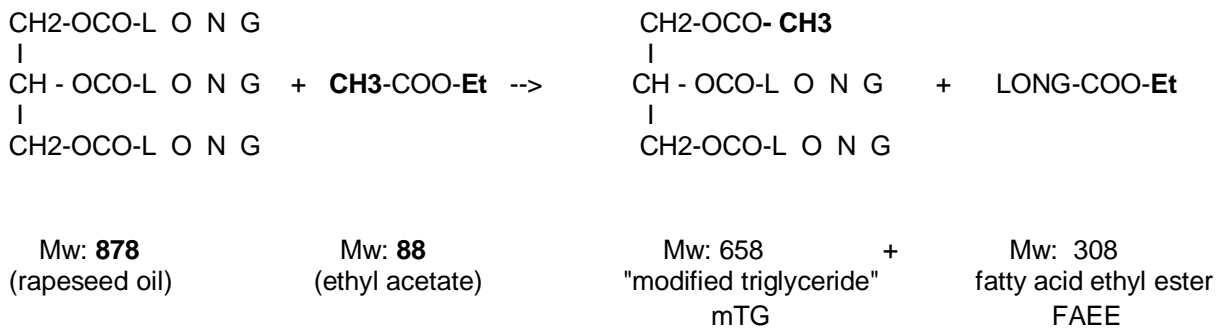


TBK-Biodiesel: a novel 100% green petrodiesel substitute

It is well known from EU directive 30/2009 that blending of conventional biodiesel (FAME) into petrodiesel has been limited to 7% (article [4], Appendix II.) „owing to technical considerations” (article [33]). It is also evident for any professional of the art that „neat” (unblended) FAME’s on account of their high cloud points (this being - 4°C in the case of rapeseed based FAME) are inapplicable in diesel engines in moderate-climate countries. So it seems that the life cycle of first generation petrodiesel both as an additive/substitute has reached the decline stage.

As to the second generation diesel substitutes and relating processes (in general, the BTL processes, e.g. Neste’s NExBTL method, but also biomass-based Fischer-Tropsch syntheses, or pyrolytic procedures, in short: „thermochemical pathways”), have thus far failed to produce viable alternatives, for a variety of reasons (the pertaining products – e.g. „non-ester biodiesel” -- themselves otherwise not being subject to limitations, unlike FAME’s, see again in point [33] of EU directive 30/2009). E.g. consider extreme reaction conditions (energy-intensive, high pressure/temperature parameters, multi-step reactions, isomerisation, use of huge volumes of *fossil derived hydrogen*, cost and recovery cost of precious-metal catalysts, loss of appr. 20% feedstock in the hydrotreatment/pyrolytic process in the form of carbondioxide and water, high investment, equipment and operating costs, etc.). Not to mention the most important fact, that such bioparaffin products – the respective feedstock biomasses having been deprived of their inherent internal oxygen content in the hydrotreatment/pyrolytic processes – will have the same unfavourable emission profiles, as their fossil-derived counterparts (requiring oxygenate additives for improving exhaust gases), such issues having been the very reason previously for propagating introduction of e.g. biodiesel (FAME), this being an oxygenated fuel, owing to the presence of oxygen atoms in the ester linkages.

Now, in view of all this, we are proposing introduction of our novel, 100% green diesel substitute, „TBK-Biodiesel”, an award winning combustible of the 2007 Geneva International Salon of Inventions („Gold Medal”, „Invention of the Year” in Hungary), since then patented in Hungary (HU 226 873), and patents pending in 50 or so countries (PCT/HU 2008/000013). Our feedstock is the same as for FAME (any triglyceride) but we react these high viscosity oils (in themselves unfit for use in diesel engines for this very reason) with 100% bioderived ethyl acetate (as against *fossil derived methanol* in the FAME processes), whereby we partially exchange the original long (C16 –C24) acyl chains of oils bound to the glycerol backbone, for acetyl (C2) chains, affording modified triglycerides („light oils”) with amply reduced viscosities, the displaced long chains forming at the same time ethyl esters of fatty acids (FAEE’s), these latter themselves long known and approved as diesel biofuels. So there is no glycerol formation, as the glycerol backbone has been retained, moreover on account of incorporation of the ethyl acetate moieties into the fuel, from one unit of feedstock oil we get 15 – 20 % more fuel. That is:



T B K - B i o d i e s e l

So every atom of feedstock oils is turned into fuel, with no glycerol byproduct, no wastes, our fuel having superior fuel properties over conventional biodiesel (FAME), e.g. our cloud point (with rapeseed feedstock) being – 13°C, our iodine number 90 - 95 (always necessarily lower than in the corresponding FAME, on account of „dilution of double bonds” with the incorporation of ethyl acetate moieties), our oxidation stability being 11.6 hours (as against < 6 hours with FAME), our specific gravity being 0.915 (FAME: 0.88), making our volumetric energy density practically the same as that of petrodiesel (specific gravity here being 0.83), etc. And on account of retention of the glycerol backbone, our internal oxygen content is 30% higher than that of FAME, resulting in superb emission profiles as against gas station petrodiesel, used as control fuel in our engine and emission tests, performed in an accredited laboratory (see link of our website). So fuel properties of TBK-Biodiesel render this renewable fuel applicable in diesel engines *in unblended form* as well (as TBK100).

May we point out here some most important aspects concerning our emissions: we have 75 – 80% less smoke, than petrodiesel, less NOx (nitrogen oxide) and HC (unburnt hydrocarbon) emissions, all most important aspects in city transport. Please see our diagrams, but kindly note that they were plotted on mass basis (as function of grams of fuel consumed), but owing to TBK’s much higher specific gravity, on volumetric basis, i.e. „mileage with one tanking”, we are very near to petrodiesel, that is our volumetric energy density is just a few percent behind.

We also emphasise here that our production costs are 5 – 10% below that of conventional biodiesel, we can produce TBK-Biodiesel in operating FAME plants (after some modifications) or in closed-down BD plants (with some revamping). Owing to absence of the glycerol side-streams, our investment costs are appr. 30% lower than those of conventional BD plants, etc.

Finally we wish to stress that EU directive 28/2009 expressly and explicitly supports R&D work on „novel fuels and technologies” (see articles [13, 14, 22, 29, 42, 66, 89, k]), that is, our novel, 100% sustainable petrodiesel substitute falling into this recommended category.

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