

The Solubility of Partial Glycerides (PG) as a Factor in the Blocking of Biodiesel Fuel Filters During Cold Weather

**Presented at the 99TH American Oil Chemists
Society (AOCS) Meeting-Seattle**

May 21, 2008

By

Richard W. Heiden, Ph.D.

R. W. Heiden Associates, LLC

1026 New Holland Avenue

Lancaster, PA 17601 USA

PH: 717 299 6860

FAX: 717 299 6868

www.supersleuthchemists.com

**First Presented at the International Congress on Biodiesel, The
Science and Technology, Vienna, Austria, November 5-7, 2007**

The Solubility of Partial Glycerides (PG) as a Factor in the Blocking of Biodiesel Fuel Filters During Cold Weather-Abstract, AOCS National Meeting-5/22/2008

Partial glycerides (PG's) are formed during the transesterification of triglycerides and frequently remain as residues of incomplete conversion to the methyl esters of biodiesel. As such, PG's represent important impurities that can exert an influence on biodiesel fuel properties. These PG'S represent members of families of similar substances, namely mono and diglycerides, that are defined initially by the feedstock fatty acid fingerprint. The individual substances in each group varying considerably in their solubility with the least soluble of these families being saturated.

We recently reported that the saturated partial glycerides (SPG's) are implicated in a breakout of fuel filter blockages associated with B20 use during the winter of 2005-6 ¹. When analyzed by GC and GC/MS, the B20 associated with these filter blockages had levels of partial glycerides that were near or below total glycerin limits (0.24%). Gel flocs nonetheless formed at 1.5-2C, and when isolated the compositions of the flocs were consistent with that of substances found on the filters, namely SPGs. Among numerous other types of substances that might cause fuel filter blockages, in these instances the SPGs played a dominant role, and defining the solubility properties could help understand the cause of filter blockages.

Monoglycerides are frequently the most prevalent PG in commercial biodiesel, so we experimentally determined the temperature dependence of the solubility of the predominant saturated monoglycerides (SMG's) in various diesel fuels, blends and 100% soy methyl esters. Diagrams of the solubility of SMG's as a function of temperature were constructed and are presented here.

These diagrams indicate that both the temperature and fuel blend composition have a strong effect on the solubilities of SMG's. Near 0 degrees C the SMG's are only very slightly soluble. At a concentration of 0.2% wt monoglycerides total (as glycerin) and 1/5 as SMG, the diagrams predict that the solubilities of the C16 and C18 SMG's are exceeded as temperatures sink below 10 C, considerably raising the total amount of potentially collectable debris on filters.

[¹] R. W. Heiden, "Impurities in Biodiesel that Cause Fuel Filter Plugging During Cold Weather", presented at the International Biodiesel Congress, The Science and Technology, Vienna, November 2-5, 2007.