Polymerization Report (Aug 17, 2007)

1st test Home Baked Polymerization test.
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In an attempt to reproduce polymerization, and find a way to stop or dissolve it, I used my oven, some steel bolts and a muffin pan filled with various mixtures. The items used were filtered and dewatered WVO of unknown origin, New rapeseed oil, Stanadyne diesel fuel additive, and #2 diesel. (read an explanation about polymerization at Wikipedia)

1. 10ml WVO
2. 10ml WVO/1ml Stanadyne
3. 10ml WVO/ 1ml diesel

5. 10ml SVO
6. 10ml SVO/1ml Stanadyne
7. 10ml SVO/1ml Diesel

The results of this test, while not strictly in a controlled scientific environment, have been revealing to say the least. This test was performed in hopes of getting some polymerization, and trying to find a way to prevent it. So far it would appear to be a success.

Figure 1: Initial polymerization test. Cups are numbered 1,2,3 across the top and 5,6,7 across the bottom. These were baked for 8 hrs at 350f.

Figure 2: This took place purely by accident. This is the result of further baking at 300 for a few more hours.

In Figure 1 (above) the top row represents filtered and dewatered WVO from my own stock, and the bottom row is new rapeseed oil. After baking for 8 hrs at 350 degrees, the buildup and polymerization on the bolts in cups 1 and 2 were startling. The buildup took place where the oil met the air, and only on the steel. The Aluminum pan was unaffected. The bolts in dishes 3,5,6, and 7 had very minimal buildup and was light in color. It was of particular interest to note that dish #2 that had the Stanadyne treatment developed as much, if not more buildup than the WVO alone. However, the WVO with diesel remained unaffected.

Figure 2 (above). This is where things really got cool. Having thought I had completed my testing, I removed the bolts, catalogued them, then put the pan back in the oven (350°f) for a little bit intending only to warm up the oil to make it easier to clean. When I removed the pan, I noticed a fair amount of crystal structures forming in dishes 1 and 2. Keep in mind, that earlier in the bolt test the formation kept only on the bolt, there was no free floating buildup, or any on the aluminum pan. So at that point I reduced the temperature of the oven down closer to engine temperature of 200°f and let the pan sit for another hou r. There was no discernable increase in the amount of crystals formed. For the next several hours I would raise the temperature by 25°, and let the pan sit for another hour. There was no change until I went from 275° to 300° at which point the entire surface of the oil in dishes 1 and 2 were completely covered. I went ahead and let it bake for another hour, and the polymerized coating only thickened. However, the sample of 10ml/1ml WVO/diesel remained unaffected. Not even a hint of a crystalline formation anywhere. Same goes for all the new oil samples. Although the viscosity of all the samples increased significantly.

There are several conclusions that can be drawn form this, most notably is that 10:1 ratio of diesel prevents polymerization from taking place. Next is that there is either something in, or something missing from the new oil that prevents it from polymerizing also. And that polymerization crystals would appear to attract themselves to the steel bolts. Where no bolt was present they formed in a random pattern and were not apparently attracted to the aluminum.

This is only a single preliminary test, and I will be repeating this again after I return from Vacation, as well as a host of other tests branching off these findings. My single biggest question here is "Why did I only see polymerization at 300℉ and above?" It is well known that this event can take place at much lower temperatures. My suspicions are that it has to do with the Iodine value of the Oil in question, which I will be testing next time as well.

And of course I will be recommending that as a precautionary measure, people mix their WVO at a ratio of 10:1. 100 gallons WVO to 10 gallons Diesel.

1. 10ml Filtered WVO

2. 10ml Filtered WVO
1 ml Stanadyne Diesel Fuel additive

3. 10ml Filtered WVO
1 ml Diesel

5. 10ml New Vegetable Oil (Rapeseed)

6. 10ml New Vegetable Oil
1 ml Stanadyne Diesel Fuel Additive

7. 10ml New Vegetable Oil
1 ml Diesel