0.8498	0.8498	0.8498	0.8498
6.89	0.8547	0.8555	0.8546	0.8550	0.8550
13.79	0.8598	0.8604	0.8593	0.8597	0.8598
20.68	0.8644	0.8648	0.8640	0.8642	0.8644
27.58	0.8687	0.8688	0.8683	0.8683	0.8685
34.5	0.8728	0.8726	0.8724	0.8720	0.8724
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1266.2	1268.4	1265.4	1270.0	1267.5
6.89	1300.1	1304.2	1298.1	1302.2	1301.2
13.79	1333.2	1335.6	1329.5	1334.0	1333.1
20.68	1364.7	1364.9	1360.1	1363.9	1363.4
27.58	1391.2	1392.7	1390.1	1391.4	1391.4
34.5	1419.6	1419.6	1417.0	1417.0	1418.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1362.5	1367.3	1360.8	1370.7	1365.3
6.89	1444.6	1455.3	1440.0	1449.9	1447.4
13.79	1528.2	1534.9	1518.8	1530.0	1528.0
20.68	1609.9	1611.0	1598.2	1607.7	1606.7
27.58	1681.3	1685.3	1677.8	1681.0	1681.3
34.5	1759.0	1758.4	1751.8	1750.8	1755.0

Table C-2. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8356	0.8356	0.8356	0.8356	0.8356
6.89	0.8411	0.8409	0.8411	0.8414	0.8411
13.79	0.8461	0.8456	0.8461	0.8465	0.8461
20.68	0.8519	0.8504	0.8511	0.8515	0.8512
27.58	0.8558	0.8555	0.8560	0.8559	0.8558
34.5	0.8607	0.8597	0.8604	0.8599	0.8602
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1201.5	1205.2	1200.0	1203.1	1202.4
6.89	1237.7	1242.1	1235.3	1239.8	1238.7
13.79	1271.4	1274.8	1268.7	1274.0	1272.2
20.68	1305.1	1306.8	1301.6	1304.9	1304.6
27.58	1334.6	1337.9	1332.8	1334.4	1334.9
34.5	1365.8	1365.8	1361.7	1361.7	1363.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1206.3	1213.8	1203.2	1209.5	1208.2
6.89	1288.5	1297.2	1283.3	1293.3	1290.6
13.79	1367.8	1374.2	1361.9	1373.9	1369.5
20.68	1451.0	1452.1	1441.9	1449.9	1448.7
27.58	1524.1	1531.2	1520.6	1523.9	1525.0
34.5	1605.5	1603.7	1595.4	1594.5	1599.8
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8214	0.8214	0.8214	0.8214	0.8214
6.89	0.8273	0.8275	0.8273	0.8273	0.8273
13.79	0.8326	0.8329	0.8331	0.8334	0.8330
20.68	0.8383	0.8385	0.8384	0.8386	0.8385
27.58	0.8434	0.8434	0.8437	0.8437	0.8436
34.5	0.8482	0.8477	0.8487	0.8482	0.8482
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1144.5	1146.7	1138.9	1140.9	1142.8
6.89	1182.6	1185.5	1175.9	1180.0	1181.0
13.79	1218.5	1221.4	1213.0	1216.8	1217.4
20.68	1254.5	1257.6	1246.5	1249.7	1252.1
27.58	1287.7	1289.3	1279.9	1281.5	1284.6
34.5	1317.8	1317.8	1309.6	1309.6	1313.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1076.0	1080.1	1065.4	1069.2	1072.7
6.89	1157.0	1163.0	1144.0	1152.0	1154.0
13.79	1236.2	1242.7	1225.7	1233.9	1234.6
20.68	1319.3	1326.1	1302.7	1309.6	1314.4
27.58	1398.6	1402.1	1382.1	1385.6	1392.1
34.5	1473.0	1472.0	1455.6	1454.7	1463.8

Table C-3. Raw density, speed of sound and isentropic bulk modulus data for Certified D2

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8407	0.8407	0.8407	0.8407	0.8407
6.89	0.8455	0.8461	0.8448	0.8451	0.8454
13.79	0.8491	0.8501	0.8489	0.8492	0.8493
20.68	0.8533	0.8540	0.8529	0.8532	0.8533
27.58	0.8570	0.8577	0.8568	0.8569	0.8571
34.5	0.8609	0.8611	0.8604	0.8600	0.8606
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1370.8	1373.5	1374.8	1374.5	1373.4
6.89	1404.5	1409.2	1407.2	1409.9	1407.7
13.79	1435.8	1439.9	1437.7	1441.5	1438.7
20.68	1466.7	1471.4	1467.6	1471.6	1469.3
27.58	1493.2	1495.2	1496.8	1498.3	1495.9
34.5	1522.3	1522.3	1522.8	1522.8	1522.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1579.6	1586.0	1589.0	1588.1	1585.7
6.89	1667.9	1680.2	1673.0	1679.9	1675.2
13.79	1750.6	1762.5	1754.6	1764.8	1758.1
20.68	1835.6	1848.9	1836.9	1847.7	1842.3
27.58	1910.8	1917.6	1919.5	1923.6	1917.9
34.5	1995.1	1995.6	1995.2	1994.3	1995.1
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8265	0.8265	0.8265	0.8265	0.8265
6.89	0.8311	0.8316	0.8313	0.8312	0.8313
13.79	0.8357	0.8363	0.8362	0.8363	0.8361
20.68	0.8401	0.8406	0.8411	0.8411	0.8407
27.58	0.8444	0.8447	0.8456	0.8453	0.8450
34.5	0.8484	0.8485	0.8506	0.8500	0.8494
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1297.1	1297.2	1299.9	1301.2	1298.9
6.89	1331.8	1334.0	1333.5	1337.2	1334.1
13.79	1365.0	1367.2	1366.9	1370.4	1367.4
20.68	1397.5	1399.6	1399.1	1402.2	1399.6
27.58	1427.8	1429.6	1429.6	1430.8	1429.4
34.5	1457.7	1457.7	1458.3	1458.3	1458.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1390.6	1390.9	1396.6	1399.5	1394.4
6.89	1474.0	1480.0	1478.2	1486.3	1479.6
13.79	1557.3	1563.3	1562.3	1570.4	1563.3
20.68	1640.8	1646.7	1646.3	1653.7	1646.9
27.58	1721.2	1726.4	1728.2	1730.5	1726.6
34.5	1802.7	1802.9	1809.0	1807.7	1805.6

Table C-3. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8126	0.8126	0.8126	0.8126	0.8126
6.89	0.8179	0.8180	0.8175	0.8184	0.8180
13.79	0.8230	0.8232	0.8226	0.8234	0.8230
20.68	0.8279	0.8280	0.8271	0.8281	0.8278
27.58	0.8325	0.8325	0.8318	0.8324	0.8323
34.5	0.8369	0.8365	0.8362	0.8366	0.8366
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1226.3	1227.6	1228.8	1230.5	1228.3
6.89	1262.9	1265.9	1265.3	1268.3	1265.6
13.79	1299.6	1302.2	1301.4	1304.2	1301.9
20.68	1333.9	1335.6	1334.6	1338.3	1335.6
27.58	1365.4	1367.8	1367.1	1368.9	1367.3
34.5	1396.8	1396.8	1398.9	1398.9	1397.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1222.0	1224.6	1227.0	1230.3	1226.0
6.89	1304.5	1310.9	1308.8	1316.3	1310.1
13.79	1389.9	1396.0	1393.1	1400.6	1394.9
20.68	1473.0	1477.0	1473.1	1483.1	1476.6
27.58	1552.1	1557.4	1554.5	1559.9	1556.0
34.5	1632.8	1632.0	1636.4	1637.0	1634.5
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7984	0.7984	0.7984	0.7984	0.7984
6.89	0.8043	0.8045	0.8040	0.8046	0.8043
13.79	0.8097	0.8102	0.8092	0.8098	0.8097
20.68	0.8149	0.8155	0.8145	0.8152	0.8150
27.58	0.8201	0.8204	0.8193	0.8199	0.8199
34.5	0.8250	0.8247	0.8241	0.8243	0.8245
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1158.4	1159.8	1160.9	1159.8	1159.7
6.89	1198.7	1200.7	1200.1	1203.4	1200.7
13.79	1236.3	1239.8	1237.8	1239.8	1238.4
20.68	1271.7	1275.9	1274.3	1277.3	1274.8
27.58	1306.9	1309.4	1308.6	1309.6	1308.6
34.5	1339.7	1339.7	1340.7	1340.7	1340.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1071.3	1074.0	1076.0	1074.0	1073.8
6.89	1155.6	1159.8	1157.9	1165.2	1159.6
13.79	1237.6	1245.3	1239.8	1244.7	1241.8
20.68	1317.9	1327.5	1322.6	1330.0	1324.5
27.58	1400.7	1406.6	1403.0	1406.2	1404.1
34.5	1480.6	1480.0	1481.3	1481.7	1480.9



Table C-3. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7884	0.7884	0.7884	0.7884	0.7884
6.89	0.7945	0.7952	0.7944	0.7944	0.7946
13.79	0.8004	0.8015	0.8004	0.8005	0.8007
20.68	0.8061	0.8071	0.8060	0.8060	0.8063
27.58	0.8117	0.8126	0.8115	0.8109	0.8117
34.5	0.8169	0.8174	0.8164	0.8158	0.8166
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1093.1	1094.0	1096.0	1096.6	1094.9
6.89	1138.1	1139.3	1138.6	1141.6	1139.4
13.79	1177.4	1179.9	1179.7	1182.6	1179.9
20.68	1216.0	1217.8	1217.1	1220.0	1217.7
27.58	1252.2	1253.2	1253.7	1255.9	1253.7
34.5	1286.6	1286.6	1289.3	1289.3	1288.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	941.9	943.5	947.0	948.0	945.1
6.89	1029.1	1032.2	1030.0	1035.3	1031.6
13.79	1109.6	1115.8	1114.1	1119.6	1114.7
20.68	1192.1	1197.0	1193.8	1199.6	1195.6
27.58	1272.7	1276.2	1275.5	1278.9	1275.8
34.5	1352.2	1353.1	1357.2	1356.2	1354.7

Table C-4. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Hydrogenated Soy.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8482	0.8482	0.8482	0.8482	0.8482
6.89	0.8525	0.8529	0.8524	0.8529	0.8527
13.79	0.8566	0.8573	0.8565	0.8574	0.8570
20.68	0.8609	0.8613	0.8611	0.8614	0.8612
27.58	0.8651	0.8650	0.8648	0.8650	0.8650
34.5	0.8688	0.8684	0.8687	0.8683	0.8685
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1324.6	1327.4	1325.0	1327.8	1326.2
6.89	1355.9	1360.1	1356.3	1361.0	1358.3
13.79	1384.6	1390.8	1385.9	1392.0	1388.3
20.68	1415.2	1419.0	1418.0	1420.8	1418.3
27.58	1444.6	1445.4	1445.6	1446.7	1445.6
34.5	1470.1	1470.1	1471.4	1471.4	1470.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1488.28	1494.51	1489.06	1495.29	1491.78
6.89	1567.42	1577.86	1568.08	1579.95	1573.33
13.79	1642.07	1658.35	1645.13	1661.33	1651.72
20.68	1724.33	1734.18	1731.40	1738.79	1732.17
27.58	1805.34	1807.16	1807.37	1810.42	1807.57
34.5	1877.72	1876.81	1880.66	1879.97	1878.79
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8340	0.8340	0.8340	0.8340	0.8340
6.89	0.8389	0.8395	0.8389	0.8392	0.8391
13.79	0.8435	0.8439	0.8434	0.8439	0.8437
20.68	0.8479	0.8480	0.8479	0.8485	0.8481
27.58	0.8524	0.8519	0.8523	0.8524	0.8523
34.5	0.8566	0.8554	0.8566	0.8561	0.8562
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1255.9	1257.4	1255.6	1257.1	1256.5
6.89	1289.8	1293.4	1288.7	1292.1	1291.0
13.79	1321.5	1326.0	1319.8	1326.2	1323.4
20.68	1351.8	1355.9	1350.9	1356.5	1353.8
27.58	1382.7	1385.0	1380.8	1384.6	1383.3
34.5	1411.7	1411.7	1410.9	1410.9	1411.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1315.5	1318.7	1314.8	1318.1	1316.8
6.89	1395.7	1404.4	1393.1	1401.1	1398.6
13.79	1473.2	1483.9	1469.1	1484.3	1477.6
20.68	1549.5	1559.2	1547.3	1561.2	1554.3
27.58	1629.7	1634.0	1625.0	1634.1	1630.7
34.5	1707.2	1704.6	1705.2	1704.2	1705.3

Table C-4. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8209	0.8209	0.8209	0.8209	0.8209
6.89	0.8262	0.8264	0.8261	0.8265	0.8263
13.79	0.8314	0.8317	0.8313	0.8317	0.8315
20.68	0.8363	0.8366	0.8362	0.8367	0.8365
27.58	0.8411	0.8408	0.8407	0.8409	0.8409
34.5	0.8456	0.8449	0.8451	0.8449	0.8451
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1190.1	1192.5	1190.8	1192.1	1191.4
6.89	1226.2	1229.6	1226.2	1230.0	1228.0
13.79	1260.7	1265.7	1261.5	1265.1	1263.3
20.68	1294.4	1297.6	1294.3	1297.6	1296.0
27.58	1326.0	1327.2	1326.2	1327.2	1326.7
34.5	1356.8	1356.8	1355.0	1355.0	1355.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1162.7	1167.3	1164.0	1166.5	1165.1
6.89	1242.2	1249.3	1242.0	1250.5	1246.0
13.79	1321.4	1332.4	1322.9	1331.2	1327.0
20.68	1401.2	1408.5	1400.8	1408.8	1404.8
27.58	1478.9	1481.1	1478.7	1481.3	1480.0
34.5	1556.7	1555.5	1551.7	1551.3	1553.8
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8071	0.8071	0.8071	0.8071	0.8071
6.89	0.8126	0.8125	0.8129	0.8132	0.8128
13.79	0.8181	0.8186	0.8186	0.8190	0.8186
20.68	0.8240	0.8240	0.8241	0.8245	0.8241
27.58	0.8288	0.8285	0.8292	0.8292	0.8289
34.5	0.8337	0.8328	0.8340	0.8334	0.8335
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1126.3	1128.5	1127.6	1129.9	1128.1
6.89	1166.3	1168.9	1165.3	1169.0	1167.4
13.79	1203.4	1206.7	1202.8	1207.2	1205.0
20.68	1239.0	1241.8	1240.8	1243.3	1241.2
27.58	1271.6	1273.2	1272.2	1273.5	1272.6
34.5	1303.6	1303.6	1304.1	1304.1	1303.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1023.8	1027.9	1026.3	1030.4	1027.1
6.89	1105.4	1110.1	1103.8	1111.3	1107.7
13.79	1184.7	1191.8	1184.3	1193.7	1188.6
20.68	1265.0	1270.6	1268.8	1274.4	1269.7
27.58	1340.1	1343.0	1342.1	1344.8	1342.5
34.5	1416.7	1415.1	1418.3	1417.2	1416.8

Table C-5. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Linoleate

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8841	0.8841	0.8841	0.8841	0.8841
6.89	0.8884	0.8884	0.8881	0.8882	0.8883
13.79	0.8923	0.8923	0.8921	0.8922	0.8922
20.68	0.8961	0.8960	0.8958	0.8958	0.8959
27.58	0.8999	0.8997	0.8997	0.8994	0.8997
34.5	0.9035	0.9029	0.9032	0.9024	0.9030
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1409.3	1410.5	1409.2	1413.1	1410.5
6.89	1436.7	1439.3	1435.8	1439.5	1437.8
13.79	1464.0	1467.8	1463.6	1467.8	1465.8
20.68	1491.5	1493.7	1489.7	1494.1	1492.3
27.58	1518.2	1520.5	1517.3	1518.7	1518.7
34.5	1541.5	1541.5	1540.8	1540.8	1541.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1756.1	1759.0	1755.6	1765.4	1759.0
6.89	1833.7	1840.4	1831.0	1840.5	1836.4
13.79	1912.4	1922.4	1910.9	1922.1	1916.9
20.68	1993.5	1999.1	1988.0	1999.7	1995.1
27.58	2074.4	2080.1	2071.3	2074.5	2075.0
34.5	2146.9	2145.5	2144.1	2142.3	2144.7
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8732	0.8732	0.8732	0.8732	0.8732
6.89	0.8775	0.8775	0.8774	0.8773	0.8774
13.79	0.8812	0.8817	0.8819	0.8820	0.8817
20.68	0.8861	0.8859	0.8862	0.8863	0.8861
27.58	0.8901	0.8897	0.8906	0.8910	0.8904
34.5	0.8940	0.8932	0.8955	0.8951	0.8945
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1336.3	1339.7	1336.8	1339.7	1338.1
6.89	1366.7	1370.2	1367.8	1370.4	1368.8
13.79	1395.6	1398.1	1397.9	1400.8	1398.1
20.68	1426.0	1427.4	1425.8	1429.0	1427.0
27.58	1452.5	1453.7	1454.5	1456.4	1454.3
34.5	1477.6	1477.6	1479.5	1479.5	1478.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1559.4	1567.2	1560.6	1567.2	1563.6
6.89	1639.1	1647.4	1641.6	1647.6	1643.9
13.79	1716.3	1723.4	1723.4	1730.7	1723.5
20.68	1801.8	1805.0	1801.5	1809.7	1804.5
27.58	1877.8	1880.3	1884.3	1889.9	1883.1
34.5	1951.8	1950.2	1960.3	1959.4	1955.4

Table C-5. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8588	0.8588	0.8588	0.8588	0.8588
6.89	0.8633	0.8636	0.8633	0.8637	0.8635
13.79	0.8678	0.8685	0.8679	0.8678	0.8680
20.68	0.8727	0.8730	0.8724	0.8729	0.8728
27.58	0.8771	0.8772	0.8770	0.8770	0.8771
34.5	0.8811	0.8809	0.8810	0.8807	0.8810
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1269.8	1270.6	1270.8	1272.5	1271.0
6.89	1301.1	1302.6	1301.6	1305.4	1302.6
13.79	1332.1	1336.3	1333.3	1336.8	1334.6
20.68	1362.5	1366.3	1363.4	1367.6	1365.0
27.58	1392.5	1394.3	1393.3	1394.8	1393.7
34.5	1419.8	1419.8	1421.2	1421.2	1420.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1384.9	1386.6	1386.9	1390.8	1387.3
6.89	1461.4	1465.2	1462.6	1471.8	1465.2
13.79	1539.8	1550.9	1543.0	1551.0	1546.2
20.68	1619.9	1629.7	1621.7	1632.7	1626.0
27.58	1700.9	1705.3	1702.5	1706.2	1703.7
34.5	1776.2	1775.8	1779.5	1778.8	1777.6
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8443	0.8443	0.8443	0.8443	0.8443
6.89	0.8497	0.8498	0.8490	0.8498	0.8496
13.79	0.8544	0.8546	0.8542	0.8540	0.8543
20.68	0.8595	0.8595	0.8588	0.8587	0.8591
27.58	0.8644	0.8639	0.8640	0.8639	0.8640
34.5	0.8688	0.8679	0.8695	0.8688	0.8687
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1202.1	1203.8	1205.5	1207.2	1204.7
6.89	1237.7	1239.5	1237.2	1241.3	1238.9
13.79	1270.8	1274.8	1270.6	1274.8	1272.7
20.68	1302.9	1305.7	1302.4	1305.7	1304.2
27.58	1333.3	1335.6	1334.7	1335.1	1334.7
34.5	1363.4	1363.4	1362.3	1362.5	1362.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1220.0	1223.4	1226.9	1230.4	1225.2
6.89	1301.5	1305.5	1299.6	1309.4	1304.0
13.79	1379.9	1388.7	1379.1	1387.7	1383.8
20.68	1459.0	1465.4	1456.8	1464.1	1461.3
27.58	1536.6	1541.0	1539.3	1539.8	1539.2
34.5	1614.9	1613.2	1613.6	1612.7	1613.6

Table C-5. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8310	0.8310	0.8310	0.8310	0.8310
6.89	0.8367	0.8365	0.8363	0.8367	0.8366
13.79	0.8422	0.8421	0.8421	0.8428	0.8423
20.68	0.8476	0.8476	0.8473	0.8474	0.8475
27.58	0.8534	0.8526	0.8526	0.8525	0.8527
34.5	0.8583	0.8575	0.8575	0.8569	0.8575
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1141.7	1144.4	1139.5	1143.1	1142.2
6.89	1177.7	1181.3	1174.3	1179.9	1178.3
13.79	1216.0	1216.8	1211.5	1215.3	1214.9
20.68	1250.9	1252.0	1244.6	1250.5	1249.5
27.58	1283.2	1284.3	1278.1	1279.9	1281.4
34.5	1313.8	1313.8	1309.4	1309.4	1311.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1083.1	1088.3	1079.0	1085.8	1084.1
6.89	1160.5	1167.3	1153.2	1164.9	1161.5
13.79	1245.4	1246.7	1236.0	1244.8	1243.2
20.68	1326.4	1328.7	1312.5	1325.1	1323.2
27.58	1405.0	1406.2	1392.8	1396.6	1400.1
34.5	1481.6	1480.2	1470.3	1469.3	1475.3

Table C-6. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Linseed

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8923	0.8923	0.8923	0.8923	0.8923
6.89	0.8965	0.8964	0.8975	0.8966	0.8967
13.79	0.9004	0.9004	0.9013	0.9005	0.9006
20.68	0.9042	0.9042	0.9053	0.9044	0.9045
27.58	0.9080	0.9078	0.9091	0.9079	0.9082
34.5	0.9118	0.9110	0.9127	0.9110	0.9116
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1415.8	1418.0	1414.5	1416.8	1416.3
6.89	1443.8	1447.1	1440.9	1446.3	1444.5
13.79	1470.5	1475.2	1468.2	1473.5	1471.9
20.68	1496.5	1502.5	1494.8	1499.6	1498.4
27.58	1523.0	1526.4	1521.0	1523.2	1523.4
34.5	1549.7	1549.7	1546.9	1546.9	1548.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1788.6	1794.1	1785.1	1791.1	1789.7
6.89	1868.8	1877.1	1863.4	1875.4	1871.2
13.79	1947.1	1959.5	1942.9	1955.3	1951.2
20.68	2025.1	2041.4	2022.7	2033.8	2030.7
27.58	2106.2	2115.1	2103.0	2106.4	2107.7
34.5	2189.9	2187.8	2184.0	2179.8	2185.4
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8788	0.8788	0.8788	0.8788	0.8788
6.89	0.8827	0.8833	0.8828	0.8833	0.8830
13.79	0.8869	0.8876	0.8868	0.8875	0.8872
20.68	0.8910	0.8917	0.8911	0.8917	0.8914
27.58	0.8950	0.8954	0.8953	0.8955	0.8953
34.5	0.8988	0.8989	0.8993	0.8991	0.8990
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1348.0	1344.8	1342.5	1342.7	1344.5
6.89	1377.4	1378.7	1370.2	1373.5	1375.0
13.79	1406.2	1408.6	1397.5	1401.6	1403.5
20.68	1433.8	1436.4	1427.4	1432.4	1432.5
27.58	1460.8	1462.3	1454.1	1457.7	1458.7
34.5	1486.2	1486.2	1481.3	1481.3	1483.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1597.0	1589.4	1583.9	1584.3	1588.7
6.89	1674.9	1679.2	1657.4	1666.3	1669.5
13.79	1753.9	1761.0	1732.1	1743.4	1747.6
20.68	1831.8	1839.9	1815.5	1829.7	1829.2
27.58	1909.9	1914.6	1893.1	1902.8	1905.1
34.5	1985.5	1985.6	1973.1	1972.7	1979.2

Table C-6. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8646	0.8646	0.8646	0.8646	0.8646
6.89	0.8689	0.8691	0.8692	0.8696	0.8692
13.79	0.8734	0.8741	0.8738	0.8744	0.8739
20.68	0.8779	0.8784	0.8785	0.8791	0.8785
27.58	0.8822	0.8824	0.8828	0.8831	0.8826
34.5	0.8864	0.8861	0.8869	0.8868	0.8865
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1276.1	1277.7	1275.7	1277.7	1276.8
6.89	1305.9	1308.8	1306.9	1309.3	1307.7
13.79	1337.2	1342.1	1338.8	1342.0	1340.0
20.68	1366.5	1370.6	1370.2	1373.0	1370.1
27.58	1395.6	1398.1	1398.5	1399.4	1397.9
34.5	1424.6	1424.6	1427.2	1427.2	1425.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1407.8	1411.4	1407.1	1411.4	1409.4
6.89	1481.8	1488.7	1484.6	1490.7	1486.5
13.79	1561.7	1574.5	1566.2	1574.7	1569.3
20.68	1639.4	1650.1	1649.4	1657.1	1649.0
27.58	1718.3	1724.8	1726.6	1729.4	1724.8
34.5	1798.8	1798.2	1806.5	1806.2	1802.4
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8503	0.8503	0.8503	0.8503	0.8503
6.89	0.8555	0.8554	0.8554	0.8558	0.8555
13.79	0.8604	0.8607	0.8605	0.8610	0.8607
20.68	0.8655	0.8654	0.8653	0.8657	0.8655
27.58	0.8702	0.8699	0.8702	0.8702	0.8701
34.5	0.8747	0.8743	0.8748	0.8743	0.8745
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1212.7	1214.9	1209.7	1212.7	1212.5
6.89	1246.6	1248.2	1243.7	1248.2	1246.7
13.79	1279.6	1282.7	1277.5	1282.0	1280.4
20.68	1312.0	1314.2	1308.9	1312.3	1311.9
27.58	1342.8	1343.6	1340.9	1342.3	1342.4
34.5	1372.8	1372.8	1369.8	1369.8	1371.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1250.4	1254.9	1244.2	1250.4	1250.0
6.89	1329.5	1332.6	1323.2	1333.3	1329.7
13.79	1408.8	1416.1	1404.3	1415.1	1411.1
20.68	1489.7	1494.7	1482.6	1490.9	1489.5
27.58	1569.1	1570.3	1564.6	1567.9	1568.0
34.5	1648.5	1647.6	1641.5	1640.6	1644.5



Table C-6. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8358	0.8358	0.8358	0.8358	0.8358
6.89	0.8413	0.8415	0.8410	0.8413	0.8413
13.79	0.8468	0.8469	0.8465	0.8470	0.8468
20.68	0.8521	0.8521	0.8517	0.8522	0.8520
27.58	0.8572	0.8571	0.8569	0.8572	0.8571
34.5	0.8619	0.8616	0.8621	0.8618	0.8618
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1149.2	1150.6	1148.9	1150.6	1149.8
6.89	1184.3	1187.3	1181.5	1184.3	1184.4
13.79	1220.3	1221.9	1217.1	1221.6	1220.2
20.68	1254.2	1255.4	1250.6	1253.7	1253.5
27.58	1287.2	1287.2	1284.0	1286.9	1286.3
34.5	1316.6	1316.6	1315.0	1315.0	1315.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1103.8	1106.6	1103.3	1106.6	1105.1
6.89	1180.0	1186.3	1174.0	1180.0	1180.1
13.79	1261.0	1264.5	1253.8	1264.0	1260.8
20.68	1340.4	1342.9	1332.1	1339.4	1338.7
27.58	1420.4	1420.1	1412.7	1419.6	1418.2
34.5	1494.0	1493.4	1490.8	1490.3	1492.1

Table C-7. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Oxidized Soy

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8818	0.8818	0.8818	0.8818	0.8818
6.89	0.8858	0.8860	0.8858	0.8859	0.8859
13.79	0.8896	0.8900	0.8898	0.8900	0.8899
20.68	0.8934	0.8939	0.8937	0.8937	0.8937
27.58	0.8972	0.8975	0.8974	0.8973	0.8973
34.5	0.9009	0.9006	0.9011	0.9006	0.9008
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1406.4	1407.8	1407.6	1409.5	1407.8
6.89	1434.2	1437.1	1436.2	1439.3	1436.7
13.79	1461.9	1464.8	1464.0	1467.4	1464.5
20.68	1488.2	1492.1	1490.2	1493.5	1491.0
27.58	1515.1	1516.6	1516.6	1518.5	1516.7
34.5	1539.4	1539.4	1542.0	1542.0	1540.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1744.3	1747.7	1747.2	1752.0	1747.8
6.89	1822.1	1829.6	1827.2	1835.3	1828.5
13.79	1901.2	1909.7	1907.1	1916.3	1908.6
20.68	1978.8	1990.2	1984.5	1993.4	1986.7
27.58	2059.3	2064.3	2064.2	2069.0	2064.2
34.5	2134.8	2134.3	2142.5	2141.4	2138.2
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8672	0.8672	0.8672	0.8672	0.8672
6.89	0.8715	0.8719	0.8715	0.8719	0.8717
13.79	0.8760	0.8763	0.8759	0.8763	0.8761
20.68	0.8802	0.8805	0.8800	0.8806	0.8803
27.58	0.8844	0.8843	0.8842	0.8846	0.8844
34.5	0.8882	0.8878	0.8883	0.8883	0.8881
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1334.6	1335.4	1335.1	1335.6	1335.2
6.89	1364.7	1367.4	1365.6	1368.2	1366.5
13.79	1395.2	1397.7	1396.0	1398.3	1396.8
20.68	1423.8	1425.2	1424.2	1427.8	1425.2
27.58	1451.4	1452.7	1453.1	1455.0	1453.0
34.5	1476.1	1476.1	1481.0	1481.0	1478.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1544.5	1546.6	1545.7	1547.0	1545.9
6.89	1623.1	1630.3	1625.2	1632.1	1627.7
13.79	1705.2	1712.0	1706.8	1713.4	1709.4
20.68	1784.2	1788.3	1784.9	1795.0	1788.1
27.58	1863.0	1866.1	1867.0	1872.6	1867.2
34.5	1935.2	1934.4	1948.6	1948.4	1941.7

Table C-7. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8531	0.8531	0.8531	0.8531	0.8531
6.89	0.8580	0.8583	0.8580	0.8578	0.8580
13.79	0.8614	0.8630	0.8625	0.8625	0.8623
20.68	0.8667	0.8675	0.8671	0.8670	0.8671
27.58	0.8718	0.8716	0.8715	0.8713	0.8715
34.5	0.8758	0.8756	0.8757	0.8751	0.8755
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1267.3	1267.9	1268.1	1270.0	1268.3
6.89	1300.2	1302.6	1301.6	1304.2	1302.1
13.79	1331.4	1334.6	1331.9	1335.3	1333.3
20.68	1362.5	1365.2	1363.4	1365.6	1364.2
27.58	1392.5	1393.1	1393.5	1394.3	1393.4
34.5	1420.0	1420.0	1420.8	1420.8	1420.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1370.2	1371.6	1371.9	1376.0	1372.4
6.89	1450.5	1456.2	1453.5	1459.2	1454.8
13.79	1526.9	1537.0	1530.1	1537.8	1533.0
20.68	1608.9	1616.8	1611.7	1616.8	1613.6
27.58	1690.5	1691.6	1692.3	1693.8	1692.1
34.5	1765.9	1765.4	1767.7	1766.5	1766.4
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8388	0.8388	0.8388	0.8388	0.8388
6.89	0.8441	0.8444	0.8440	0.8442	0.8442
13.79	0.8492	0.8497	0.8492	0.8495	0.8494
20.68	0.8542	0.8546	0.8541	0.8544	0.8543
27.58	0.8588	0.8591	0.8591	0.8590	0.8590
34.5	0.8633	0.8632	0.8636	0.8633	0.8633
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1202.9	1203.2	1203.1	1204.5	1203.4
6.89	1237.5	1240.2	1237.8	1240.5	1239.0
13.79	1272.2	1274.8	1272.5	1274.5	1273.5
20.68	1304.7	1306.4	1305.6	1307.6	1306.1
27.58	1335.4	1336.1	1336.8	1338.6	1336.8
34.5	1363.6	1363.6	1367.2	1367.2	1365.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1213.8	1214.4	1214.1	1217.0	1214.8
6.89	1292.6	1298.8	1293.2	1299.2	1296.0
13.79	1374.5	1380.8	1375.2	1379.8	1377.6
20.68	1454.1	1458.6	1455.9	1460.8	1457.4
27.58	1531.7	1533.7	1535.4	1539.2	1535.0
34.5	1605.2	1604.9	1614.4	1613.8	1609.6

Table C-7. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8231	0.8231	0.8231	0.8231	0.8231
6.89	0.8287	0.8293	0.8289	0.8292	0.8290
13.79	0.8348	0.8348	0.8346	0.8347	0.8347
20.68	0.8402	0.8401	0.8397	0.8399	0.8400
27.58	0.8456	0.8454	0.8450	0.8453	0.8453
34.5	0.8503	0.8491	0.8498	0.8494	0.8497
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1139.7	1141.4	1140.2	1140.9	1140.5
6.89	1176.9	1180.0	1178.2	1180.3	1178.9
13.79	1212.7	1216.0	1215.0	1218.2	1215.5
20.68	1248.5	1250.6	1249.1	1251.4	1249.9
27.58	1280.2	1282.8	1281.2	1283.3	1281.9
34.5	1311.3	1311.3	1312.5	1312.5	1311.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1069.0	1072.4	1070.0	1071.4	1070.7
6.89	1147.8	1154.7	1150.8	1155.1	1152.1
13.79	1227.7	1234.4	1232.1	1238.8	1233.2
20.68	1309.7	1314.0	1310.1	1315.2	1312.2
27.58	1385.9	1391.2	1387.1	1392.0	1389.1
34.5	1462.1	1460.1	1463.9	1463.3	1462.3

Table C-8. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Soy Ester.

<i>At 20 °C</i>									
<i>Density (gr/cm<sup>3</sup>)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	0.87730	0.87730	0.87730	0.87730	0.87730	0.87730	0.87730	0.87730	0.87730
6.89	0.88174	0.88161	0.88118	0.88224	0.88197	0.88175	0.88106	0.88191	0.88168
13.79	0.88562	0.88563	0.88503	0.88605	0.88583	0.88574	0.88493	0.88584	0.88558
20.68	0.88947	0.88955	0.88881	0.88981	0.88958	0.88949	0.88871	0.88934	0.88934
27.58	0.89340	0.89303	0.89252	0.89353	0.89337	0.89288	0.89236	0.89285	0.89299
34.5	0.89702	0.89618	0.89607	0.89658	0.89703	0.89597	0.89597	0.89597	0.89635
<i>Speed of Sound (m/s)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1407.20	1410.13	1410.13	1410.52	1408.18	1410.72	1410.72	1410.33	1409.74
6.89	1435.64	1439.71	1437.06	1440.52	1436.85	1440.93	1437.46	1441.34	1438.69
13.79	1462.29	1467.78	1464.40	1468.84	1463.56	1468.63	1462.92	1468.63	1465.88
20.68	1489.95	1495.44	1491.27	1495.22	1490.17	1495.88	1490.39	1494.56	1492.86
27.58	1517.78	1519.14	1517.55	1519.37	1516.19	1519.82	1517.55	1519.14	1518.32
34.5	1542.43	1542.43	1542.20	1542.20	1542.20	1542.20	1542.20	1542.20	1542.26
<i>Isentropic Bulk Modulus (MPa)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1737.25	1744.49	1744.49	1745.46	1739.65	1745.94	1745.94	1744.97	1743.52
6.89	1817.32	1827.36	1819.75	1830.74	1820.87	1830.76	1820.54	1832.14	1824.93
13.79	1893.73	1908.00	1897.91	1911.66	1897.43	1910.45	1893.88	1910.64	1902.96
20.68	1974.58	1989.34	1976.60	1989.32	1975.42	1990.36	1974.07	1986.51	1982.02
27.58	2058.08	2060.92	2055.45	2062.70	2053.70	2062.42	2055.07	2060.50	2058.61
34.5	2134.09	2132.10	2131.20	2132.39	2133.48	2130.96	2130.96	2130.96	2132.02
<i>At 40 °C</i>									
<i>Density (gr/cm<sup>3</sup>)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	0.8629	0.8629	0.8629	0.8629	0.8629	0.8629	0.8629	0.8629	0.8629
6.89	0.8671	0.8677	0.8672	0.8675	0.8670	0.8674	0.8670	0.8677	0.8673
13.79	0.8713	0.8720	0.8714	0.8719	0.8713	0.8719	0.8712	0.8720	0.8716
20.68	0.8755	0.8764	0.8755	0.8760	0.8754	0.8760	0.8751	0.8761	0.8757
27.58	0.8795	0.8801	0.8796	0.8797	0.8795	0.8798	0.8792	0.8798	0.8796
34.5	0.8834	0.8836	0.8835	0.8831	0.8833	0.8832	0.8831	0.8832	0.8833
<i>Speed of Sound (m/s)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1337.4	1337.2	1337.2	1338.3	1338.4	1338.8	1338.8	1339.0	1338.1
6.89	1366.7	1369.1	1366.3	1370.8	1367.2	1370.4	1367.2	1371.7	1368.7
13.79	1395.8	1399.3	1395.2	1400.2	1397.1	1400.0	1396.8	1401.2	1398.2
20.68	1425.2	1428.8	1423.6	1428.6	1424.6	1427.4	1425.6	1428.4	1426.5
27.58	1452.9	1453.7	1452.7	1453.3	1453.9	1454.1	1453.1	1455.0	1453.6
34.5	1478.9	1478.9	1478.7	1478.7	1479.3	1479.3	1479.5	1479.5	1479.1
<i>Isentropic Bulk Modulus (MPa)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1543.3	1542.9	1542.9	1545.3	1545.7	1546.5	1546.5	1546.9	1545.0
6.89	1619.6	1626.4	1619.0	1630.0	1620.7	1629.0	1620.7	1632.6	1624.8
13.79	1697.4	1707.3	1696.2	1709.4	1700.8	1709.0	1699.6	1712.1	1704.0
20.68	1778.3	1789.0	1774.2	1787.7	1776.6	1784.7	1778.5	1787.4	1782.0
27.58	1856.5	1859.9	1856.1	1858.0	1859.1	1860.4	1856.5	1862.4	1858.6
34.5	1932.0	1932.4	1931.7	1930.9	1932.9	1932.9	1933.2	1933.3	1932.4

Table C-8. Continued

<i>At 60 °C</i>									
<i>Density (gr/cm<sup>3</sup>)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	0.8489	0.8489	0.8489	0.8489	0.8489	0.8489	0.8489	0.8489	0.8489
6.89	0.8534	0.8539	0.8535	0.8540	0.8534	0.8543	0.8536	0.8539	0.8537
13.79	0.8581	0.8587	0.8581	0.8587	0.8579	0.8590	0.8580	0.8586	0.8584
20.68	0.8626	0.8634	0.8626	0.8633	0.8623	0.8634	0.8626	0.8628	0.8629
27.58	0.8662	0.8675	0.8673	0.8675	0.8667	0.8674	0.8668	0.8668	0.8670
34.5	0.8712	0.8713	0.8714	0.8712	0.8709	0.8710	0.8709	0.8704	0.8710
<i>Speed of Sound (m/s)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1268.1	1267.5	1267.5	1267.3	1268.4	1267.1	1267.1	1270.5	1267.9
6.89	1298.7	1300.6	1298.6	1302.2	1300.2	1302.9	1299.4	1303.9	1300.8
13.79	1330.4	1333.5	1330.2	1334.2	1330.0	1334.9	1330.2	1335.1	1332.3
20.68	1361.0	1364.9	1360.7	1365.0	1360.7	1365.2	1360.8	1364.7	1362.9
27.58	1390.1	1393.1	1391.4	1393.9	1389.3	1392.7	1390.1	1391.8	1391.5
34.5	1418.6	1418.6	1419.0	1419.0	1418.2	1418.2	1417.4	1417.4	1418.3
<i>Isentropic Bulk Modulus (MPa)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1365.0	1363.7	1363.7	1363.3	1365.7	1363.0	1363.0	1370.2	1364.7
6.89	1439.5	1444.3	1439.3	1448.2	1442.8	1450.1	1441.2	1451.8	1444.7
13.79	1518.7	1527.0	1518.3	1528.6	1517.6	1530.7	1518.2	1530.4	1523.7
20.68	1597.8	1608.3	1597.0	1608.6	1596.4	1609.3	1597.4	1606.9	1602.7
27.58	1673.8	1683.7	1679.0	1685.5	1672.8	1682.5	1675.0	1679.1	1678.9
34.5	1753.3	1753.5	1754.6	1754.2	1751.6	1751.8	1749.7	1748.7	1752.2
<i>At 80 °C</i>									
<i>Density (gr/cm<sup>3</sup>)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	0.8348	0.8348	0.8348	0.8348	0.8348	0.8348	0.8348	0.8348	0.8348
6.89	0.8398	0.8401	0.8395	0.8401	0.8400	0.8407	0.8399	0.8406	0.8401
13.79	0.8450	0.8452	0.8448	0.8453	0.8449	0.8456	0.8447	0.8458	0.8452
20.68	0.8499	0.8497	0.8496	0.8503	0.8497	0.8507	0.8497	0.8505	0.8500
27.58	0.8543	0.8547	0.8542	0.8546	0.8544	0.8550	0.8544	0.8549	0.8546
34.5	0.8588	0.8588	0.8587	0.8587	0.8589	0.8590	0.8588	0.8588	0.8588
<i>Speed of Sound (m/s)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1203.6	1203.6	1203.6	1203.9	1203.5	1202.4	1202.4	1202.7	1203.2
6.89	1236.6	1238.4	1236.3	1238.7	1239.0	1241.4	1238.1	1241.0	1238.7
13.79	1270.8	1272.7	1270.2	1273.3	1271.3	1274.6	1270.3	1275.4	1272.3
20.68	1303.7	1305.7	1302.7	1306.9	1303.7	1307.4	1302.6	1307.3	1305.0
27.58	1334.2	1335.6	1333.2	1334.9	1334.4	1337.4	1334.6	1336.8	1335.1
34.5	1363.2	1363.2	1362.7	1362.7	1364.3	1364.3	1363.2	1363.2	1363.3
<i>Isentropic Bulk Modulus (MPa)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1209.4	1209.4	1209.4	1210.0	1209.1	1206.9	1206.9	1207.4	1208.6
6.89	1284.2	1288.5	1283.2	1289.0	1289.6	1295.7	1287.5	1294.6	1289.0
13.79	1364.6	1369.1	1362.9	1370.6	1365.4	1373.8	1363.2	1375.9	1368.2
20.68	1444.6	1448.7	1441.9	1452.4	1444.3	1454.1	1441.6	1453.5	1447.6
27.58	1520.8	1524.7	1518.2	1523.0	1521.4	1529.2	1521.8	1527.9	1523.4
34.5	1596.0	1595.9	1594.4	1594.4	1598.8	1598.9	1595.9	1595.9	1596.3

Table C-8. Continued

<i>At 100 °C</i>									
<i>Density (gr/cm<sup>3</sup>)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	0.8206	0.8206	0.8206	0.8206	0.8206	0.8206	0.8206	0.8206	0.8206
6.89	0.8262	0.8269	0.8264	0.8265	0.8262	0.8261	0.8265	0.8273	0.8265
13.79	0.8314	0.8326	0.8325	0.8327	0.8319	0.8331	0.8320	0.8327	0.8324
20.68	0.8367	0.8377	0.8375	0.8379	0.8372	0.8375	0.8378	0.8380	0.8375
27.58	0.8418	0.8433	0.8427	0.8429	0.8424	0.8427	0.8429	0.8433	0.8427
34.5	0.8471	0.8479	0.8478	0.8473	0.8476	0.8477	0.8476	0.8474	0.8475
<i>Speed of Sound (m/s)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1142.9	1137.5	1137.5	1141.6	1139.9	1141.1	1141.1	1143.5	1140.6
6.89	1176.6	1178.2	1174.8	1178.0	1176.3	1174.7	1177.6	1181.9	1177.3
13.79	1214.6	1215.2	1214.3	1217.5	1212.3	1213.9	1213.4	1217.2	1214.8
20.68	1246.0	1248.2	1246.9	1249.5	1246.3	1247.7	1249.7	1251.7	1248.3
27.58	1279.0	1282.5	1279.0	1283.3	1280.7	1281.9	1282.5	1285.8	1281.8
34.5	1312.2	1312.2	1312.2	1312.2	1311.3	1311.3	1313.3	1313.3	1312.2
<i>Isentropic Bulk Modulus (MPa)</i>									
Pressure M(Pa)	I	II	III	IV	V	VI	VII	VIII	Average
0	1071.8	1061.7	1061.7	1069.4	1066.3	1068.4	1068.4	1073.0	1067.6
6.89	1143.7	1148.0	1140.7	1146.9	1143.3	1140.0	1146.1	1155.8	1145.6
13.79	1226.5	1229.4	1227.5	1234.3	1222.5	1227.5	1225.0	1233.8	1228.3
20.68	1299.1	1305.1	1302.1	1308.3	1300.4	1303.7	1308.4	1312.9	1305.0
27.58	1376.9	1387.0	1378.4	1388.1	1381.8	1384.7	1386.3	1394.1	1384.7
34.5	1458.5	1459.8	1459.7	1458.8	1457.4	1457.6	1462.0	1461.7	1459.4

Table C-9. Raw density, speed of sound and isentropic bulk modulus data for Ethyl Stearate

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8483	0.8483	0.8483	0.8483	0.8483
6.89	0.8528	0.8533	0.8533	0.8535	0.8532
13.79	0.8574	0.8578	0.8577	0.8579	0.8577
20.68	0.8618	0.8621	0.8619	0.8622	0.8620
27.58	0.8661	0.8662	0.8660	0.8660	0.8661
34.5	0.8700	0.8697	0.8701	0.8695	0.8698
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1313.5	1315.6	1314.4	1317.8	1315.3
6.89	1344.3	1348.2	1349.8	1352.0	1348.6
13.79	1376.3	1379.3	1379.9	1383.4	1379.7
20.68	1406.6	1409.3	1409.7	1412.9	1409.6
27.58	1435.0	1436.4	1438.3	1438.9	1437.2
34.5	1462.3	1462.3	1464.4	1464.4	1463.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1463.5	1468.1	1465.4	1473.0	1467.5
6.89	1541.2	1551.1	1554.7	1560.0	1551.7
13.79	1624.1	1632.0	1633.1	1642.0	1632.8
20.68	1705.1	1712.4	1712.9	1721.1	1712.9
27.58	1783.5	1787.2	1791.4	1793.0	1788.8
34.5	1860.2	1859.7	1865.8	1864.7	1862.6
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8346	0.8346	0.8346	0.8346	0.8346
6.89	0.8393	0.8397	0.8397	0.8396	0.8396
13.79	0.8441	0.8446	0.8445	0.8444	0.8444
20.68	0.8489	0.8491	0.8497	0.8491	0.8492
27.58	0.8534	0.8534	0.8536	0.8534	0.8534
34.5	0.8581	0.8575	0.8581	0.8572	0.8577
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1248.5	1249.7	1249.4	1252.6	1250.0
6.89	1280.9	1283.5	1282.3	1286.7	1283.4
13.79	1313.0	1317.1	1315.0	1319.1	1316.1
20.68	1344.6	1347.8	1347.1	1350.3	1347.5
27.58	1374.5	1376.7	1377.1	1380.1	1377.1
34.5	1405.3	1405.3	1407.0	1407.0	1406.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1300.8	1303.4	1302.7	1309.5	1304.1
6.89	1377.0	1383.2	1380.8	1390.1	1382.8
13.79	1455.2	1465.1	1460.4	1469.3	1462.5
20.68	1534.8	1542.4	1541.9	1548.3	1541.9
27.58	1612.2	1617.4	1618.7	1625.3	1618.4
34.5	1694.6	1693.4	1698.7	1697.0	1695.9



Table C-9. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8197	0.8197	0.8197	0.8197	0.8197
6.89	0.8258	0.8266	0.8256	0.8255	0.8259
13.79	0.8315	0.8322	0.8307	0.8310	0.8314
20.68	0.8370	0.8376	0.8360	0.8363	0.8367
27.58	0.8424	0.8428	0.8411	0.8408	0.8418
34.5	0.8497	0.8495	0.8484	0.8480	0.8489
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1177.8	1178.7	1182.1	1183.0	1180.4
6.89	1214.7	1218.2	1221.2	1223.1	1219.3
13.79	1250.6	1253.5	1255.9	1258.4	1254.6
20.68	1284.1	1286.4	1290.2	1293.4	1288.5
27.58	1317.1	1319.5	1322.9	1323.4	1320.7
34.5	1349.3	1349.3	1352.1	1352.1	1350.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1137.2	1138.8	1145.4	1147.3	1142.1
6.89	1218.5	1226.7	1231.1	1234.9	1227.8
13.79	1300.5	1307.7	1310.3	1315.9	1308.6
20.68	1380.2	1386.1	1391.5	1399.1	1389.2
27.58	1461.3	1467.3	1472.0	1472.6	1468.3
34.5	1546.8	1546.5	1551.2	1550.4	1548.7
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8070	0.8070	0.8070	0.8070	0.8070
6.89	0.8128	0.8140	0.8129	0.8129	0.8131
13.79	0.8187	0.8197	0.8189	0.8185	0.8190
20.68	0.8239	0.8251	0.8243	0.8241	0.8244
27.58	0.8299	0.8299	0.8293	0.8293	0.8296
34.5	0.8355	0.8358	0.8347	0.8340	0.8350
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1128.8	1130.1	1122.4	1125.1	1126.6
6.89	1168.4	1171.0	1161.8	1164.6	1166.5
13.79	1204.8	1208.8	1200.9	1203.1	1204.4
20.68	1238.6	1243.3	1233.2	1235.7	1237.7
27.58	1273.3	1274.8	1267.9	1269.7	1271.4
34.5	1305.2	1305.2	1299.9	1299.9	1302.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1028.2	1030.7	1016.6	1021.6	1024.2
6.89	1109.6	1116.2	1097.2	1102.5	1106.4
13.79	1188.4	1197.7	1181.1	1184.7	1188.0
20.68	1264.0	1275.3	1253.5	1258.4	1262.8
27.58	1345.6	1348.6	1333.2	1336.9	1341.1
34.5	1423.4	1424.0	1410.4	1409.3	1416.8

Table C-10. Raw density, speed of sound and isentropic bulk modulus data for Methyl Canola

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8796	0.8796	0.8796	0.8796	0.8796
6.89	0.8836	0.8837	0.8840	0.8837	0.8838
13.79	0.8875	0.8878	0.8880	0.8875	0.8877
20.68	0.8914	0.8915	0.8919	0.8912	0.8915
27.58	0.8952	0.8951	0.8959	0.8947	0.8952
34.5	0.8986	0.8983	0.8993	0.8980	0.8986
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1413.1	1415.0	1414.1	1418.4	1415.1
6.89	1440.7	1444.0	1440.9	1446.5	1443.0
13.79	1468.4	1472.0	1469.3	1473.3	1470.8
20.68	1496.1	1498.5	1497.6	1499.4	1497.9
27.58	1522.6	1523.9	1524.2	1524.2	1523.7
34.5	1547.1	1547.1	1548.1	1548.1	1547.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1756.3	1761.2	1758.7	1769.5	1761.4
6.89	1834.0	1842.7	1835.5	1848.9	1840.3
13.79	1913.6	1923.9	1917.0	1926.4	1920.2
20.68	1995.1	2002.0	2000.6	2003.6	2000.3
27.58	2075.2	2078.8	2081.2	2078.5	2078.4
34.5	2150.9	2150.1	2155.3	2152.2	2152.1
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8656	0.8656	0.8656	0.8656	0.8656
6.89	0.8699	0.8702	0.8696	0.8700	0.8699
13.79	0.8741	0.8747	0.8737	0.8744	0.8742
20.68	0.8785	0.8788	0.8778	0.8784	0.8783
27.58	0.8825	0.8826	0.8818	0.8819	0.8822
34.5	0.8866	0.8862	0.8855	0.8855	0.8860
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1341.1	1342.1	1344.8	1345.5	1343.4
6.89	1371.1	1373.7	1373.5	1375.9	1373.6
13.79	1399.8	1405.3	1403.3	1406.4	1403.7
20.68	1430.2	1433.2	1431.0	1432.4	1431.7
27.58	1457.7	1460.2	1457.9	1460.2	1459.0
34.5	1484.3	1484.3	1484.3	1484.3	1484.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1556.7	1559.2	1565.4	1567.0	1562.1
6.89	1635.4	1642.1	1640.6	1647.1	1641.3
13.79	1712.9	1727.3	1720.5	1729.6	1722.6
20.68	1796.8	1805.1	1797.4	1802.2	1800.4
27.58	1875.2	1881.9	1874.1	1880.4	1877.9
34.5	1953.3	1952.4	1950.9	1951.0	1951.9

Table C-10. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8499	0.8499	0.8499	0.8499	0.8499
6.89	0.8546	0.8549	0.8548	0.8548	0.8548
13.79	0.8593	0.8596	0.8594	0.8596	0.8595
20.68	0.8638	0.8640	0.8639	0.8641	0.8640
27.58	0.8681	0.8683	0.8682	0.8681	0.8682
34.5	0.8723	0.8722	0.8723	0.8718	0.8721
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1274.1	1275.3	1273.8	1276.5	1274.9
6.89	1308.3	1308.4	1305.1	1308.3	1307.5
13.79	1338.4	1341.1	1338.8	1342.7	1340.2
20.68	1368.5	1370.8	1368.5	1372.4	1370.1
27.58	1397.3	1399.1	1397.7	1399.6	1398.4
34.5	1425.6	1425.6	1426.4	1426.4	1426.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1379.8	1382.2	1379.1	1385.0	1381.5
6.89	1462.6	1463.6	1455.9	1463.1	1461.3
13.79	1539.4	1546.0	1540.3	1549.6	1543.8
20.68	1617.8	1623.5	1618.0	1627.5	1621.7
27.58	1695.1	1699.6	1696.0	1700.6	1697.8
34.5	1772.8	1772.4	1774.7	1773.7	1773.4
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8356	0.8356	0.8356	0.8356	0.8356
6.89	0.8408	0.8411	0.8407	0.8413	0.8410
13.79	0.8459	0.8463	0.8457	0.8464	0.8461
20.68	0.8509	0.8512	0.8505	0.8509	0.8509
27.58	0.8555	0.8556	0.8552	0.8557	0.8555
34.5	0.8601	0.8599	0.8598	0.8599	0.8599
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1207.5	1209.1	1211.4	1210.2	1209.6
6.89	1242.2	1244.9	1246.3	1248.6	1245.5
13.79	1275.6	1279.1	1279.0	1282.8	1279.1
20.68	1308.9	1310.3	1311.0	1312.3	1310.6
27.58	1338.8	1340.5	1341.8	1344.3	1341.3
34.5	1368.7	1368.7	1371.1	1371.1	1369.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1218.4	1221.6	1226.3	1223.9	1222.6
6.89	1297.5	1303.6	1305.8	1311.6	1304.6
13.79	1376.4	1384.7	1383.3	1392.9	1384.3
20.68	1457.8	1461.3	1461.7	1465.4	1461.6
27.58	1533.4	1537.6	1539.7	1546.4	1539.3
34.5	1611.4	1611.0	1616.4	1616.5	1613.8

Table C-10. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8206	0.8206	0.8206	0.8206	0.8206
6.89	0.8262	0.8266	0.8262	0.8265	0.8264
13.79	0.8318	0.8323	0.8317	0.8322	0.8320
20.68	0.8369	0.8375	0.8372	0.8374	0.8373
27.58	0.8421	0.8424	0.8423	0.8424	0.8423
34.5	0.8471	0.8469	0.8470	0.8468	0.8469
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1145.0	1146.5	1145.8	1148.3	1146.4
6.89	1182.1	1185.4	1182.9	1185.8	1184.0
13.79	1219.0	1221.2	1218.8	1222.3	1220.3
20.68	1251.7	1254.8	1253.9	1256.3	1254.2
27.58	1284.5	1286.4	1287.2	1288.2	1286.6
34.5	1317.4	1317.4	1318.1	1318.1	1317.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1075.9	1078.6	1077.3	1082.0	1078.4
6.89	1154.5	1161.6	1156.0	1162.1	1158.6
13.79	1236.0	1241.1	1235.4	1243.3	1239.0
20.68	1311.3	1318.6	1316.2	1321.8	1316.9
27.58	1389.4	1394.0	1395.5	1397.8	1394.2
34.5	1470.2	1469.9	1471.5	1471.2	1470.7

Table C-11. Raw density, speed of sound and isentropic bulk modulus data for Methyl Hydrogenated Soy.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
v0	0.8528	0.8528	0.8528	0.8528	0.8528
6.89	0.8578	0.8580	0.8576	0.8575	0.8577
13.79	0.8624	0.8625	0.8619	0.8620	0.8622
20.68	0.8667	0.8668	0.8655	0.8656	0.8661
27.58	0.8709	0.8710	0.8698	0.8698	0.8704
34.5	0.8746	0.8740	0.8732	0.8725	0.8736
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1332.8	1335.1	1331.8	1333.3	1333.2
6.89	1365.4	1371.1	1364.3	1369.8	1367.7
13.79	1397.7	1401.4	1395.4	1399.4	1398.5
20.68	1428.0	1432.2	1422.2	1425.4	1426.9
27.58	1457.0	1461.2	1452.5	1455.6	1456.6
34.5	1483.6	1483.6	1476.7	1476.7	1480.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1514.9	1520.0	1512.5	1516.1	1515.9
6.89	1599.2	1613.1	1596.3	1609.0	1604.4
13.79	1684.7	1693.9	1678.2	1688.2	1686.3
20.68	1767.3	1777.9	1750.5	1758.6	1763.6
27.58	1848.9	1859.7	1834.9	1842.9	1846.6
34.5	1925.3	1923.8	1904.3	1902.8	1914.0
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8423	0.8423	0.8423	0.8423	0.8423
6.89	0.8470	0.8474	0.8469	0.8466	0.8470
13.79	0.8518	0.8522	0.8513	0.8516	0.8517
20.68	0.8561	0.8563	0.8559	0.8562	0.8561
27.58	0.8606	0.8604	0.8605	0.8601	0.8604
34.5	0.8646	0.8640	0.8645	0.8637	0.8642
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1263.4	1266.7	1265.6	1269.2	1266.2
6.89	1295.6	1300.6	1299.1	1302.2	1299.4
13.79	1328.5	1333.3	1328.6	1333.9	1331.1
20.68	1358.5	1362.7	1361.0	1365.6	1361.9
27.58	1388.5	1390.6	1391.0	1392.5	1390.7
34.5	1416.2	1416.2	1418.8	1418.8	1417.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1344.4	1351.4	1349.1	1356.8	1350.4
6.89	1421.7	1433.3	1429.2	1435.7	1430.0
13.79	1503.2	1514.9	1502.8	1515.2	1509.0
20.68	1579.9	1590.0	1585.5	1596.7	1588.0
27.58	1659.3	1663.9	1665.0	1668.0	1664.0
34.5	1734.2	1733.0	1740.3	1738.6	1736.5

Table C-11. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8286	0.8286	0.8286	0.8286	0.8286
6.89	0.8339	0.8342	0.8337	0.8340	0.8339
13.79	0.8390	0.8394	0.8383	0.8383	0.8388
20.68	0.8440	0.8446	0.8435	0.8434	0.8439
27.58	0.8487	0.8490	0.8490	0.8488	0.8489
34.5	0.8533	0.8528	0.8528	0.8520	0.8527
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1198.0	1200.1	1199.4	1201.7	1199.8
6.89	1233.3	1237.2	1234.8	1239.0	1236.1
13.79	1267.8	1271.6	1267.0	1271.6	1269.5
20.68	1300.6	1306.6	1300.2	1303.9	1302.8
27.58	1331.9	1334.2	1332.3	1333.7	1333.0
34.5	1362.8	1362.8	1362.3	1362.3	1362.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1189.2	1193.4	1192.0	1196.5	1192.8
6.89	1268.3	1276.8	1271.2	1280.4	1274.2
13.79	1348.6	1357.3	1345.7	1355.5	1351.8
20.68	1427.6	1441.9	1426.1	1433.9	1432.4
27.58	1505.7	1511.3	1506.9	1509.7	1508.4
34.5	1584.8	1584.0	1582.6	1581.1	1583.1
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8154	0.8154	0.8154	0.8154	0.8154
6.89	0.8216	0.8219	0.8213	0.8215	0.8216
13.79	0.8273	0.8271	0.8270	0.8271	0.8271
20.68	0.8325	0.8322	0.8322	0.8324	0.8323
27.58	0.8375	0.8365	0.8371	0.8370	0.8370
34.5	0.8422	0.8413	0.8412	0.8406	0.8413
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1136.0	1138.6	1134.7	1136.5	1136.4
6.89	1174.7	1178.7	1172.7	1175.9	1175.5
13.79	1212.0	1216.5	1208.5	1212.4	1212.3
20.68	1246.5	1248.5	1244.0	1246.9	1246.5
27.58	1278.0	1276.4	1275.3	1278.0	1276.9
34.5	1296.1	1296.1	1301.2	1301.2	1298.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1052.2	1057.2	1049.9	1053.2	1053.1
6.89	1133.8	1141.8	1129.5	1135.9	1135.2
13.79	1215.1	1224.0	1207.8	1215.7	1215.7
20.68	1293.4	1297.1	1287.9	1294.2	1293.2
27.58	1367.8	1362.8	1361.3	1367.1	1364.7
34.5	1414.8	1413.2	1424.3	1423.4	1418.9

Table C-12. Raw density, speed of sound and isentropic bulk modulus data for Methyl Lard

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8746	0.8746	0.8746	0.8746	0.8746
6.89	0.8785	0.8787	0.8786	0.8789	0.8787
13.79	0.8825	0.8830	0.8825	0.8828	0.8827
20.68	0.8862	0.8868	0.8863	0.8867	0.8865
27.58	0.8899	0.8902	0.8902	0.8901	0.8901
34.5	0.8937	0.8935	0.8938	0.8932	0.8935
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1406.6	1408.2	1406.0	1409.0	1407.4
6.89	1433.6	1436.2	1434.0	1438.1	1435.5
13.79	1462.1	1466.9	1461.9	1466.1	1464.2
20.68	1488.2	1493.0	1488.0	1494.1	1490.8
27.58	1516.2	1517.8	1516.2	1517.8	1517.0
34.5	1541.3	1541.3	1540.8	1540.8	1541.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1730.5	1734.4	1729.1	1736.3	1732.6
6.89	1805.6	1812.6	1806.9	1817.5	1810.6
13.79	1886.5	1900.2	1885.9	1897.5	1892.5
20.68	1962.8	1976.7	1962.4	1979.4	1970.3
27.58	2045.8	2050.8	2046.3	2050.6	2048.4
34.5	2123.0	2122.4	2121.9	2120.5	2122.0
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8599	0.8599	0.8599	0.8599	0.8599
6.89	0.8638	0.8642	0.8642	0.8646	0.8642
13.79	0.8681	0.8686	0.8684	0.8689	0.8685
20.68	0.8723	0.8724	0.8730	0.8730	0.8727
27.58	0.8763	0.8764	0.8769	0.8769	0.8766
34.5	0.8802	0.8800	0.8808	0.8805	0.8804
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1333.9	1335.3	1333.0	1334.7	1334.2
6.89	1361.9	1364.5	1362.8	1366.3	1363.9
13.79	1391.2	1395.4	1391.8	1396.2	1393.6
20.68	1420.6	1422.0	1422.8	1424.6	1422.5
27.58	1448.3	1449.2	1449.8	1452.7	1450.0
34.5	1476.1	1476.1	1476.3	1476.3	1476.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1530.0	1533.2	1528.0	1532.0	1530.8
6.89	1602.3	1608.9	1605.1	1614.0	1607.6
13.79	1680.2	1691.4	1682.1	1693.8	1686.9
20.68	1760.3	1764.1	1767.3	1771.7	1765.8
27.58	1838.2	1840.5	1843.1	1850.6	1843.1
34.5	1917.8	1917.3	1919.8	1919.0	1918.5

Table 12. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8455	0.8455	0.8455	0.8455	0.8455
6.89	0.8502	0.8504	0.8501	0.8506	0.8503
13.79	0.8547	0.8550	0.8553	0.8554	0.8551
20.68	0.8593	0.8595	0.8597	0.8599	0.8596
27.58	0.8637	0.8637	0.8637	0.8642	0.8638
34.5	0.8681	0.8676	0.8681	0.8680	0.8679
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1265.7	1268.3	1264.9	1266.0	1266.2
6.89	1298.2	1301.6	1296.9	1300.1	1299.2
13.79	1329.7	1333.3	1331.1	1333.0	1331.8
20.68	1360.5	1364.5	1361.0	1363.2	1362.3
27.58	1390.6	1392.2	1389.3	1391.6	1390.9
34.5	1418.8	1418.8	1418.2	1418.2	1418.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1354.5	1359.9	1352.8	1355.2	1355.6
6.89	1432.9	1440.6	1429.8	1437.7	1435.3
13.79	1511.2	1520.1	1515.3	1519.9	1516.6
20.68	1590.5	1600.3	1592.4	1598.0	1595.3
27.58	1670.3	1673.9	1667.1	1673.5	1671.2
34.5	1747.4	1746.4	1745.9	1745.7	1746.4
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8311	0.8311	0.8311	0.8311	0.8311
6.89	0.8366	0.8370	0.8361	0.8368	0.8366
13.79	0.8417	0.8419	0.8412	0.8418	0.8416
20.68	0.8465	0.8468	0.8461	0.8470	0.8466
27.58	0.8512	0.8512	0.8509	0.8514	0.8512
34.5	0.8555	0.8551	0.8554	0.8556	0.8554
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1199.4	1200.2	1200.2	1199.2	1199.8
6.89	1236.3	1239.0	1233.9	1235.3	1236.1
13.79	1270.2	1272.9	1267.5	1269.5	1270.0
20.68	1302.7	1305.4	1299.2	1303.4	1302.7
27.58	1333.3	1334.4	1331.2	1332.8	1332.9
34.5	1362.3	1362.3	1360.8	1360.8	1361.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1195.5	1197.2	1197.2	1195.2	1196.3
6.89	1278.7	1285.0	1273.0	1276.8	1278.4
13.79	1357.8	1364.0	1351.4	1356.7	1357.5
20.68	1436.7	1443.1	1428.2	1439.0	1436.7
27.58	1513.2	1515.6	1507.9	1512.5	1512.3
34.5	1587.7	1586.9	1584.0	1584.5	1585.8



Table C-12. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8174	0.8174	0.8174	0.8174	0.8174
6.89	0.8234	0.8230	0.8231	0.8234	0.8232
13.79	0.8288	0.8286	0.8289	0.8289	0.8288
20.68	0.8338	0.8342	0.8342	0.8342	0.8341
27.58	0.8390	0.8391	0.8394	0.8390	0.8391
34.5	0.8439	0.8436	0.8435	0.8433	0.8436
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1137.1	1138.2	1137.1	1138.5	1137.7
6.89	1175.1	1175.7	1175.0	1177.3	1175.8
13.79	1210.8	1211.4	1212.0	1212.4	1211.7
20.68	1243.9	1247.4	1246.5	1247.4	1246.3
27.58	1277.5	1279.1	1276.7	1278.0	1277.8
34.5	1308.9	1308.9	1306.6	1306.6	1307.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1056.9	1059.0	1056.9	1059.5	1058.1
6.89	1137.0	1137.6	1136.4	1141.3	1138.0
13.79	1215.0	1215.9	1217.6	1218.4	1216.7
20.68	1290.1	1298.1	1296.1	1298.0	1295.6
27.58	1369.3	1372.8	1368.2	1370.3	1370.2
34.5	1445.8	1445.3	1440.1	1439.7	1442.7

Table C-13. Raw density, speed of sound and isentropic bulk modulus data for Methyl Laurate.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8684	0.8684	0.8684	0.8684	0.8684
6.89	0.8726	0.8730	0.8727	0.8731	0.8728
13.79	0.8768	0.8774	0.8769	0.8772	0.8771
20.68	0.8808	0.8815	0.8813	0.8814	0.8812
27.58	0.8847	0.8852	0.8851	0.8851	0.8850
34.5	0.8888	0.8885	0.8892	0.8886	0.8888
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1358.1	1360.1	1357.7	1361.0	1359.2
6.89	1387.4	1390.6	1387.6	1391.2	1389.2
13.79	1416.6	1422.0	1415.0	1419.8	1418.4
20.68	1443.8	1448.9	1444.4	1448.3	1446.4
27.58	1471.2	1474.6	1470.5	1474.4	1472.7
34.5	1498.5	1498.5	1497.9	1497.9	1498.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1601.7	1606.5	1600.9	1608.6	1604.4
6.89	1679.7	1688.2	1680.3	1689.9	1684.5
13.79	1759.7	1774.2	1755.9	1768.3	1764.5
20.68	1836.1	1850.6	1838.7	1848.8	1843.6
27.58	1914.8	1924.9	1914.0	1924.1	1919.5
34.5	1995.9	1995.3	1995.1	1993.6	1994.9
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8530	0.8530	0.8530	0.8530	0.8530
6.89	0.8576	0.8581	0.8575	0.8581	0.8578
13.79	0.8622	0.8626	0.8618	0.8627	0.8623
20.68	0.8666	0.8672	0.8662	0.8674	0.8668
27.58	0.8711	0.8712	0.8709	0.8714	0.8711
34.5	0.8751	0.8747	0.8748	0.8750	0.8749
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1283.5	1285.4	1286.4	1285.8	1285.3
6.89	1314.9	1318.8	1317.8	1319.1	1317.6
13.79	1346.4	1350.7	1346.9	1349.8	1348.5
20.68	1375.6	1381.2	1376.7	1381.2	1378.7
27.58	1405.8	1408.0	1406.2	1408.6	1407.2
34.5	1432.6	1432.6	1433.8	1433.8	1433.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1405.1	1409.4	1411.5	1410.1	1409.0
6.89	1482.7	1492.4	1489.0	1493.2	1489.3
13.79	1563.1	1573.8	1563.5	1571.8	1568.0
20.68	1639.9	1654.3	1641.6	1654.7	1647.6
27.58	1721.7	1727.0	1722.1	1728.9	1724.9
34.5	1796.1	1795.3	1798.4	1798.8	1797.2

Table C-13. Continued.

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8374	0.8374	0.8374	0.8374	0.8374
6.89	0.8426	0.8428	0.8428	0.8432	0.8428
13.79	0.8478	0.8479	0.8481	0.8486	0.8481
20.68	0.8526	0.8528	0.8528	0.8535	0.8529
27.58	0.8576	0.8573	0.8576	0.8579	0.8576
34.5	0.8620	0.8613	0.8623	0.8621	0.8619
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1211.3	1213.0	1211.8	1211.7	1211.9
6.89	1245.6	1249.7	1247.1	1249.8	1248.0
13.79	1279.3	1283.3	1281.4	1285.1	1282.3
20.68	1311.5	1315.2	1312.5	1317.4	1314.2
27.58	1343.2	1345.0	1344.4	1346.4	1344.8
34.5	1372.2	1372.2	1373.9	1373.9	1373.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1228.6	1232.1	1229.8	1229.5	1230.0
6.89	1307.2	1316.2	1310.7	1317.2	1312.8
13.79	1387.4	1396.4	1392.5	1401.5	1394.4
20.68	1466.5	1475.2	1469.1	1481.4	1473.0
27.58	1547.2	1550.8	1550.2	1555.3	1550.9
34.5	1623.1	1621.9	1627.6	1627.4	1625.0
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8223	0.8223	0.8223	0.8223	0.8223
6.89	0.8281	0.8283	0.8286	0.8292	0.8285
13.79	0.8336	0.8342	0.8342	0.8348	0.8342
20.68	0.8390	0.8394	0.8394	0.8400	0.8395
27.58	0.8442	0.8444	0.8447	0.8451	0.8446
34.5	0.8489	0.8486	0.8497	0.8494	0.8492
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1144.3	1146.0	1144.5	1142.7	1144.4
6.89	1179.7	1184.1	1185.3	1189.7	1184.7
13.79	1218.1	1221.6	1221.3	1225.6	1221.6
20.68	1250.8	1256.3	1254.6	1258.4	1255.0
27.58	1284.5	1287.7	1287.4	1290.3	1287.5
34.5	1314.2	1314.2	1319.0	1319.0	1316.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1076.7	1079.9	1077.2	1073.8	1076.9
6.89	1152.5	1161.4	1164.0	1173.7	1162.9
13.79	1236.9	1244.9	1244.3	1253.9	1245.0
20.68	1312.6	1324.9	1321.4	1330.2	1322.2
27.58	1392.8	1400.2	1399.9	1407.0	1400.0
34.5	1466.1	1465.6	1478.2	1477.7	1471.9

Table C-13. Continued.

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8069	0.8069	0.8069	0.8069	0.8069
6.89	0.8133	0.8143	0.8136	0.8142	0.8138
13.79	0.8196	0.8208	0.8197	0.8203	0.8201
20.68	0.8256	0.8270	0.8259	0.8263	0.8262
27.58	0.8312	0.8320	0.8313	0.8314	0.8315
34.5	0.8364	0.8366	0.8366	0.8363	0.8365
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1079.7	1081.3	1077.8	1079.7	1079.6
6.89	1119.1	1123.0	1119.4	1123.1	1121.2
13.79	1158.5	1163.3	1157.4	1160.7	1160.0
20.68	1195.7	1199.1	1195.3	1198.0	1197.0
27.58	1230.2	1233.0	1228.8	1229.4	1230.4
34.5	1263.2	1263.2	1260.7	1260.7	1262.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	940.7	943.5	937.3	940.7	940.6
6.89	1018.5	1027.0	1019.5	1027.1	1023.0
13.79	1100.0	1110.8	1098.1	1105.2	1103.5
20.68	1180.4	1189.1	1180.0	1185.9	1183.8
27.58	1257.8	1264.9	1255.3	1256.7	1258.7
34.5	1334.7	1335.0	1329.7	1329.2	1332.1

Table C-14. Raw density, speed of sound and isentropic bulk modulus data for Methyl Linoleate.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8904	0.8904	0.8904	0.8904	0.8904
6.89	0.8949	0.8948	0.8945	0.8947	0.8947
13.79	0.8987	0.8991	0.8987	0.8986	0.8988
20.68	0.9026	0.9028	0.9026	0.9024	0.9026
27.58	0.9063	0.9062	0.9061	0.9059	0.9061
34.5	0.9100	0.9094	0.9098	0.9092	0.9096
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1417.4	1418.0	1419.0	1420.2	1418.6
6.89	1445.2	1447.9	1444.8	1448.5	1446.6
13.79	1472.7	1478.0	1473.7	1475.5	1475.0
20.68	1499.2	1503.0	1499.0	1501.6	1500.7
27.58	1525.5	1527.4	1524.4	1526.4	1525.9
34.5	1550.7	1550.7	1548.3	1548.3	1549.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1788.9	1790.4	1792.9	1795.9	1792.0
6.89	1869.1	1876.0	1867.3	1877.3	1872.4
13.79	1949.2	1964.1	1951.9	1956.1	1955.3
20.68	2028.7	2039.2	2028.0	2034.8	2032.7
27.58	2109.2	2113.9	2105.6	2110.8	2109.9
34.5	2188.3	2186.7	2181.0	2179.5	2183.9
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8759	0.8759	0.8759	0.8759	0.8759
6.89	0.8802	0.8806	0.8804	0.8804	0.8804
13.79	0.8844	0.8849	0.8845	0.8848	0.8847
20.68	0.8885	0.8892	0.8889	0.8890	0.8889
27.58	0.8925	0.8929	0.8929	0.8928	0.8928
34.5	0.8969	0.8968	0.8967	0.8963	0.8967
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1347.5	1348.2	1345.3	1346.1	1346.8
6.89	1376.5	1379.7	1375.0	1376.5	1376.9
13.79	1405.6	1409.2	1403.5	1407.2	1406.4
20.68	1433.8	1437.9	1433.4	1435.6	1435.2
27.58	1460.6	1464.4	1461.9	1462.3	1462.3
34.5	1487.1	1487.1	1486.2	1486.2	1486.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1590.5	1592.1	1585.4	1587.1	1588.8
6.89	1667.7	1676.3	1664.5	1668.1	1669.2
13.79	1747.4	1757.2	1742.3	1752.0	1749.8
20.68	1826.5	1838.4	1826.3	1832.4	1830.9
27.58	1904.0	1914.7	1908.2	1909.1	1909.0
34.5	1983.4	1983.3	1980.8	1979.9	1981.9

Table C-14. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8616	0.8616	0.8616	0.8616	0.8616
6.89	0.8662	0.8668	0.8663	0.8667	0.8665
13.79	0.8707	0.8711	0.8711	0.8714	0.8711
20.68	0.8753	0.8757	0.8756	0.8760	0.8757
27.58	0.8798	0.8800	0.8800	0.8801	0.8800
34.5	0.8840	0.8837	0.8842	0.8840	0.8840
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1277.7	1278.6	1277.2	1277.5	1277.7
6.89	1307.9	1309.8	1307.8	1311.1	1309.2
13.79	1340.9	1342.5	1341.1	1343.4	1342.0
20.68	1370.6	1373.5	1370.8	1373.3	1372.0
27.58	1399.6	1401.6	1398.9	1401.0	1400.3
34.5	1426.8	1426.8	1426.6	1426.6	1426.7
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1406.5	1408.6	1405.4	1406.1	1406.7
6.89	1481.8	1487.0	1481.6	1489.9	1485.0
13.79	1565.6	1570.1	1566.7	1572.6	1568.7
20.68	1644.2	1652.1	1645.3	1652.2	1648.5
27.58	1723.5	1728.6	1722.1	1727.5	1725.4
34.5	1799.5	1799.0	1799.4	1799.0	1799.2
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8473	0.8473	0.8473	0.8473	0.8473
6.89	0.8522	0.8529	0.8525	0.8528	0.8526
13.79	0.8571	0.8576	0.8575	0.8580	0.8576
20.68	0.8621	0.8625	0.8620	0.8629	0.8624
27.58	0.8669	0.8672	0.8674	0.8677	0.8673
34.5	0.8717	0.8712	0.8720	0.8720	0.8717
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1212.1	1213.6	1211.4	1211.0	1212.0
6.89	1245.4	1250.5	1245.7	1246.6	1247.0
13.79	1277.7	1282.8	1279.0	1280.7	1280.0
20.68	1309.6	1313.3	1311.5	1312.8	1311.8
27.58	1340.9	1343.7	1341.8	1343.6	1342.5
34.5	1372.0	1372.0	1371.5	1371.5	1371.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1244.8	1247.8	1243.3	1242.4	1244.6
6.89	1321.8	1333.6	1322.9	1325.3	1325.9
13.79	1399.2	1411.4	1402.7	1407.4	1405.2
20.68	1478.5	1487.6	1482.7	1487.3	1484.0
27.58	1558.7	1565.8	1561.6	1566.3	1563.1
34.5	1641.0	1640.1	1640.3	1640.2	1640.4

Table C-14. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8331	0.8331	0.8331	0.8331	0.8331
6.89	0.8386	0.8389	0.8388	0.8392	0.8389
13.79	0.8443	0.8447	0.8444	0.8447	0.8445
20.68	0.8493	0.8500	0.8497	0.8504	0.8498
27.58	0.8547	0.8549	0.8551	0.8552	0.8550
34.5	0.8598	0.8595	0.8595	0.8594	0.8595
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1150.9	1153.0	1149.3	1150.1	1150.8
6.89	1187.2	1190.7	1185.8	1188.7	1188.1
13.79	1222.3	1226.2	1221.4	1223.7	1223.4
20.68	1255.7	1260.5	1255.1	1258.7	1257.5
27.58	1289.5	1292.0	1288.4	1289.3	1289.8
34.5	1320.2	1320.2	1317.6	1317.6	1318.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1103.5	1107.5	1100.5	1102.0	1103.4
6.89	1181.9	1189.4	1179.5	1185.8	1184.1
13.79	1261.5	1270.0	1259.8	1264.8	1264.0
20.68	1339.2	1350.6	1338.4	1347.2	1343.9
27.58	1421.3	1427.0	1419.3	1421.6	1422.3
34.5	1498.5	1497.9	1492.1	1491.9	1495.1

Table C-15. Raw density, speed of sound and isentropic bulk modulus data for Methyl Linolenate.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8963	0.8963	0.8963	0.8963	0.8963
6.89	0.9006	0.9005	0.9005	0.9007	0.9006
13.79	0.9046	0.9044	0.9044	0.9047	0.9045
20.68	0.9082	0.9080	0.9082	0.9084	0.9082
27.58	0.9116	0.9113	0.9120	0.9117	0.9117
34.5	0.9151	0.9143	0.9154	0.9149	0.9149
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1422.0	1424.0	1421.0	1422.2	1422.3
6.89	1448.1	1452.1	1449.6	1452.7	1450.6
13.79	1475.5	1479.1	1476.5	1481.0	1478.0
20.68	1501.2	1504.7	1503.2	1506.7	1504.0
27.58	1525.5	1527.6	1528.7	1530.1	1528.0
34.5	1549.7	1549.7	1551.9	1551.9	1550.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1812.2	1817.3	1809.7	1812.7	1813.0
6.89	1888.6	1898.7	1892.2	1900.7	1895.0
13.79	1969.3	1978.7	1971.7	1984.5	1976.0
20.68	2046.6	2056.0	2052.2	2062.3	2054.3
27.58	2121.6	2126.5	2131.4	2134.6	2128.5
34.5	2197.7	2195.7	2204.4	2203.2	2200.3
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8811	0.8811	0.8811	0.8811	0.8811
6.89	0.8852	0.8859	0.8854	0.8859	0.8856
13.79	0.8892	0.8902	0.8895	0.8902	0.8898
20.68	0.8933	0.8943	0.8935	0.8942	0.8938
27.58	0.8973	0.8979	0.8979	0.8980	0.8978
34.5	0.9011	0.9012	0.9015	0.9014	0.9013
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1350.3	1350.2	1349.6	1350.3	1350.1
6.89	1377.8	1382.1	1380.2	1382.7	1380.7
13.79	1406.4	1410.3	1408.6	1412.1	1409.4
20.68	1434.4	1438.7	1437.5	1439.9	1437.6
27.58	1460.8	1463.3	1466.7	1468.6	1464.9
34.5	1486.2	1486.2	1492.4	1492.4	1489.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1606.6	1606.2	1604.9	1606.6	1606.1
6.89	1680.4	1692.4	1686.7	1693.6	1688.3
13.79	1758.9	1770.6	1764.8	1775.1	1767.4
20.68	1838.0	1851.0	1846.2	1854.1	1847.3
27.58	1914.9	1922.7	1931.6	1937.0	1926.5
34.5	1990.4	1990.6	2007.9	2007.6	1999.1



Table C-15. Continued.

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8668	0.8668	0.8668	0.8668	0.8668
6.89	0.8714	0.8717	0.8713	0.8716	0.8715
13.79	0.8762	0.8764	0.8757	0.8761	0.8761
20.68	0.8807	0.8809	0.8805	0.8806	0.8807
27.58	0.8852	0.8855	0.8850	0.8849	0.8851
34.5	0.8891	0.8885	0.8889	0.8886	0.8888
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1280.4	1282.3	1281.7	1282.8	1281.8
6.89	1310.1	1312.0	1312.5	1315.0	1312.4
13.79	1342.5	1344.8	1339.8	1345.5	1343.2
20.68	1373.0	1374.5	1372.6	1375.8	1373.9
27.58	1402.0	1403.1	1403.1	1404.1	1403.1
34.5	1429.2	1429.2	1429.8	1429.8	1429.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1421.1	1425.4	1424.0	1426.5	1424.3
6.89	1495.6	1500.5	1500.9	1507.2	1501.1
13.79	1579.1	1585.0	1572.0	1586.1	1580.5
20.68	1660.1	1664.2	1659.0	1666.8	1662.5
27.58	1739.8	1743.4	1742.3	1744.5	1742.5
34.5	1816.1	1814.9	1817.1	1816.5	1816.1
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8523	0.8523	0.8523	0.8523	0.8523
6.89	0.8574	0.8576	0.8572	0.8575	0.8574
13.79	0.8624	0.8626	0.8624	0.8626	0.8625
20.68	0.8675	0.8678	0.8670	0.8675	0.8675
27.58	0.8721	0.8722	0.8721	0.8719	0.8721
34.5	0.8767	0.8762	0.8764	0.8760	0.8763
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1213.1	1215.3	1216.8	1217.6	1215.7
6.89	1246.5	1249.2	1248.8	1252.6	1249.3
13.79	1279.4	1282.5	1282.2	1285.8	1282.5
20.68	1311.8	1315.2	1313.0	1316.9	1314.2
27.58	1341.6	1343.9	1345.7	1346.6	1344.5
34.5	1371.1	1371.1	1373.7	1373.7	1372.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1254.3	1258.8	1261.9	1263.7	1259.7
6.89	1332.1	1338.4	1336.7	1345.5	1338.2
13.79	1411.7	1418.9	1417.7	1426.1	1418.6
20.68	1492.9	1501.2	1494.7	1504.4	1498.3
27.58	1569.8	1575.3	1579.3	1581.1	1576.4
34.5	1648.1	1647.3	1653.8	1653.0	1650.6

Table C-15. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8382	0.8382	0.8382	0.8382	0.8382
6.89	0.8430	0.8431	0.8435	0.8437	0.8433
13.79	0.8486	0.8486	0.8491	0.8494	0.8489
20.68	0.8543	0.8538	0.8546	0.8548	0.8544
27.58	0.8591	0.8591	0.8597	0.8598	0.8594
34.5	0.8636	0.8629	0.8645	0.8643	0.8638
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1153.2	1155.6	1154.7	1154.5	1154.5
6.89	1185.5	1187.6	1188.0	1190.8	1188.0
13.79	1219.5	1223.2	1223.7	1226.8	1223.3
20.68	1256.8	1256.6	1258.5	1261.0	1258.2
27.58	1286.9	1287.9	1291.0	1292.1	1289.5
34.5	1320.0	1320.0	1320.9	1320.9	1320.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1114.7	1119.3	1117.5	1117.3	1117.2
6.89	1184.9	1189.1	1190.5	1196.4	1190.2
13.79	1262.1	1269.8	1271.3	1278.4	1270.4
20.68	1349.4	1348.2	1353.6	1359.3	1352.6
27.58	1422.8	1424.9	1432.8	1435.5	1429.0
34.5	1504.8	1503.5	1508.3	1507.8	1506.1

Table C-16. Raw density, speed of sound and isentropic bulk modulus data for Methyl Oleate.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8789	0.8789	0.8789	0.8789	0.8789
6.89	0.8828	0.8836	0.8828	0.8830	0.8831
13.79	0.8865	0.8875	0.8868	0.8866	0.8868
20.68	0.8904	0.8913	0.8907	0.8907	0.8908
27.58	0.8942	0.8946	0.8945	0.8941	0.8944
34.5	0.8977	0.8979	0.8981	0.8973	0.8977
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1411.1	1411.5	1409.3	1413.1	1411.3
6.89	1439.7	1443.6	1437.5	1444.2	1441.2
13.79	1467.6	1471.4	1464.8	1470.8	1468.6
20.68	1495.0	1497.2	1493.5	1496.5	1495.5
27.58	1520.3	1521.2	1519.4	1521.0	1520.4
34.5	1546.7	1546.7	1545.0	1545.0	1545.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1750.2	1751.1	1745.8	1755.0	1750.5
6.89	1829.7	1841.4	1824.2	1841.7	1834.3
13.79	1909.4	1921.4	1902.8	1917.8	1912.8
20.68	1990.0	1998.0	1986.6	1994.7	1992.3
27.58	2066.6	2070.2	2065.0	2068.4	2067.5
34.5	2147.5	2147.9	2143.8	2141.8	2145.3
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8645	0.8645	0.8645	0.8645	0.8645
6.89	0.8688	0.8693	0.8687	0.8686	0.8688
13.79	0.8730	0.8735	0.8729	0.8730	0.8731
20.68	0.8771	0.8777	0.8771	0.8771	0.8773
27.58	0.8816	0.8816	0.8813	0.8812	0.8814
34.5	0.8854	0.8851	0.8851	0.8844	0.8850
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1338.3	1338.4	1338.3	1341.4	1339.1
6.89	1367.8	1372.4	1368.2	1373.3	1370.4
13.79	1398.1	1402.3	1397.7	1402.3	1400.1
20.68	1426.2	1431.0	1427.0	1431.0	1428.8
27.58	1457.3	1457.9	1455.2	1457.7	1457.0
34.5	1483.2	1483.2	1481.0	1481.0	1482.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1548.2	1548.6	1548.2	1555.6	1550.2
6.89	1625.4	1637.4	1626.1	1638.3	1631.8
13.79	1706.4	1717.9	1705.4	1716.8	1711.6
20.68	1784.0	1797.4	1785.9	1796.1	1790.8
27.58	1872.2	1873.8	1866.2	1872.3	1871.1
34.5	1947.9	1947.2	1941.5	1940.0	1944.1

Table C-16. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8503	0.8503	0.8503	0.8503	0.8503
6.89	0.8549	0.8551	0.8550	0.8553	0.8551
13.79	0.8595	0.8599	0.8596	0.8598	0.8597
20.68	0.8639	0.8644	0.8641	0.8641	0.8641
27.58	0.8682	0.8685	0.8687	0.8684	0.8685
34.5	0.8729	0.8725	0.8729	0.8724	0.8727
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1269.4	1271.7	1268.6	1271.6	1270.3
6.89	1301.6	1304.6	1301.9	1307.6	1303.9
13.79	1333.3	1337.5	1333.7	1339.0	1335.9
20.68	1363.8	1367.4	1364.1	1368.2	1365.9
27.58	1393.9	1395.8	1395.2	1397.5	1395.6
34.5	1423.2	1423.2	1423.4	1423.4	1423.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1370.0	1375.2	1368.3	1374.8	1372.1
6.89	1448.2	1455.2	1449.1	1462.4	1453.7
13.79	1528.0	1538.3	1528.9	1541.4	1534.2
20.68	1606.8	1616.2	1608.0	1617.5	1612.1
27.58	1686.9	1692.1	1691.0	1696.0	1691.5
34.5	1767.9	1767.1	1768.5	1767.4	1767.7
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8360	0.8360	0.8360	0.8360	0.8360
6.89	0.8412	0.8413	0.8410	0.8411	0.8412
13.79	0.8462	0.8464	0.8460	0.8461	0.8462
20.68	0.8515	0.8513	0.8510	0.8511	0.8512
27.58	0.8557	0.8558	0.8558	0.8558	0.8558
34.5	0.8604	0.8598	0.8604	0.8597	0.8601
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1203.4	1203.8	1203.6	1204.1	1203.7
6.89	1238.4	1241.3	1238.4	1242.1	1240.0
13.79	1272.1	1276.4	1271.3	1276.1	1273.9
20.68	1304.4	1307.8	1304.6	1308.4	1306.3
27.58	1334.0	1336.1	1335.8	1337.2	1335.8
34.5	1364.9	1364.9	1365.4	1365.4	1365.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1210.5	1211.4	1211.1	1212.0	1211.3
6.89	1290.1	1296.3	1289.8	1297.6	1293.5
13.79	1369.3	1378.9	1367.2	1377.7	1373.3
20.68	1448.9	1456.0	1448.3	1457.1	1452.6
27.58	1522.8	1527.8	1527.1	1530.2	1527.0
34.5	1602.7	1601.7	1604.0	1602.8	1602.8

Table C-16. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8208	0.8208	0.8208	0.8208	0.8208
6.89	0.8267	0.8272	0.8265	0.8267	0.8268
13.79	0.8325	0.8325	0.8323	0.8325	0.8324
20.68	0.8376	0.8376	0.8378	0.8378	0.8377
27.58	0.8429	0.8425	0.8429	0.8428	0.8428
34.5	0.8476	0.8471	0.8476	0.8470	0.8473
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1141.7	1143.0	1140.3	1141.6	1141.6
6.89	1178.2	1181.4	1176.7	1180.3	1179.2
13.79	1216.2	1219.7	1214.4	1218.2	1217.1
20.68	1249.7	1252.8	1249.2	1252.3	1251.0
27.58	1282.0	1283.5	1282.5	1283.6	1282.9
34.5	1313.3	1313.3	1312.7	1312.7	1313.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1069.9	1072.4	1067.3	1069.7	1069.8
6.89	1147.7	1154.5	1144.4	1151.7	1149.6
13.79	1231.4	1238.4	1227.5	1235.5	1233.2
20.68	1308.2	1314.5	1307.4	1313.8	1311.0
27.58	1385.3	1387.9	1386.4	1388.7	1387.1
34.5	1462.1	1461.1	1460.5	1459.4	1460.8

Table C-17. Raw density, speed of sound and isentropic bulk modulus data for Methyl Oxidized Soy.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8844	0.8844	0.8844	0.8844	0.8844
6.89	0.8883	0.8886	0.8881	0.8882	0.8883
13.79	0.8921	0.8926	0.8918	0.8920	0.8921
20.68	0.8959	0.8963	0.8957	0.8957	0.8959
27.58	0.8997	0.8996	0.8993	0.8991	0.8994
34.5	0.9034	0.9029	0.9030	0.9022	0.9029
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1413.7	1416.6	1416.6	1419.0	1416.5
6.89	1440.7	1445.6	1443.6	1447.9	1444.5
13.79	1468.2	1474.2	1470.1	1474.2	1471.7
20.68	1494.3	1499.9	1498.1	1501.8	1498.5
27.58	1521.4	1524.4	1523.0	1525.1	1523.5
34.5	1547.1	1547.1	1546.9	1546.9	1547.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1767.4	1774.8	1774.8	1780.8	1774.4
6.89	1843.8	1857.1	1850.7	1862.0	1853.4
13.79	1923.0	1939.7	1927.4	1938.4	1932.1
20.68	2000.6	2016.2	2010.3	2020.4	2011.9
27.58	2082.4	2090.5	2085.9	2091.2	2087.5
34.5	2162.5	2161.2	2160.8	2158.9	2160.8
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8694	0.8694	0.8694	0.8694	0.8694
6.89	0.8735	0.8737	0.8735	0.8737	0.8736
13.79	0.8776	0.8779	0.8775	0.8781	0.8778
20.68	0.8815	0.8819	0.8817	0.8822	0.8818
27.58	0.8856	0.8855	0.8857	0.8858	0.8857
34.5	0.8894	0.8889	0.8895	0.8892	0.8892
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1345.2	1346.8	1345.0	1345.9	1345.7
6.89	1373.0	1377.6	1374.5	1375.6	1375.2
13.79	1401.8	1407.0	1402.0	1406.0	1404.2
20.68	1431.0	1433.8	1430.2	1433.0	1432.0
27.58	1457.3	1460.0	1457.9	1459.8	1458.7
34.5	1484.9	1484.9	1482.8	1482.8	1483.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1573.1	1576.8	1572.7	1574.7	1574.3
6.89	1646.5	1658.2	1650.1	1653.3	1652.0
13.79	1724.4	1738.0	1724.7	1735.9	1730.7
20.68	1805.0	1812.9	1803.4	1811.6	1808.3
27.58	1880.7	1887.4	1882.4	1887.7	1884.6
34.5	1961.1	1960.0	1955.7	1955.1	1958.0

Table C-17. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8548	0.8548	0.8548	0.8548	0.8548
6.89	0.8595	0.8602	0.8594	0.8596	0.8597
13.79	0.8640	0.8646	0.8641	0.8642	0.8642
20.68	0.8684	0.8692	0.8683	0.8687	0.8687
27.58	0.8729	0.8732	0.8727	0.8730	0.8729
34.5	0.8771	0.8769	0.8770	0.8766	0.8769
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1273.8	1275.6	1274.8	1274.6	1274.7
6.89	1305.4	1310.8	1306.6	1309.6	1308.1
13.79	1336.8	1340.4	1338.3	1341.4	1339.2
20.68	1367.1	1372.0	1368.0	1370.9	1369.5
27.58	1396.8	1399.3	1396.6	1399.3	1398.0
34.5	1424.4	1424.4	1424.6	1424.6	1424.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1387.1	1390.9	1389.2	1388.8	1389.0
6.89	1464.7	1478.0	1467.2	1474.3	1471.0
13.79	1544.0	1553.3	1547.5	1555.1	1550.0
20.68	1623.0	1636.3	1624.9	1632.6	1629.2
27.58	1702.9	1709.7	1702.1	1709.2	1706.0
34.5	1779.5	1779.1	1779.8	1779.0	1779.3
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8422	0.8422	0.8422	0.8422	0.8422
6.89	0.8474	0.8482	0.8471	0.8479	0.8476
13.79	0.8523	0.8532	0.8526	0.8529	0.8527
20.68	0.8570	0.8579	0.8573	0.8576	0.8575
27.58	0.8619	0.8623	0.8621	0.8620	0.8621
34.5	0.8665	0.8662	0.8667	0.8662	0.8664
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1209.7	1211.7	1208.9	1212.8	1210.8
6.89	1244.5	1249.7	1242.8	1249.1	1246.5
13.79	1276.9	1282.8	1278.3	1282.0	1280.0
20.68	1308.9	1313.8	1309.3	1313.2	1311.3
27.58	1340.2	1343.0	1340.5	1342.8	1341.7
34.5	1369.6	1369.6	1370.0	1370.0	1369.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1232.5	1236.6	1231.0	1238.9	1234.7
6.89	1312.4	1324.7	1308.4	1322.8	1317.1
13.79	1389.5	1404.0	1393.2	1401.7	1397.1
20.68	1468.4	1481.0	1469.6	1478.8	1474.4
27.58	1548.1	1555.3	1549.2	1554.4	1551.8
34.5	1625.5	1625.0	1626.8	1625.8	1625.8

Table C-17. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8278	0.8278	0.8278	0.8278	0.8278
6.89	0.8335	0.8340	0.8335	0.8340	0.8337
13.79	0.8391	0.8398	0.8393	0.8398	0.8395
20.68	0.8442	0.8449	0.8445	0.8449	0.8446
27.58	0.8494	0.8499	0.8495	0.8497	0.8496
34.5	0.8544	0.8542	0.8545	0.8540	0.8543
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1146.7	1148.0	1146.0	1148.0	1147.2
6.89	1184.1	1187.6	1181.7	1185.8	1184.8
13.79	1220.4	1224.8	1219.2	1222.6	1221.8
20.68	1252.9	1258.0	1253.2	1256.2	1255.1
27.58	1285.9	1289.0	1284.8	1287.5	1286.8
34.5	1317.6	1317.6	1316.1	1316.1	1316.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1088.6	1091.1	1087.1	1091.1	1089.5
6.89	1168.8	1176.3	1163.8	1172.7	1170.4
13.79	1249.8	1259.9	1247.6	1255.4	1253.2
20.68	1325.3	1337.2	1326.4	1333.2	1330.5
27.58	1404.6	1412.1	1402.2	1408.6	1406.9
34.5	1483.2	1482.9	1480.1	1479.2	1481.3



Table C-18. Raw density, speed of sound and isentropic bulk modulus data for Methyl Palmitate.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8554	0.8554	0.8554	0.8554	0.8554
6.89	0.8600	0.8605	0.8598	0.8602	0.8602
13.79	0.8646	0.8650	0.8642	0.8650	0.8647
20.68	0.8690	0.8694	0.8684	0.8691	0.8690
27.58	0.8733	0.8733	0.8727	0.8729	0.8730
34.5	0.8773	0.8768	0.8767	0.8764	0.8768
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1316.7	1371.5	1318.1	1319.3	1331.4
6.89	1346.9	1351.4	1347.3	1349.6	1348.8
13.79	1378.2	1382.3	1378.0	1381.9	1380.1
20.68	1407.8	1412.3	1405.6	1410.5	1409.1
27.58	1436.4	1438.3	1434.8	1437.3	1436.7
34.5	1464.0	1464.0	1461.9	1461.9	1462.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1483.1	1609.0	1486.2	1488.9	1516.8
6.89	1560.3	1571.6	1560.8	1566.9	1564.9
13.79	1642.3	1652.8	1641.1	1651.9	1647.0
20.68	1722.2	1734.0	1715.8	1729.1	1725.3
27.58	1801.9	1806.4	1796.6	1803.2	1802.0
34.5	1880.2	1879.2	1873.5	1873.0	1876.5
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8426	0.8426	0.8426	0.8426	0.8426
6.89	0.8477	0.8480	0.8475	0.8479	0.8478
13.79	0.8526	0.8528	0.8526	0.8527	0.8527
20.68	0.8573	0.8573	0.8571	0.8575	0.8573
27.58	0.8617	0.8616	0.8618	0.8616	0.8617
34.5	0.8660	0.8655	0.8661	0.8655	0.8658
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1246.5	1248.8	1246.3	1250.2	1247.9
6.89	1280.1	1284.1	1280.9	1284.6	1282.4
13.79	1313.0	1316.4	1312.5	1314.0	1314.0
20.68	1343.9	1346.8	1343.7	1347.8	1345.6
27.58	1373.2	1375.9	1374.1	1374.8	1374.5
34.5	1402.2	1402.2	1402.5	1402.5	1402.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1309.1	1314.0	1308.8	1316.9	1312.2
6.89	1389.0	1398.3	1390.4	1399.2	1394.2
13.79	1469.8	1477.8	1468.7	1472.3	1472.2
20.68	1548.3	1555.0	1547.6	1557.8	1552.2
27.58	1624.8	1631.2	1627.2	1628.6	1627.9
34.5	1702.7	1701.5	1703.8	1702.6	1702.6

Table C-18. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8277	0.8277	0.8277	0.8277	0.8277
6.89	0.8333	0.8337	0.8331	0.8338	0.8335
13.79	0.8388	0.8394	0.8384	0.8392	0.8390
20.68	0.8437	0.8442	0.8441	0.8447	0.8442
27.58	0.8488	0.8491	0.8485	0.8488	0.8488
34.5	0.8535	0.8532	0.8530	0.8529	0.8531
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1180.2	1182.2	1180.7	1181.7	1181.2
6.89	1216.6	1221.2	1215.9	1220.1	1218.4
13.79	1252.8	1256.2	1251.1	1254.9	1253.7
20.68	1284.5	1288.5	1283.8	1287.4	1286.0
27.58	1317.4	1319.0	1316.1	1317.1	1317.4
34.5	1347.8	1347.8	1346.2	1346.2	1347.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1152.8	1156.9	1153.9	1155.8	1154.8
6.89	1233.4	1243.3	1231.6	1241.3	1237.4
13.79	1316.4	1324.5	1312.3	1321.7	1318.7
20.68	1392.0	1401.6	1391.2	1400.0	1396.2
27.58	1473.2	1477.1	1469.6	1472.4	1473.1
34.5	1550.5	1550.0	1545.9	1545.7	1548.0
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8134	0.8134	0.8134	0.8134	0.8134
6.89	0.8195	0.8196	0.8193	0.8200	0.8196
13.79	0.8253	0.8257	0.8252	0.8254	0.8254
20.68	0.8309	0.8310	0.8308	0.8306	0.8308
27.58	0.8361	0.8360	0.8359	0.8363	0.8361
34.5	0.8408	0.8402	0.8412	0.8406	0.8407
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1117.7	1121.5	1116.9	1121.4	1119.4
6.89	1157.2	1160.2	1154.5	1159.8	1157.9
13.79	1194.7	1199.5	1192.3	1195.7	1195.6
20.68	1229.9	1232.6	1227.2	1230.8	1230.1
27.58	1262.3	1264.0	1258.7	1262.4	1261.8
34.5	1292.6	1292.6	1291.5	1291.5	1292.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1016.2	1023.1	1014.6	1022.9	1019.2
6.89	1097.3	1103.2	1092.1	1103.0	1098.9
13.79	1178.0	1188.1	1173.2	1180.2	1179.9
20.68	1256.9	1262.5	1251.1	1258.2	1257.2
27.58	1332.2	1335.7	1324.3	1332.8	1331.2
34.5	1404.9	1403.8	1403.0	1402.1	1403.5

Table C-19. Raw density, speed of sound and isentropic bulk modulus data for Methyl Soy Ester.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8818	0.8818	0.8818	0.8818	0.8818
6.89	0.8856	0.8861	0.8858	0.8858	0.8858
13.79	0.8895	0.8900	0.8897	0.8898	0.8898
20.68	0.8934	0.8938	0.8936	0.8933	0.8936
27.58	0.8971	0.8972	0.8975	0.8967	0.8971
34.5	0.9007	0.9004	0.9010	0.8998	0.9005
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1414.3	1416.2	1412.1	1416.8	1414.8
6.89	1442.0	1446.7	1440.5	1446.3	1443.9
13.79	1470.1	1474.2	1467.8	1474.2	1471.6
20.68	1498.7	1501.8	1495.0	1499.0	1498.6
27.58	1524.2	1526.2	1521.2	1522.3	1523.5
34.5	1548.1	1548.1	1546.0	1546.0	1547.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1763.7	1768.6	1758.3	1770.1	1765.2
6.89	1841.3	1854.4	1838.2	1852.8	1846.7
13.79	1922.5	1934.1	1916.8	1933.7	1926.8
20.68	2006.9	2016.1	1997.3	2007.3	2006.9
27.58	2084.0	2089.9	2076.7	2078.2	2082.2
34.5	2158.7	2157.8	2153.2	2150.6	2155.1
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8675	0.8675	0.8675	0.8675	0.8675
6.89	0.8719	0.8723	0.8718	0.8718	0.8719
13.79	0.8760	0.8765	0.8758	0.8760	0.8761
20.68	0.8802	0.8807	0.8801	0.8801	0.8803
27.58	0.8843	0.8845	0.8842	0.8840	0.8842
34.5	0.8883	0.8880	0.8880	0.8874	0.8879
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1341.6	1342.8	1340.5	1343.0	1342.0
6.89	1373.0	1375.6	1370.8	1374.8	1373.5
13.79	1400.8	1405.3	1399.4	1405.3	1402.7
20.68	1429.6	1434.4	1428.6	1431.8	1431.1
27.58	1458.1	1459.1	1455.4	1457.7	1457.6
34.5	1484.1	1484.1	1481.7	1481.7	1482.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1561.5	1564.4	1559.0	1564.8	1562.4
6.89	1643.6	1650.5	1638.0	1647.8	1645.0
13.79	1719.0	1730.9	1715.3	1729.9	1723.8
20.68	1798.8	1812.2	1796.0	1804.3	1802.8
27.58	1880.1	1883.2	1872.8	1878.3	1878.6
34.5	1956.5	1955.8	1949.6	1948.2	1952.5

Table C-19. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8534	0.8534	0.8534	0.8534	0.8534
6.89	0.8580	0.8583	0.8582	0.8583	0.8582
13.79	0.8626	0.8631	0.8629	0.8630	0.8629
20.68	0.8672	0.8674	0.8675	0.8675	0.8674
27.58	0.8714	0.8716	0.8718	0.8716	0.8716
34.5	0.8756	0.8753	0.8759	0.8754	0.8756
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1274.6	1275.7	1271.7	1274.3	1274.1
6.89	1306.4	1309.3	1305.1	1307.6	1307.1
13.79	1338.3	1341.8	1335.4	1339.8	1338.8
20.68	1368.7	1370.9	1366.3	1370.4	1369.1
27.58	1397.9	1399.8	1395.8	1397.3	1397.7
34.5	1424.4	1424.4	1423.4	1423.4	1423.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1386.4	1388.8	1380.2	1385.7	1385.3
6.89	1464.3	1471.2	1461.7	1467.6	1466.2
13.79	1544.9	1553.9	1538.8	1549.3	1546.7
20.68	1624.6	1630.2	1619.4	1629.1	1625.9
27.58	1702.9	1707.9	1698.4	1701.9	1702.8
34.5	1776.5	1775.8	1774.7	1773.5	1775.1
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8389	0.8389	0.8389	0.8389	0.8389
6.89	0.8441	0.8445	0.8437	0.8442	0.8442
13.79	0.8489	0.8495	0.8494	0.8495	0.8493
20.68	0.8540	0.8544	0.8543	0.8541	0.8542
27.58	0.8588	0.8587	0.8589	0.8589	0.8588
34.5	0.8632	0.8628	0.8635	0.8630	0.8631
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1207.5	1209.2	1205.2	1208.4	1207.6
6.89	1242.8	1245.9	1239.3	1243.4	1242.9
13.79	1275.3	1279.6	1275.6	1278.5	1277.2
20.68	1308.8	1312.3	1307.3	1308.6	1309.2
27.58	1340.0	1340.5	1338.6	1339.8	1339.8
34.5	1367.8	1367.8	1367.2	1367.2	1367.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1223.2	1226.7	1218.5	1224.9	1223.3
6.89	1303.9	1310.8	1295.9	1305.2	1304.0
13.79	1380.6	1391.0	1382.1	1388.5	1385.5
20.68	1462.9	1471.4	1459.9	1462.6	1464.2
27.58	1542.2	1543.2	1539.1	1541.8	1541.6
34.5	1614.9	1614.2	1614.2	1613.2	1614.1

Table C-19. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8249	0.8249	0.8249	0.8249	0.8249
6.89	0.8302	0.8304	0.8306	0.8303	0.8304
13.79	0.8357	0.8360	0.8360	0.8359	0.8359
20.68	0.8412	0.8415	0.8415	0.8413	0.8414
27.58	0.8463	0.8464	0.8467	0.8465	0.8465
34.5	0.8511	0.8507	0.8515	0.8508	0.8510
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1140.4	1141.6	1144.0	1146.7	1143.2
6.89	1176.2	1180.0	1181.3	1183.3	1180.2
13.79	1214.4	1218.2	1216.6	1219.5	1217.2
20.68	1249.1	1252.0	1251.2	1254.0	1251.6
27.58	1282.0	1286.1	1284.1	1286.1	1284.6
34.5	1313.5	1313.5	1314.5	1314.5	1314.0
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1072.8	1075.0	1079.6	1084.7	1078.0
6.89	1148.5	1156.3	1159.0	1162.7	1156.6
13.79	1232.5	1240.8	1237.4	1243.3	1238.5
20.68	1312.5	1319.0	1317.5	1323.0	1318.0
27.58	1391.0	1400.0	1396.2	1400.1	1396.8
34.5	1468.4	1467.8	1471.4	1470.2	1469.4

Table C-20. Raw density, speed of sound and isentropic bulk modulus data for Methyl Stearate.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8588	0.8588	0.8588	0.8588	0.8588
6.89	0.8629	0.8631	0.8631	0.8633	0.8631
13.79	0.8671	0.8668	0.8675	0.8677	0.8673
20.68	0.8714	0.8716	0.8717	0.8720	0.8717
27.58	0.8755	0.8752	0.8756	0.8760	0.8756
34.5	0.8792	0.8787	0.8800	0.8795	0.8794
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1328.3	1332.1	1326.9	1329.3	1329.1
6.89	1357.4	1361.9	1357.0	1359.2	1358.9
13.79	1387.2	1391.8	1387.4	1388.7	1388.8
20.68	1416.8	1419.8	1415.8	1419.8	1418.1
27.58	1442.4	1444.4	1443.8	1447.5	1444.5
34.5	1470.5	1470.5	1471.6	1471.6	1471.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1515.1	1523.9	1512.0	1517.5	1517.1
6.89	1589.9	1601.0	1589.4	1594.8	1593.8
13.79	1668.6	1679.0	1669.8	1673.5	1672.7
20.68	1749.2	1756.9	1747.5	1757.8	1752.8
27.58	1821.3	1826.0	1825.2	1835.4	1827.0
34.5	1901.3	1900.2	1905.8	1904.7	1903.0
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8447	0.8447	0.8447	0.8447	0.8447
6.89	0.8495	0.8496	0.8497	0.8502	0.8497
13.79	0.8542	0.8545	0.8547	0.8551	0.8547
20.68	0.8589	0.8591	0.8593	0.8594	0.8592
27.58	0.8636	0.8635	0.8641	0.8640	0.8638
34.5	0.8677	0.8671	0.8691	0.8687	0.8681
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1258.8	1260.5	1255.9	1257.7	1258.2
6.89	1290.3	1293.8	1290.7	1294.3	1292.3
13.79	1323.3	1327.8	1323.8	1328.1	1325.7
20.68	1353.9	1357.6	1353.8	1358.3	1355.9
27.58	1383.4	1385.3	1383.4	1385.1	1384.3
34.5	1412.7	1412.7	1411.7	1411.7	1412.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1338.6	1342.2	1332.3	1336.2	1337.3
6.89	1414.3	1422.0	1415.4	1424.2	1419.0
13.79	1495.8	1506.5	1497.8	1508.3	1502.1
20.68	1574.5	1583.2	1574.8	1585.6	1579.5
27.58	1652.9	1657.3	1653.9	1657.7	1655.5
34.5	1731.7	1730.4	1732.0	1731.1	1731.3

Table C-20. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8303	0.8303	0.8303	0.8303	0.8303
6.89	0.8358	0.8359	0.8357	0.8361	0.8359
13.79	0.8410	0.8416	0.8409	0.8414	0.8412
20.68	0.8461	0.8465	0.8460	0.8464	0.8462
27.58	0.8511	0.8511	0.8506	0.8509	0.8509
34.5	0.8554	0.8553	0.8551	0.8549	0.8552
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1191.8	1192.2	1193.7	1195.3	1193.3
6.89	1228.2	1229.0	1230.2	1233.0	1230.1
13.79	1262.7	1266.0	1264.9	1269.2	1265.7
20.68	1295.6	1298.4	1299.4	1302.6	1299.0
27.58	1328.5	1329.5	1329.0	1331.6	1329.6
34.5	1357.4	1357.4	1359.2	1359.2	1358.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1179.3	1180.1	1183.2	1186.2	1182.2
6.89	1260.9	1262.5	1264.7	1271.1	1264.8
13.79	1340.9	1349.0	1345.5	1355.4	1347.7
20.68	1420.2	1427.1	1428.4	1436.1	1427.9
27.58	1502.0	1504.4	1502.3	1508.7	1504.3
34.5	1576.0	1575.9	1579.8	1579.3	1577.7
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8154	0.8154	0.8154	0.8154	0.8154
6.89	0.8214	0.8225	0.8215	0.8216	0.8218
13.79	0.8273	0.8283	0.8272	0.8269	0.8274
20.68	0.8326	0.8337	0.8335	0.8336	0.8333
27.58	0.8386	0.8386	0.8384	0.8376	0.8383
34.5	0.8443	0.8446	0.8441	0.8434	0.8441
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1128.8	1130.1	1130.1	1131.2	1130.1
6.89	1168.4	1171.0	1169.8	1173.2	1170.6
13.79	1204.8	1208.8	1207.1	1209.5	1207.5
20.68	1238.6	1243.3	1242.1	1242.8	1241.7
27.58	1273.3	1274.8	1277.2	1278.0	1275.8
34.5	1305.2	1305.2	1309.3	1309.3	1307.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1039.0	1041.5	1041.5	1043.4	1041.3
6.89	1121.2	1127.9	1124.3	1130.9	1126.1
13.79	1200.9	1210.3	1205.3	1209.8	1206.6
20.68	1277.2	1288.7	1285.8	1287.5	1284.8
27.58	1359.8	1362.8	1367.7	1368.1	1364.6
34.5	1438.4	1438.9	1446.9	1445.7	1442.5

Table C-21. Raw density, speed of sound and isentropic bulk modulus data for Methyl Tallow.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8708	0.8708	0.8708	0.8708	0.8708
6.89	0.8748	0.8753	0.8749	0.8751	0.8750
13.79	0.8788	0.8793	0.8787	0.8791	0.8790
20.68	0.8826	0.8831	0.8825	0.8830	0.8828
27.58	0.8865	0.8867	0.8862	0.8866	0.8865
34.5	0.8901	0.8900	0.8900	0.8898	0.8900
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1407.6	1413.1	1414.1	1418.4	1413.3
6.89	1436.4	1442.0	1440.9	1446.5	1441.5
13.79	1463.6	1470.1	1469.3	1473.3	1469.1
20.68	1492.4	1495.2	1497.6	1499.4	1496.2
27.58	1517.6	1519.1	1524.2	1524.2	1521.2
34.5	1542.2	1542.2	1548.1	1548.1	1545.1
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1725.2	1738.7	1741.1	1751.8	1739.2
6.89	1805.0	1819.9	1816.5	1830.9	1818.1
13.79	1882.3	1900.5	1896.9	1908.3	1897.0
20.68	1965.7	1974.2	1979.3	1985.2	1976.1
27.58	2041.6	2046.3	2058.7	2059.5	2051.5
34.5	2116.9	2116.8	2133.0	2132.3	2124.7
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8561	0.8561	0.8561	0.8561	0.8561
6.89	0.8606	0.8608	0.8604	0.8609	0.8607
13.79	0.8651	0.8651	0.8646	0.8652	0.8650
20.68	0.8696	0.8694	0.8688	0.8694	0.8693
27.58	0.8735	0.8734	0.8731	0.8731	0.8733
34.5	0.8774	0.8769	0.8772	0.8768	0.8771
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1327.9	1329.7	1330.9	1333.7	1330.5
6.89	1358.1	1361.6	1361.9	1366.3	1362.0
13.79	1388.4	1391.4	1391.2	1395.8	1391.7
20.68	1419.6	1422.0	1421.2	1426.2	1422.2
27.58	1446.7	1448.7	1449.6	1452.3	1449.3
34.5	1473.7	1473.7	1478.7	1478.7	1476.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1509.7	1513.7	1516.4	1522.8	1515.7
6.89	1587.4	1595.8	1595.9	1607.1	1596.6
13.79	1667.5	1674.8	1673.4	1685.7	1675.3
20.68	1752.5	1758.0	1754.7	1768.3	1758.4
27.58	1828.0	1833.0	1834.5	1841.5	1834.3
34.5	1905.7	1904.5	1918.0	1917.2	1911.3



Table C-21. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8417	0.8417	0.8417	0.8417	0.8417
6.89	0.8466	0.8467	0.8457	0.8462	0.8463
13.79	0.8512	0.8517	0.8504	0.8510	0.8511
20.68	0.8558	0.8564	0.8550	0.8556	0.8557
27.58	0.8601	0.8604	0.8593	0.8593	0.8598
34.5	0.8647	0.8644	0.8638	0.8638	0.8642
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1259.8	1261.0	1262.9	1264.3	1262.0
6.89	1292.5	1294.9	1290.7	1293.8	1293.0
13.79	1324.6	1328.1	1323.6	1326.2	1325.6
20.68	1355.6	1359.9	1354.5	1358.3	1357.1
27.58	1384.0	1387.8	1384.4	1387.2	1385.9
34.5	1414.3	1414.3	1414.5	1414.5	1414.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1335.8	1338.4	1342.4	1345.4	1340.5
6.89	1414.1	1419.8	1408.7	1416.5	1414.8
13.79	1493.6	1502.2	1489.8	1496.7	1495.6
20.68	1572.6	1583.8	1568.6	1578.5	1575.9
27.58	1647.5	1657.1	1646.9	1653.6	1651.3
34.5	1729.4	1728.8	1728.2	1728.2	1728.7
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8275	0.8275	0.8275	0.8275	0.8275
6.89	0.8326	0.8328	0.8329	0.8336	0.8330
13.79	0.8384	0.8379	0.8380	0.8387	0.8382
20.68	0.8429	0.8428	0.8432	0.8435	0.8431
27.58	0.8477	0.8477	0.8478	0.8480	0.8478
34.5	0.8523	0.8518	0.8523	0.8522	0.8522
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1193.0	1195.6	1197.5	1199.0	1196.3
6.89	1227.5	1230.9	1235.0	1239.2	1233.1
13.79	1262.3	1264.6	1269.5	1273.5	1267.5
20.68	1295.3	1297.4	1303.4	1305.4	1300.4
27.58	1326.7	1329.1	1334.4	1335.8	1331.5
34.5	1356.7	1356.7	1364.9	1364.9	1360.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1177.8	1182.8	1186.7	1189.5	1184.2
6.89	1254.6	1261.8	1270.3	1280.0	1266.7
13.79	1335.8	1340.0	1350.6	1360.1	1346.7
20.68	1414.2	1418.7	1432.4	1437.3	1425.7
27.58	1492.0	1497.5	1509.6	1513.1	1503.1
34.5	1568.7	1567.8	1587.7	1587.5	1577.9

Table C21. Continued

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8132	0.8132	0.8132	0.8132	0.8132
6.89	0.8192	0.8195	0.8190	0.8191	0.8192
13.79	0.8249	0.8253	0.8249	0.8248	0.8250
20.68	0.8304	0.8306	0.8300	0.8300	0.8302
27.58	0.8357	0.8357	0.8350	0.8350	0.8353
34.5	0.8411	0.8408	0.8397	0.8395	0.8403
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1131.9	1132.7	1134.4	1136.2	1133.8
6.89	1170.0	1171.9	1172.7	1173.8	1172.1
13.79	1207.2	1209.8	1210.1	1211.0	1209.5
20.68	1241.9	1243.6	1243.1	1244.3	1243.2
27.58	1275.4	1276.4	1275.9	1277.3	1276.3
34.5	1307.9	1307.9	1306.8	1306.8	1307.3
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1041.8	1043.2	1046.5	1049.8	1045.3
6.89	1121.3	1125.4	1126.3	1128.5	1125.4
13.79	1202.2	1207.9	1207.9	1209.6	1206.9
20.68	1280.7	1284.5	1282.6	1285.1	1283.2
27.58	1359.4	1361.5	1359.3	1362.4	1360.6
34.5	1438.9	1438.4	1433.9	1433.5	1436.2

Table C-22. Raw density, speed of sound and isentropic bulk modulus data for Methyl Yellow Grease.

<i>At 20 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8741	0.8741	0.8741	0.8741	0.8741
6.89	0.8780	0.8780	0.8785	0.8783	0.8782
13.79	0.8816	0.8819	0.8825	0.8824	0.8821
20.68	0.8856	0.8855	0.8864	0.8861	0.8859
27.58	0.8893	0.8888	0.8902	0.8897	0.8895
34.5	0.8928	0.8920	0.8939	0.8930	0.8930
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1408.0	1412.5	1407.2	1410.3	1409.5
6.89	1435.6	1440.9	1436.7	1439.9	1438.3
13.79	1462.7	1470.1	1463.8	1467.8	1466.1
20.68	1490.4	1495.9	1490.8	1494.8	1493.0
27.58	1517.1	1519.4	1517.3	1519.1	1518.2
34.5	1543.6	1543.6	1544.1	1544.1	1543.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1732.8	1743.9	1730.8	1738.5	1736.5
6.89	1809.5	1822.9	1813.3	1821.0	1816.7
13.79	1886.3	1905.9	1890.9	1901.0	1896.0
20.68	1967.1	1981.4	1970.0	1979.9	1974.6
27.58	2046.7	2051.9	2049.4	2053.2	2050.3
34.5	2127.4	2125.3	2131.3	2129.2	2128.3
<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8594	0.8594	0.8594	0.8594	0.8594
6.89	0.8637	0.8639	0.8637	0.8639	0.8638
13.79	0.8678	0.8680	0.8681	0.8685	0.8681
20.68	0.8719	0.8722	0.8723	0.8727	0.8723
27.58	0.8760	0.8760	0.8765	0.8765	0.8762
34.5	0.8800	0.8794	0.8804	0.8800	0.8800
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1336.7	1339.5	1335.6	1337.0	1337.2
6.89	1367.6	1371.1	1365.2	1367.8	1367.9
13.79	1395.8	1400.6	1396.0	1400.4	1398.2
20.68	1425.4	1429.0	1425.0	1427.8	1426.8
27.58	1453.9	1456.4	1453.9	1456.0	1455.1
34.5	1481.0	1481.0	1480.8	1480.8	1480.9
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1535.5	1542.0	1533.0	1536.3	1536.7
6.89	1615.4	1624.1	1609.7	1616.3	1616.4
13.79	1690.7	1702.8	1691.7	1703.4	1697.1
20.68	1771.4	1780.9	1771.2	1779.0	1775.6
27.58	1851.7	1858.1	1852.9	1858.1	1855.2
34.5	1930.3	1929.1	1930.6	1929.7	1929.9

Table C22. Continued

<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8451	0.8451	0.8451	0.8451	0.8451
6.89	0.8497	0.8498	0.8498	0.8498	0.8498
13.79	0.8544	0.8548	0.8543	0.8546	0.8545
20.68	0.8589	0.8592	0.8590	0.8592	0.8590
27.58	0.8632	0.8633	0.8635	0.8634	0.8633
34.5	0.8673	0.8670	0.8676	0.8672	0.8673
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1268.7	1268.1	1267.9	1269.7	1268.6
6.89	1300.2	1302.7	1300.1	1301.7	1301.2
13.79	1332.6	1336.8	1331.2	1334.7	1333.9
20.68	1363.4	1367.1	1362.7	1365.6	1364.7
27.58	1392.9	1394.6	1392.7	1394.1	1393.6
34.5	1420.6	1420.6	1420.2	1420.2	1420.4
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1360.4	1359.0	1358.7	1362.4	1360.1
6.89	1436.5	1442.3	1436.3	1440.0	1438.8
13.79	1517.3	1527.6	1514.0	1522.5	1520.4
20.68	1596.5	1605.6	1595.0	1602.2	1599.8
27.58	1674.9	1679.1	1674.9	1677.9	1676.7
34.5	1750.3	1749.7	1749.9	1749.0	1749.7
<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8310	0.8310	0.8310	0.8310	0.8310
6.89	0.8363	0.8366	0.8363	0.8368	0.8365
13.79	0.8413	0.8417	0.8414	0.8419	0.8416
20.68	0.8463	0.8467	0.8463	0.8468	0.8465
27.58	0.8508	0.8510	0.8511	0.8513	0.8510
34.5	0.8554	0.8551	0.8555	0.8554	0.8553
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1203.2	1205.1	1203.6	1204.6	1204.1
6.89	1238.4	1242.1	1239.0	1242.8	1240.6
13.79	1273.0	1275.6	1273.7	1276.2	1274.6
20.68	1306.2	1308.8	1305.9	1308.8	1307.4
27.58	1336.1	1338.3	1337.5	1338.4	1337.6
34.5	1366.1	1366.1	1366.3	1366.3	1366.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1203.1	1206.8	1204.0	1206.0	1205.0
6.89	1282.5	1290.7	1283.8	1292.5	1287.4
13.79	1363.4	1369.6	1364.9	1371.2	1367.3
20.68	1444.0	1450.2	1443.3	1450.4	1447.0
27.58	1518.9	1524.1	1522.6	1525.0	1522.6
34.5	1596.5	1595.9	1597.1	1596.9	1596.6

Table C-22. Continued.

<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.8167	0.8167	0.8167	0.8167	0.8167
6.89	0.8229	0.8229	0.8232	0.8228	0.8229
13.79	0.8283	0.8288	0.8287	0.8286	0.8286
20.68	0.8339	0.8339	0.8340	0.8340	0.8340
27.58	0.8389	0.8389	0.8393	0.8388	0.8390
34.5	0.8437	0.8432	0.8441	0.8433	0.8436
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1142.0	1143.1	1141.2	1141.6	1142.0
6.89	1179.1	1182.4	1179.3	1181.4	1180.5
13.79	1215.2	1219.7	1215.5	1218.5	1217.2
20.68	1250.9	1253.4	1249.8	1253.4	1251.9
27.58	1283.2	1284.6	1282.7	1284.5	1283.7
34.5	1314.0	1314.0	1314.4	1314.4	1314.2
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1065.1	1067.3	1063.7	1064.4	1065.1
6.89	1143.9	1150.4	1144.9	1148.4	1146.9
13.79	1223.1	1232.9	1224.3	1230.3	1227.7
20.68	1304.9	1310.1	1302.9	1310.3	1307.0
27.58	1381.2	1384.3	1380.8	1383.9	1382.6
34.5	1456.7	1455.9	1458.2	1456.9	1456.9

Table C-23. Raw density, speed of sound and isentropic bulk modulus data for N-Octadecane.

<i>At 40 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7719	0.7719	0.7719	0.7719	0.7719
6.89	0.7792	0.7803	0.7788	0.7787	0.7793
13.79	0.7837	0.7843	0.7835	0.7833	0.7837
20.68	0.7880	0.7888	0.7878	0.7873	0.7880
27.58	0.7921	0.7927	0.7918	0.7911	0.7919
34.5	0.7960	0.7961	0.7958	0.7944	0.7956
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1304.7	1305.1	1307.3	1307.3	1306.1
6.89	1337.5	1341.4	1341.4	1347.8	1342.1
13.79	1371.9	1375.2	1376.5	1382.3	1376.5
20.68	1404.5	1408.8	1408.6	1413.9	1408.9
27.58	1435.8	1438.1	1439.5	1443.0	1439.1
34.5	1465.2	1465.2	1469.7	1469.7	1467.5
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1314.0	1314.7	1319.1	1319.1	1316.7
6.89	1394.0	1404.2	1401.5	1414.7	1403.6
13.79	1474.9	1483.3	1484.5	1496.7	1484.9
20.68	1554.4	1565.5	1563.1	1573.8	1564.2
27.58	1633.0	1639.3	1640.8	1647.2	1640.1
34.5	1708.9	1709.2	1718.9	1715.9	1713.2
<i>At 60 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7630	0.7630	0.7630	0.7630	0.7630
6.89	0.7678	0.7688	0.7686	0.7689	0.7685
13.79	0.7728	0.7736	0.7733	0.7740	0.7734
20.68	0.7776	0.7783	0.7780	0.7784	0.7781
27.58	0.7821	0.7827	0.7827	0.7825	0.7825
34.5	0.7865	0.7865	0.7869	0.7861	0.7865
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1233.3	1232.6	1235.0	1237.5	1234.6
6.89	1269.0	1274.5	1271.9	1277.2	1273.2
13.79	1306.9	1311.6	1309.1	1316.1	1310.9
20.68	1342.7	1346.6	1343.9	1350.3	1345.9
27.58	1376.3	1378.9	1378.6	1382.1	1379.0
34.5	1408.0	1408.0	1409.5	1409.5	1408.8
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1160.5	1159.1	1163.6	1168.5	1162.9
6.89	1236.5	1248.8	1243.5	1254.2	1245.7
13.79	1320.0	1330.9	1325.3	1340.6	1329.2
20.68	1401.9	1411.3	1405.1	1419.3	1409.4
27.58	1481.5	1488.3	1487.4	1494.8	1488.0
34.5	1559.1	1559.1	1563.3	1561.8	1560.8

Table C-23. Continued

<i>At 80 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7507	0.7507	0.7507	0.7507	0.7507
6.89	0.7561	0.7563	0.7560	0.7562	0.7561
13.79	0.7616	0.7628	0.7611	0.7613	0.7617
20.68	0.7673	0.7677	0.7662	0.7661	0.7668
27.58	0.7727	0.7720	0.7722	0.7716	0.7721
34.5	0.7768	0.7761	0.7756	0.7752	0.7759
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1165.9	1170.5	1168.1	1173.6	1169.5
6.89	1206.1	1210.5	1206.2	1208.5	1207.8
13.79	1246.5	1252.8	1244.3	1245.1	1247.2
20.68	1275.9	1279.0	1279.9	1282.2	1279.2
27.58	1305.7	1307.4	1312.2	1313.3	1309.7
34.5	1351.1	1351.1	1346.1	1346.1	1348.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1020.5	1028.5	1024.3	1034.0	1026.8
6.89	1099.8	1108.3	1099.9	1104.4	1103.1
13.79	1183.3	1197.1	1178.4	1180.3	1184.8
20.68	1249.2	1255.8	1255.1	1259.5	1254.9
27.58	1317.4	1319.7	1329.5	1330.8	1324.4
34.5	1418.0	1416.6	1405.3	1404.6	1411.1
<i>At 100 °C</i>					
<i>Density (gr/cm<sup>3</sup>)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	0.7388	0.7388	0.7388	0.7388	0.7388
6.89	0.7445	0.7440	0.7450	0.7453	0.7447
13.79	0.7516	0.7505	0.7509	0.7512	0.7510
20.68	0.7564	0.7569	0.7575	0.7575	0.7571
27.58	0.7603	0.7598	0.7613	0.7615	0.7607
34.5	0.7655	0.7646	0.7666	0.7658	0.7656
<i>Speed of Sound (m/s)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	1102.6	1105.9	1103.3	1106.4	1104.5
6.89	1145.4	1147.1	1147.5	1153.0	1148.3
13.79	1193.5	1192.5	1189.1	1194.6	1192.4
20.68	1228.5	1231.8	1230.0	1233.8	1231.0
27.58	1259.9	1262.4	1265.6	1267.8	1263.9
34.5	1293.8	1293.8	1299.4	1299.4	1296.6
<i>Isentropic Bulk Modulus (MPa)</i>					
Pressure (MPa)	I	II	III	IV	Average
0	898.1	903.6	899.3	904.4	901.3
6.89	976.8	979.1	980.9	990.8	981.9
13.79	1070.5	1067.3	1061.8	1072.0	1067.9
20.68	1141.7	1148.5	1146.0	1153.1	1147.3
27.58	1207.0	1210.9	1219.4	1223.9	1215.3
34.5	1281.3	1279.9	1294.4	1293.0	1287.1

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13. ABSTRACT ( <i>Maximum 200 words</i> ) This study measures the isentropic bulk modulus, and speed of sound of biodiesel and the pure esters that are the constituents of biodiesel at temperatures from 20°C to 100°C and at pressures from atmospheric to 34.5 Mpa.				
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