

Article from **LUBE REPORT** (http://www.imakenews.com/Ing/e_article002050215.cfm?x=bjfvQ2B,b424vh8T)

March 23, 2011

Biodiesel Dilution Challenges Lubes

By Nancy DeMarco

LONDON – In Brazil, where biofuels are widely used, Ipiranga found that biodiesel accumulation in lubricants affects cold starts, can cause gel formation, requires more antioxidant additives, and shortens drain intervals.

“We need to learn a lot about biofuels and lubricants,” Sergio Luiz Camacho Viscardi, technical manager for fuels and lubricants at Ipiranga Produtos de Petroleo, told the ICIS World Base Oils & Lubricants Conference here on Feb. 25.

Ipiranga, headquartered in Rio de Janeiro, is Brazil’s second largest fuel distributor and third largest lubricants producer and marketer.

Brazil’s Market

Brazil’s GDP grew over 7 percent from 2009 to 2010, and the country now ranks fourth in the world in total vehicle sales (after China, the U.S. and Japan). Vehicle sales grew 10.5 percent from 2009 to 2010, totaling 3.5 million vehicles sold last year.

The motorcycle fleet is large, estimated to total 11 million two-wheelers in 2010, and predicted to top 18 million in 2015.

Brazil currently produces only API Group I and naphthenic base stocks, Viscardi said. The total base oil market in 2010 was 1.3 billion liters. Thirty-nine percent of demand was met with imported base oils.

Turning to finished lubricants, Petrobras has 24.6 percent of the market, he continued. Texaco is second with 15.3 percent, followed closely by Ipiranga with 14.4 percent, Shell with 14.3 percent and ExxonMobil with 14.1 percent.

Brazil’s finished lubricant market is growing at the rate of 3.9 percent per year, and is expected to rise from an estimated 1.45 million liters in 2011 to nearly 1.7 million liters in 2015.

Emissions legislation in Brazil, as in Europe and North America, has had a major impact on both fuels and lubricant quality, said Viscardi. National legislation currently establishes three motor fuels: 1) 25 percent anhydrous ethanol is mandatory in gasoline; 2) hydrated ethanol; and 3) compressed natural gas.

Brazil saw 86 percent flex-fuel vehicle sales in 2010.

Biodiesel and Lubes

Biodiesel offers important advantages over diesel, said Viscardi, including lower levels of emissions, lower soot formation and increased lubricity. But the properties of biodiesel lead to higher fuel dilution levels in the crankcase than mineral diesel.

“Some OEMs have reported 15 percent to 20 percent biofuel dilution at oil drain, and OEMs often reduce drain intervals when biodiesel is used,” Viscardi noted. “In the U.S., over 5 percent biodiesel, intervals drop.”

Ipiranga’s Quality and Applied Technology Center evaluated a methodology to identify biodiesel dilution in lubricants, and its consequences in the real service conditions of vehicles.

The company selected a B5 (5 percent biodiesel) and a B20 (20 percent biodiesel) fuel for its

tests, with an SAE 15W-40 API CI-4/SL lubricant. Using gas chromatography and infrared, said Viscardi, "we found dilution with B20 was much higher than with B5."

Results of Ipiringa Biodiesel Dilution Tests				
Vehicle One: B20 Dilution Results				
Sample	Km oil	% diesel	% biodiesel	% total dilution
Intermediate	11,898	1.0	2.96	3.96
1 st change	35,000	0.8	5.21	6.01
2 nd change	35,600	2.0	7.63	9.63
Intermediate	23,120	1.8	5.11	6.91
3 rd change	35,000	1.6	6.19	7.79
Vehicle Two: B5 Dilution Results				
Sample	Km oil	% diesel	% biodiesel	% total dilution
Intermediate	12,493	0.5	1.64	2.14
1 st change	35,000	1.5	1.11	2.61
2 nd change	37,483	0.1	0.87	0.97
Intermediate	26,333	0.2	0.62	0.82
3 rd change	35,000	0.2	1.87	2.07

"The high boiling point of biodiesel causes its accumulation in the lubricant," Viscardi explained. "The biodiesel at higher temperatures than the diesel forms crystals. When diluted in the lubricant, those crystals affect the cold start property."

In addition, he went on, biodegradability and high hygroscopy are unstable with temperature variations and humidity, and that can cause gel formation.

"Biodiesel from soy has a high content of unsaturated substances, requiring high absorption of antioxidant additives," he said.

Increased biodiesel content in fuels means that new techniques are needed to evaluate lubricant performance, Viscardi concluded. Industry must reevaluate oil change periods, and must look at both base oils and additives, particularly antioxidants, to improve lubricant performance with biodiesel fuels.

Published by [LNG Publishing Co., Inc.](#)

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