經濟部暨所屬機關因公出國人員報告書
（出國類別：赴德國考察國外實施生質柴油現況）

報告書

出 國 人：服務機關：中油公司總公司
職務：
姓名：谷家嵩、徐武永、
張慶賢、高樹義、劉榮宗
出國地點：德國
出國期間：95 年 10 月 31 日至 11 月 9 日
報告日期：　96 年 1 月 25 日

目　錄

一、前言

依能源局 2005 年 11 月 15 日能技字第 09404014800 號函要求本公司配合執行生質柴油摻配計劃，配合本計畫本公司成立生質柴油推動摻配小組因應，由於生質柴油為非石油系統類產品，雖和石化類柴油可完全互溶，但由於生質柴油分子具不飽和鍵，儲存中極易氧化形成不溶性之膠化物，尤其儲存系統或引擎油路系統含特殊之金屬如銅類等更甚，此些氧化物易致堵塞車輛引擎燃油系統之過濾器及在柴油噴射系統產生積碳物，另由於生質柴油為由動植物油脂經轉化成低分子之單甲基酯化物，本質上極易經自然界之細菌分解產生膠化物，且由於本物質為含高量不飽和物質，儲存中極易氧化產生膠化物，此兩種生質柴油物化性原因造成生質柴油應用上甚多之困擾。另外生質柴油為極性化合物和現行石化柴油互溶相當好，但為極佳溶劑，因此在使用之初對原留存於儲槽中某些積碳物之溶解性極佳，因此由石化柴油轉存生質柴油或摻配生質柴油之油料儲槽需作適當之處裡。

二、參訪目的

本公司接獲能源局之要求，經多次討論，規劃推動摻配，但由於生質柴由尚存如下之疑問：

1、生質柴油（5%以下）之運輸作業

自港口運輸至煉油廠或油庫，及煉油廠與油庫間，相關油輪運輸、長途管線輸送。

(1). 可否與石化汽油、石化柴油、酒精汽油共用管線輸送。長途管線輸多種油料之先後次序、切轉方法及混合油量可容許比例為何。

(2). 長途管線管輸生質柴油後，對後面頂油之其他油料之品質有何影響，處理作業程序為何？

(3). 長途管線內部累積之沉澱物，管線輸油初期是否可能逐步溶解該物質造成管線堵塞、引擎油路過濾器堵塞、或油料劣化等問題。若是，則事先防範及事後處理作業程序為何。

(4). 長途管線底部沉澱水是否會生物分解酸化物質，造成管線與油槽腐蝕及堵塞，或油料劣化等問題。若是，則事先防範及事後處理作業程序為何。

(5). 船艙儲存生質柴油、石化汽油、石化柴油、酒精汽油等多種油料之先後次序、切轉方法及混合油量可容許比例為何。

(6). 原輸儲生質柴油之船艙換儲其他油料時，是否需洗艙，品管作業程序為何。

(7). 油輪輸儲生質柴油，有否氧化安定性及含水劣化之虞。

(8). 相關輸儲設備與輸儲石化汽柴油有何差異，及應注意事項為何。

(9). 生質柴油是否會因油輪海上運輸發生油料品質不符合規範，或劣化致不能使用之情況。若發生上列情況，處理作業程序為何。

2、生質柴油（5%以下）之收油作業

長途管線輸油作業

(1)、若發油單位用油槽摻配方式摻配成生質柴油，並經檢驗符合該油料規範後，將合格檢驗報告送收油單位，再泵輸收油單位，其收油前、收油中、收油後之作業品管程序與石化石油差異為何。

(2)、若發油單位用線上摻配方式泵輸至收油單位，與輸送成品油不同，其收油前、收油中、收油後之作業品管及檢驗項目與方法為何，如何確認油料合格，若於收油作業發生油料不合格，處理作業程序為何。

油輪運輸作業

(1)、若發油單位以油槽摻配方式摻配成生質柴油，並經檢驗符合該油料規範後，再泵輸卸入船艙，並於船艙取樣，將合格檢驗報告送收油單位，經海上運輸至收油港收油單位卸收，其收油前、收油中、收油後之作業品管及檢驗項目與方法為何,與輸儲石化油化有何差異。

(2)、若發油單位以線上摻配方式泵卸入船艙，運至卸油港，其收油前、收油中、收油後之作業品管及檢驗項目與方法為何，如何確認油料合格，若於收油作業發生油料不合格，處理作業程序為何。

(3)、生質柴油是否需經水份處理裝置或其他特殊裝置後收入油槽。

(4)、原輸儲石化柴油之儲槽換儲生質柴油，及管線第一次輸送生質柴油之作業，應預先做何處理及相關作業程序為何。

3、生質柴油（5%以下）之儲存作業

(1)、石化柴油油槽是否適用，及內部鋼板是否須塗佈特殊內襯。

(2)、油槽頂部是否需設置空氣呼吸乾燥處理裝置。

(3)、油槽內底部水份，需作何特殊排水處理，所需設備為何。

(4)、收入油槽後，除原石化柴油檢驗項目外，須增加哪些檢驗項目及方法。

(5)、儲存有效期限及相關品質管制之處理程序，與輸儲石化油料差異為何，是否有油料被氧化、產生膠狀物質或酸化物質等劣化之虞。是否需另加其它添加劑如抗氧化劑、殺菌劑、流動點降低劑、清淨添加劑及潤化性添加劑等？其劑量如何？添加地點？

4、生質柴油（5%以下）之摻配作業

(1)、以生質柴油 B100 或 B50 或 B20 摻配成 B1 或 B2，何者最適，如何抉擇，其評估基準為何。

(2)、B1、B2 或 B5 之濃度含量分析方法。

(3)、以線上、槽內或槽車等方式摻配，如何抉擇，其評估基準為何。若在灌口點添加，其摻配後之品質如何確認後出貨，相關品管及檢驗項目與方法為何。

5、生質柴油（5%以下）之其他作業事項

(1)、油槽、管線、泵浦、灌裝流量計、灌裝臂、過濾器、及油封等相關輸儲設備之材質、結構等規範與現有石化柴油泵輸設備差異為何，及是否須另設置其他處理設備。
(2)、海運或漁船用油之適用性，否則有何改善方法。
(3)、消防系統規範及用劑，與石化柴油油槽差異為何。
(4)、工安衛生事項與石化柴油油槽差異為何。

三、生質柴油物化性問題

生質柴油為由蔬菜油、動物油脂或廢沙拉油等經轉酯化所產生之油料，此等油料含高量不飽和物質，極易氧化及生物分解產生膠狀物質堵塞過濾器及造成引擎噴嘴積碳等客訴案，如長時間和水接觸其界面極易產生生物分解產生酸化物質(文獻報告 28 天內可分解 85%以上)。生質柴油如由廢沙拉油或非精製油脂產製，則由於含高量雜物或游離酸，所產製之生質柴油如無進一步處理，極易造成客訴案件。

本公司長途管線為舊有設備，長年可能累積高量之沉澱物，生質柴油為極佳之溶劑，極易溶解附著管壁或槽壁之沉積物，管輸初期可能逐步溶解此些物質造成引擎堵塞等客訴案，另長途管線沉澱水亦會造成生物分解酸化物質，造成管線腐蝕及堵塞等問題。

依文獻報告生質柴油之推廣，如輸儲管理得當則市場之客訴案極少發生，歐洲生質柴油執行極少發生客訴案，但管理不良則客訴案極易發生，如 Minnesota 州 2005 年 9 月起執行 B2 卻發生客訴案高達 62%，主要問題點為油路過濾器發生阻塞，經查主要發生在生質柴油反應不完全含高量之甘油所造成。

生質柴油為由蔬菜油或動物油脂經和甲醇反應，轉酯化成低分子量之有機酸甲酯，其物化性能和柴油相似，自 1983 年由奧地利研發成功，歐洲各國即以不同比例摻入柴油使用或直接使用於現行柴油車而引擎不必經任何修改，自 2005 年起歐洲執行 B2 計劃，美國執行 B20(超柴 80%+生質柴油 20%)廣範使用於公務車輛。依國外經驗，生質柴油摻入柴油之點有煉油廠、油庫及加油站（加油機販售 B100 供客戶自摻或直接使用）等三地點，其中以油庫灌島前以大槽預摻或線上注入油罐車等兩方式較常見，由於生質柴油產量少，因此，以地下管線傳輸較少見。

四、訪問單位

1、 參訪 AGQM 公司

AGQM(Association for the Quality Management of Biodiesel)為 1999 年成立，其宗旨為生質柴油品質管制之組織，作為協助生質柴油工業促進生質柴油市場化，成立之前為由 UFOP（Union for the Promotion of Oil and Protein Plants, Berlin）和福斯汽車公司洽談生質柴油品質不足作為車用燃料事宜中成立之組織，目前該組織已為生質柴油生產單位、儲存單位及加油站等單位之品質執行及品管組織。

該組織接待人員 Dr. Haupt 為國際知名之生質柴油專家，曾多次發表專文於文獻中，11 月 2 日早上 Dr. Haupt 特意為本公司參訪人員進行 3 小時之專題報告（簡報資料參見附件），名為「The German biofuel market – status, perspectives and quality aspects」，其內容分別如下五項議題；

(1) Political frame conditions in Germany
(2) Recent market situation and potentia
(3) Quality requirements for Biodiesel
(4) Quality assurance system – practical solutions
(5) Need activities and outlook

本次與Dr. Haupt討論之重點摘錄如下：

Dr. Haupt認為生質柴油只要合乎EN14214之規範，儲存或使用中只要不含水分，即可確保生質柴油或摻配油之品質，有關詢問加油站使用品質商是否有品質客訴案件？Dr. Haupt答未聞有生質柴油劣化問題。

依Dr. Haupt 之專業如有品質問題時該如何處理劣化之生質柴油或摻配油料，Dr. Haupt回答由於生質柴油遭生物分解所產生之劣化物僅存在油水之界面，其它油相中之油品仍為合乎規範之油品，因此可僅截取此部分之油料送鍋爐燃燒。

Dr. Haupt討論到生質柴油品質問題，提出如下之規範比較表，原則AGQM所管制者為使用端之規範，而歐規EN14214所管制者為生產端，原則上生產端和使用端之品質尚有儲存時間上之差異，為保護消費者之權益，AGQM所提出之規範甚至較EN14214為嚴格。下表一中水分含量較歐規之500mg/kg還低，規範中要求生產者低於220mg/kg，而要求所有會員需低於300mg/kg，另全污染物為20mg/kg低於歐規之24mg/kg，氧化穩定度為6小時，但檢測點為使用者端之氧化穩定度而非生產者之新品，低溫流動點要求之時間管制點為每年10月19日前提前歐規之每年11月16日，另一重要之規範為要求所有生產者必須添加抗氧化劑且必須隨油品出廠報告中明示。

表1 AGQM要求規範和EN14214之比較表

QM concept: additional requirements

▶ related subjects: - Production (including raw materials) - Loading - Transportation - (Intermediate) storage	▶ Requirements exceeding the DIN EN 14214 ▶ will be adapted on new requirements permanently

Property	Unit	Limits		Responsible:	Method
		min.	max.		
Water content	mg/kg		220 300	Producers All members	EN ISO 12937
Total contamination	mg/kg		20	All members	EN 12662
Oxidation stability, 110 °C	h	6*		All members	EN 14112
CFPP: 19/10 to 28/02 (in leap years to 29/02)	°C		-20	Producers	EN 116
Fatty acid profile	% (m/m)	like rape seed		For selling at public pump stations	EN 14103

* Biodiesel producers have to add and to declare oxidation stabilizers.

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Berlin 02/11/2006 The German biofuel market – status, perspectives and quality aspects

詢問Dr. Haupt有關近期美國Minisoda州執行B2期間所發生生質柴油品質問題，由於美國NBB報告該州自2005年9月執行B2生質柴油後，發生生質柴油品質客訴案，該報告認為主要原因為生質柴油內含反應不完全之甘油脂所造成，但Dr. Haupt卻認為是生質柴油氧化穩定性問題，而非報告之生質柴油中含甘油所致。

Dr. Haupt會後建議本公司可加入AGQM，加入後可資料共享，AGQM每年定期召開會員大會，本年度年會預計2006年11月25日於召開(邀請函及會議程如附件)，會員年費約700歐元。

2、參訪 BMV 公司

BMV公司（B.M.V. Mineralol Versorgungsgesellschaft mbH）為坐落於東柏林郊區之一小型汽柴油料摻配工廠，其員工人數為8人，該公司1984成立至今已屆23年，負責管理該工廠之人員為Mr. Tormaso自成立以來即在該公司工作，Mr. Tomaso原為設計鑽頭之機械工程師，該廠成立以後即為公司挖角管理該公司，該公司所有之摻配系統採自動摻配，汽柴油原料為由鄰近之煉油廠購買柴油或汽油，同時亦購買汽柴油摻配基礎油自行摻配，而生質柴油則採合約方式和協力廠商採購，生質柴油或生質酒精等品質保證皆由生產廠負責。Mr. Tomaso談及幾乎未發生過生質柴油不合格之情事，只有在初期推出時，因未專車裝油、車櫃未清洗等原因，以致發生油料不合格，改善後即未再發生。油料儲存發生油料不合格時，分層取樣，已變質的部份抽出分析後回廠或分批降級處理，未變質的再摻配處理成合

格油料等方式處理。
生質柴油原料購入後，取樣保存三個月，並作室外保存，依Tomaso先生之口述，該公司所購入之生質柴油儲合乎EN14214外，生產廠商必須加入抗氧化劑，因此該公司購入之生質柴油皆有含抗氧化劑，圖1中為該公司樣品式外儲存之地點和本公司參訪人討論情景，圖示中白色樣品瓶中所裝之油樣為Palm Oil之生質柴油(時序室外溫度約為8℃)，右下方照片之樣品為Rapseed 生質柴油。

圖1 BMV公司生質柴油B100儲存場所

依Mr. Tomaso講述目前德國市售之柴油中，B100部分不得使用Rapseed油品以外之生質柴油，但柴油油品含5%之生質柴油，可使用其他生質柴油油品，其中包括Palm Oil之生質柴油，由於Palm Oil之生質柴油之Pour Point高，因此BMV在摻B5時Palm Oil之生質柴油含量僅摻配1%以降低成本(由於Palm Oil之生質柴油相對較便宜)。
原料生質酒精或生質柴油及摻配後之油料儲存皆採氣密處理以防止濕氣進入，亦就是油槽上方加入氣管密封，油槽進油或發貨時氣體壓力固定，氣體成分Mr. Tomaso並未告知，油槽底部採V型設計一方面降低油面和水接觸之面積，另一方面油槽排水較易，底部下端增加一高度為2~5公分之真空室，內裝氣體HC分析偵測器以偵測油槽溢漏。值得一提者為該公司油槽標準體積為2000公秉，皆採直立式儲槽，亦就是底面積小，另外外殼之顏色均為白色，以防止夏天太陽光照射產生表面局部高溫(Mr. Tomaso談及該公司油槽表面最高溫度約為35℃)。

3、 參訪 Mitsubishi 及 Mitsui 公司

Mitsubishi及Mitsui公司為日系公司，由於生質柴油在歐洲成功之推廣，因此該兩公司在歐洲之分公司能源業務部門亦投入生質柴油之業務，該公司在歐洲之主要業務為代理歐洲生質柴油之產品行銷各國，同時在東南亞籌建生質柴油工場，準備行銷日本及亞洲各國。
Mitsubishi在歐洲之業務人員Mr. Martin出面接待本公司參訪人員，同時簡報該公司在歐洲之業務及歐洲生質柴油之現況(參見附件)，另案日本總公

司人員Miss Suzuki亦訪問本公司,報告該公司目前在馬來西亞建立一年產10萬噸之生質柴油工廠，預計2007年9月完成，該公司產品準備行銷日本亦可銷本公司,目前該公司有一協力廠商在日本千葉縣有生產生質柴油，如本公司目前需要該公司亦可由該廠產品行銷本公司。

Mitsui公司和Mitsubishi公司一樣,投入生質柴油行銷業務,主要為代理歐洲相關生質柴油工廠之產品行銷世界各國,目前該公司有生質柴油工程技術可販售。

目前日本政府對生質柴油之態度為僅制定B5之油料規範，而B100日本政府採取不制定而由JASO(日本油脂協會)制定。

4、參訪 SAUTER 公司

SAUTER集團為坐落於東德和波蘭邊界之工廠，該集團有一煉油廠名為PCK煉油廠，進料原油來自俄羅斯，原油年進料量約為4千萬噸，為屬於德國境內第三大煉油廠。

配合該公司執行生質燃料計畫,鄰近該煉油廠設立年產量15萬噸之生質酒精及15萬噸之生質柴油等兩廠,其中生質酒精係以小麥為原料採濕式發酵法生產酒精，小麥經磨碎成粉後再以水浸置，再放入發酵槽發酵，發酵原液在經蒸餾脫水產生無水酒精供應煉油廠所需,期間自進料至無水酒精產生約為57天。而生質柴油工廠係以粗菜籽油(Crude rapseed oil)為進料，經脫膠處理成精製之菜籽油，而以甲氧化鈉($NaOCH_3$)為觸媒，將純化後之菜籽油轉酯化成甲基酯(FAME)，以上兩種生質燃料則直接管輸(短程)供應鄰近之PCK煉油廠摻配成B5或E5等油料供售，生質柴油該公司提及添加流動點降低劑(pour point depressant)及抗氧化劑。

PCK工廠技術經理 Mr. Andre Hamerla表示該公司自1959年籌建，1960年投入基礎建設，1964年4月第一批原油投產，1966-1969年逐步增加原油蒸餾、汽柴油及氣體燃料之生產，在2003年開始規劃投入生質燃料方面之產品，至2005年完成生質柴油及生質酒精之摻配工程,相關生質燃料計畫總費用之投入達1.05億歐元，包括MTBE轉換成ETBE製程、ETBE新生產工場、生質柴油摻配計畫、酒精汽油摻配計畫及生質柴油生產工場之計畫等工程，其中值得討論者為PCK酒精汽油摻配計畫之投入額約為4百80萬歐元，而生質柴油之摻配計畫投入額為4百萬歐元。

生質燃料於煉油廠內直接線上摻配，於該工廠Terminal化驗合格後，以車輛、火車、及內陸舶船等輸送至客戶，該工廠亦使用長距離管線輸送摻配油料B5柴油及E5汽油至批發廠，距離達200公里以上，該管線輸送多種油料時，採用油料比重方式切割油料，與石化油料輸送並無甚差異，但詢問該工程師管線約3個月清洗一次。

5、參訪 RBE 公司

REB公司（Rheinische Bio Ester GmbH & Co. Kg）為座落於杜塞道夫之一生質柴油工廠，目前年產生質柴油15萬噸，主要客戶為歐陸各國，生質柴油產品輸出方式為以油罐車、火車及舶船等。由於生質柴油需求旺盛，因

此該公司目前規劃擴建，增加一年產15萬噸之工場，據該公司技術經理Mr. Anton Jarec稱新工場預計半年內可完成（據瞭解生質柴油工場本身複雜度不高，工場主要為套裝設備因此建廠時間較短），屆時該公司生質柴油產能將達30萬噸，為世界少有之大型生質柴油生產工廠。

Mr. Jarec稱REB所生產之生質柴油僅添加流動點降低劑，並未添加其他任何添加劑包括抗氧化劑，其進料為鄰近（河對面）蔡仔油工場所生產之粗菜仔油為進料,經脫膠純化成精製油後在和甲基氧化鈉混合在適當之溫度下進行轉酯化反應(反應溫度約為50℃)，反應採半連續式三槽反應，粗產品在經分離、清洗及脫水純化等步驟完成生質柴油之生產，圖2照片遠方建築物為該公司生質柴油生產場外觀，而照片左前方平地為新工場預定地，該工場採三樓建築，原料粗菜籽油於樓下一樓脫膠處裡成精製油後，再泵上三樓儲存，觸媒甲氧化鈉儲存於三樓，轉酯化反應在三樓反應後，反應粗產物在二樓進行清洗、乾燥等系列程序完成生質柴油之生產。另外粗甘油亦在二樓以真空蒸餾方式純化成醫藥級甘油再販售。圖3為生質柴油自原料菜仔至生質柴油之樣品式意圖，圖3中左方依序為粗菜仔、菜仔、菜仔油、轉酯化反應粗產品、清洗後及生質柴油等。

圖 2 RBE公司生質柴油外觀

圖 3 生質柴油原料及產品示意圖

6、參訪加油站

德國目前共約有三萬座加油站，其中國際性集團公司如 ESS0、BP(ARAL)占有率約 4 成，其餘為當地國內油品公司所屬加油站。本次行程共參觀 3 座加油站，分別為 ESS0、BP(ARAL)及 GROSSTANK 各一家，

參觀心得分述如下：

(1)、德國加油站生質燃料之發展：

有關德國加油站生質燃料之發展，生質柴油(Biodiesel)係從 1999 年開始，酒精汽油(Ethanol blend)則是 2003 年籌備，於 2004 年加油站開始銷售，除 100%生質柴油外，無論 5%生質柴油(B5 柴油)或 5%酒精汽油(E5 汽油)，銷售時並不單獨增加油品項目，仍然以原有油品項目(無鉛汽油、柴油)銷售。B5 柴油或 E5 汽油推行之初，為推動順利，德國政府或加油站並不明顯告知顧客 B5 柴油或 E5 汽油與一般汽、柴油有甚麼不同，顧客只須與平時使用一樣柴油或汽油即可，顧客車輛亦不需做任何改裝。同時 E5 汽油成分，初期亦以 EBTE 代替 MBTE 減少車輛不適應性，未來再以酒精來更換。惟顧客使用 B100 柴油時則顧客車輛油箱、管路必須有防蝕之功能，目前因 B100 柴油油價最低，以農業車使用最多。

除 B100 外不增加油品項目

至於加油站設備部份，因酒精親水性特強，防水設施最為重要，舉凡油槽、管線及油氣回收等必須做好防水措施，以保障油品質之良好。銅質材質對酒精影響最巨，因此加油站設備若有銅質材質，則絕對不得使用。加油站油槽內裝亦不能 COATING，若有 COATING 則必須刮除；儲存 100%酒精或生質柴油之設備則必須以不銹鋼為材質。


B100 農業車使用最多

目前德國政府並無強制該國油品公司必須於加油站銷售生質燃料，而是運用稅率的不同，鼓勵油品公司改售生質燃料。也因如此國際性集團公司如 ESS0、BP(ARAL)至今仍未銷售生質燃料。德國生質燃料銷量亦僅佔整體燃料銷量之 3.4%，為了改善此狀況，德國預計明(2007)年將提高稅率以增加生質燃料銷售量(如表一)。

ESSO、BP 至今仍未銷售生質燃料

表一：油品價格

油品項目		2006 年 單價(L)		2006 年 稅(L)		2007 年 稅(L)	
		歐元	新台幣	歐元	新台幣	歐元	新台幣
Benzin	92 無鉛汽油	1.059	45.01	0.65	27.63	0.65	27.63
Super	95 無鉛汽油	1.159	49.26	0.65	27.63	0.65	27.63
Ultimate100	100 無鉛汽油	1.179	50.11	0.65	27.63	0.65	27.63
Diesel	柴油	1.059	45.01	0.17	7.23	0.17	7.23
Ultimate Diesel	超級柴油	1.139	48.41	0.17	7.23	0.17	7.23
B100	100%生質柴油	0.99	42.08	0.09	3.83	0.09	3.83
B5	5%生質柴油	N\A	N\A	0.15	6.38	0.17	7.23
E5	5%酒精汽油	N\A	N\A	0	0	0.65	27.63
E85	85%酒精汽油	N\A	N\A	0	0	0	0

(2)、德國加油站之概況：

德國目前約三萬座加油站，因加油站人員操作費用高，幾乎都是顧客自助加油或洗車，工作人員僅負責加油收費或兼顧便利商店銷售及收銀。

連女性顧客都是自助加油

工作人員僅負責便利商店銷售及收銀

由於是德國民眾普遍習慣自己操作加油，因此對加油站加油設備均非常了解，加油站之設備也清楚標示。

為方便顧客清理愛車，加油站提供自助清潔工具：

提供加水充氣機及除塵機

提供車窗刷子、擦手紙

自助洗車：

自助洗車在德國亦非常普遍，為顧慮安全相關進出均有程序管制，以下為 ESSO TIGERWASH 操作程序。

1. 顧客先購買預付卡後輸入編號

2. 前洗車門自動開啟，顧客將汽車駛入洗車場

3. 前洗車門自動關閉，汽車駛入洗車機清洗

4. 汽車清洗後，後洗車門自動開啟，離去後關閉

五、心得與建議

1、為確保使用之生質柴油品質，使用前生質柴油必須符合EN14214或ASTM D6751等規範始得使用。

2、依國外經驗，輸儲系統保持無水狀態則能確保生質柴油之品質。

3、為防止水分之污染，本公司油槽建議需做適當修改。

4、國內氣候環境為高溫潮濕氣候，為確保儲存及使用B1油品之品質，建議應添加抗氧化劑及清淨添加劑。

5、國內執行摻配生質柴油，由於國內耕地有限原料生產不足供應未來之需求，因此生質柴油之供應有賴政府積極規劃。

6、生質柴油化驗報告最重要項目為乾淨度、水含量、酸指數、氧化隱定度等，除原廠化驗報告外，卸收前先檢驗乾淨度、水含量、酸指數等項目。

7、工廠油槽容量大都為數百公秉至2000公秉，摻配油料週期大約7天以內。油槽底部為"V"或"/"型，隨時排淨水份，無積水情形。油槽內頂部空氣採油氣密閉循環系統，亦無溼氣水份進入槽內情形。酒精汽油錐頂油槽尚有攪拌機裝置，以處理摻配不均勻現象。

8、油料輸送方式大都為內河船運（載運量約為1000~1500KL）、拖車（載運量火車約為120KL、汽車約為30KL），但有以管線方式輸送，B100尚有2KL油櫃方式運送。

9、油料輸送方式係以輸送量規模考量，若需求量大，輸送距離長，則以管線輸送為經濟有效。美國Countrymark公司已於2006年7月第一次成功地以管線運輸B5生質柴油，管線8-inch、管長175-mile、維時72-hour ，該公司並表示 "First, it means we're safely, efficiently and economically distributing a premium blended product in most controlled manner possible…Second, it means that we now operate the nation's first private pipeline network that has proven it can handle biofuels."，德國工廠表示亦使用長距離管線輸送摻配工廠油料至批發廠，該管線輸送多種油料時，採用油料比重方式切割油料，與石化油料輸送並無甚差異。

10、本次參訪協會機構與工廠，以生質柴油生產及摻配工廠為主，酒精汽油部分相關研討甚少，建議需進一步參訪研討。

11、德國政府或加油站，推行之初並不明顯告知顧客B5柴油或E5汽油與一般汽、柴油有甚麼不同，顧客只與平時使用一樣柴油或汽油即可，前述方式值得參考採行，可必免顧客產生疑慮，對我國政府生質燃料政策推動、各油公司加油站設備改裝及人員執行將會更順利。

12、德國因加油站人員操作費用高，幾乎都是顧客自助加油，約98%加油站一位工作人員負責加油站安全、收費或兼顧便利商店。雖然也有少部分不肖顧客加油後，不繳錢偷偷離去。德國加油站自助加油採顧客先加油後，自動至營業室繳款方式，操作程序簡單，加上良好監控設備管制，值得本公司推動自助加油時之借鏡。

13、汽車隧道式自助洗車在國內仍屬少見，未來加油站人員操作費用可能不斷提高，值得引進以減少操作成本之過度付出。

附件 一 AGQM資料

1. Dr. Haupt 簡報資料
2. Running vehiclessuccessfully on bio-diesel
3. Instructions for the transport of Biodiesel
4. Instructions for the handling with Biodiesel in own consumption filling stations
5. Instructions for the handling with Biodiesel in filling stations
6. Truths about Biodiesel
7. International Conference for Biodiesel Producer

The German biofuel market – status, perspectives and quality aspects

- Political frame conditions in Germany
- Recent market situation and potential
- Quality requirements for Biodiesel
- Quality assurance system – practical solutions
- Need activities and outlook

Who is AGQM?

- Founded in 1999 as a quality management organisation for the Biodiesel industry to improve the market situation

- Foundation was initiated by a conversation between VW and UFOP about the insufficient Biodiesel quality situation: VW announces, that the continuation of the Biodiesel release policy will depend from the improvement of the Biodiesel quality level in the market.

- **Today:**

  -Implementation and verifying of a QA system for Biodiesel in Germany applied beginning from the production over the storage companies to the petrol stations

  -Support of R&D in all fields leading to an estate property level for Biodiesel

  -Knowledge base for the application of Biodiesel

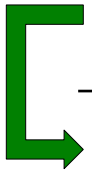
EU Promotion Directive for Biological Fuels 2003/30/EC

- Target quantities not mandatory - 2005: 2% until 2010: 5.75%
- no minimum admixture / allocation of biomass to other fields energy production is possible to reduce the national biofuel target
- **Reporting on environmental effects**
  - area usage, degree of intensity of cultivation, use of pesticides, ground water protection, efficient energy exploitation, potential greenhouse emission, combustion behaviour
  - must be published
- Overall ecological balance determines suitability for promotion / environmental tolerance investigation
- Empowerment to introduce different tax tariffs for biological fuels according to ecological criteria

EU-Directive for Biofuels 2003/30/EG
Actionplan of the EU-Commission

- Biodiesel in Germany

	2005	2010
Target Quantity	**2 %**	**5.75 %**
Diesel Consumption [1]	**30.1 Mio. t**	**30.8 Mio. t**
Biodiesel [2]	**0.70 Mio. t**	**2.06 Mio. t**
Production Capacity [3]	**2.00 Mio. t**	
Area demand [4]	**1.43 Mio. ha (1.25 Mio. ha)**	



Reference: D. Bockey, UFOP

[1] Association of mineral oil industry (MWV)

[2] Basis: Heating value of Diesel: 43 MJ/kg, Heating value of Bio Diesel: 37 MJ/kg

[3] Proportionate, estimated

[4] Basis: Production Capacity, Average Yield Biodiesel 1,4 t/ha (1,6 t/ha)

EU energy tax directive 2003/96/EC

Empowerment of the member states:

Tax tariffs for energy products, electricity => reduction to zero

- **Article 16:**
- **Listing of biological fuels:**
  - **Biodiesel according to CN codes 382490/55/80 or 99 for the biomass proportion**
- **Definition of biomass**
  - **Biological waste (vegetable and animal wastes) from forestry and corresponding industrial wastes, biologically degradable proportion of industrial and municipal wastes**
- **Tax credits must not exceed the mineral oil duty share of the respective complementary mineral oil fuel**
- **Tax credit to be adjusted in the case of overcompensation**

Changes in mineral oil duty laws (2004)

Tax credits for biological vehicle or heating fuels

•Mineral oils with tax credits to the extent in which they are proven to contain biomass/biofuels until December 31st 2009

- **Proof is mandatory**
- **Application as credit or refund**

⇨

Biological vehicle or heating fuels defined according to the Biomass Ordinance

- **the proportion of biomass is decisive for the tax credit**
- **exception (!): "Fatty acid methyl ester gained by esterification of vegetable or animal oils and fats applied as biological vehicle or heating fuels"**
- **Bioethanol = alcohol content min. 99 percent non-denatured**

Changes in mineral oil duty laws (2004)

Tax credits for biological fuels

Condition: No overcompensation of the additional costs of manufacture

involved:

BMF = German Ministry of Finance
BMWA = German Ministry for the Ecomony and Labour
BMELV = German Ministry for Nutrition, Agriculture and Consumer Issues
BMU = German Ministry of the Environment

Annual report to the German Parliament, firstly on March 31st 2005

Content:

- **Price development of biomass, crude oil, vehicle and heating fuels**
- **Adjustment of recommendations if appropriate**
- **Attention to the effects on: climate, environmental protection, natural resources, external costs of fuels, ensured supplies, objectives of the Promotion Directive**

Biofuels (Biodiesel) conditions in Germany (I)

time frame	B100		B5	
	taxation	**tax tariff**	**condition**	**tax tariff**
up to 12/2003	**no**	**-**	**no permission**	**-**
1/2004 to 7/2006[a]	**yes**	**0.00 €/L**	**voluntary**	**0.00 €/L**
8/2006 to 12/2006[b]	**yes**	**0.09 €/L**	**voluntary**	**0.15 €/L**
1/2007 to 12/2015[c]	yes	Stepwise reduction of the tax exemption	mandatory according specified energy quota	0.47 €/L

[a] Introduction of a changed mineral oil tax law (includes regulations on biofuels)
[b] Introduction of the energy tax law, substituting former mineral oil tax law
[c] Biofuel quota law, decision process is running

Biofuels (Biodiesel) conditions in Germany (II)

Year	Total quota	Diesel subquota	Gazoline subquota
2007	-	4,40 % (kal.)	1,20 % (cal.)
2008	-	subquota 4,40 % (cal.) continued	2,00 % (cal.)
2009	6,25 % (cal.)		2,80 % (cal.)
2010	6,75 % (cal.)		3,60 % (cal.)
2011	7,00 % (cal.)		subquota 3,60 % (cal.) continued
2012	7,25 % (cal.)		
2013	7,50 % (cal.)		
2014	7,75 % (cal.)		
2015	8,00 % (cal.)		

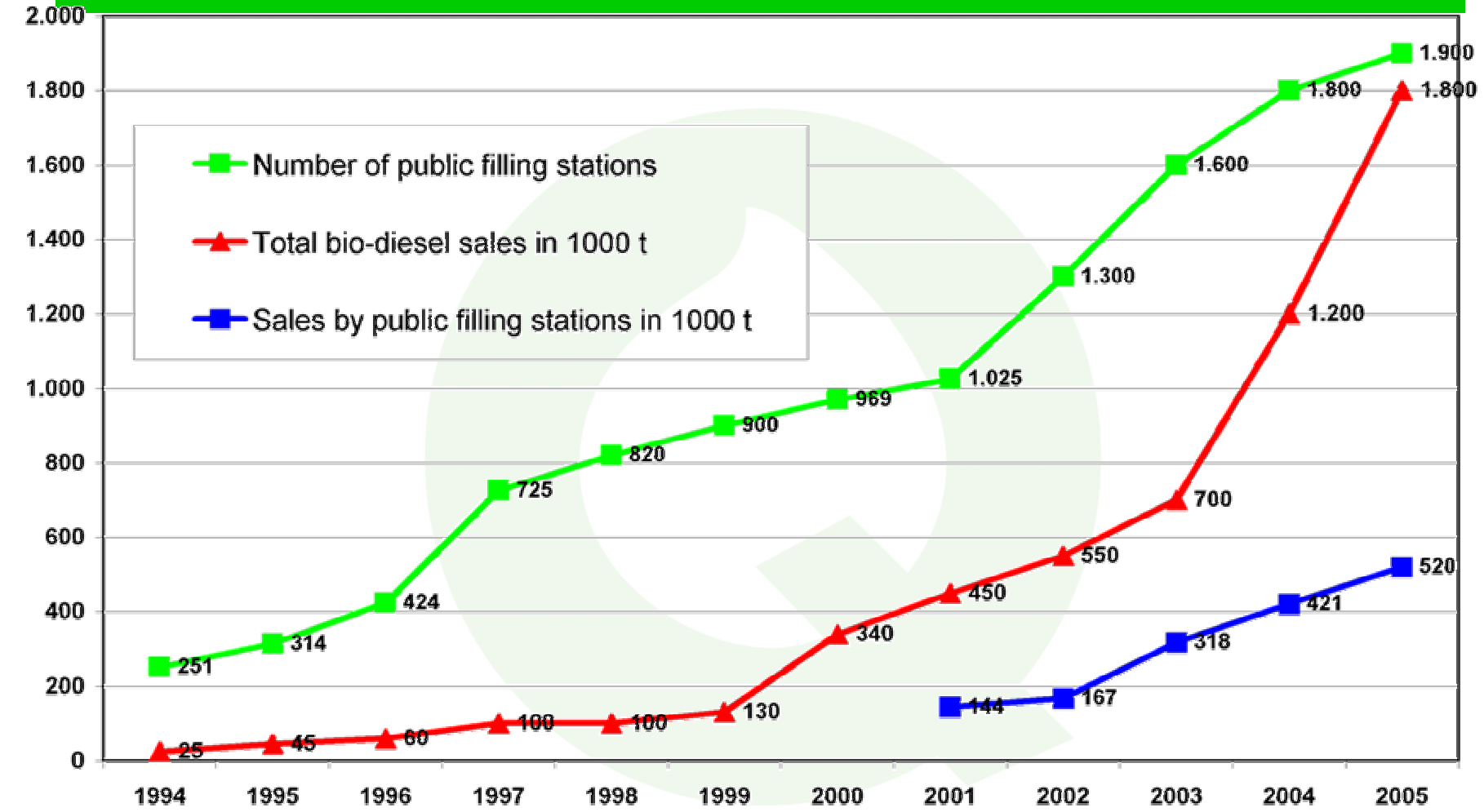
Calculation of over-compensation

Use of biodiesel as:	Pure fuel	Addition by mixing
Price of Rape Oil ex oil mill (Stock exchange price on average in 2004)	0.49 €/l	0.49 €/l
Refinery (Cleaning and preparation of the Rape Oil)	0.04 €/l	0.04 €/l
Esterification less Glycerin credit Rape Oil becomes Rape Oil Methyl Ester and Glycerin	0.07 €/l	0.07 €/l
Costs for addition by mixing Storage and warehousing, costs of the storage and mixing technique costs	--	0.03 €/l
Logistics (Freight storage delivery filling station margin)	0.08 €/l	0.08 €/l
Technical extra expenses Shortened oil change intervals and oil filter changes, special equipment…	0.03 €/l	--
Extra consumption (Due to the lower energy content of Biodiesel)	0.05 €/l	--
Sum (without purchase tax): (Theoretical price RME for the comparison with fossil Diesel)	**0.76 €/l**	**0.71 €/l**
Price on average of fossil Diesel in 2004 (mineral oil tax included without VAT	**0.81 €/l**	**0.81 €/l**
Over-compensation	**0.05 €/l**	**0.10 €/l**

Source: Deutscher Bundestag Drucksache (report) 15/5816 (2005)

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

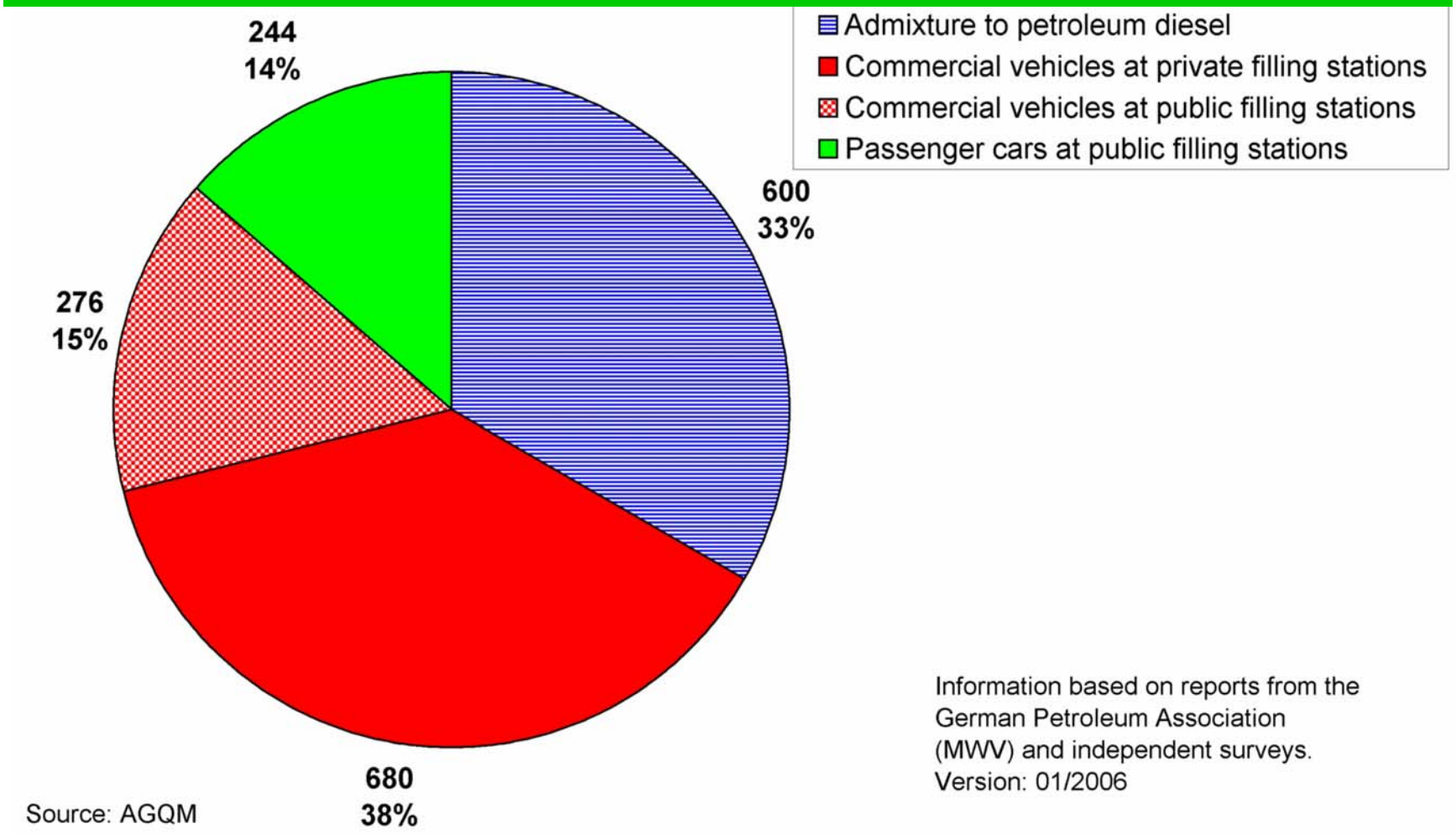
Biodiesel sales in Germany



Source: AGQM

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Biodiesel use distribution in Germany



Source: AGQM

Information based on reports from the German Petroleum Association (MWV) and independent surveys.
Version: 01/2006

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Biofuel sales and potential

Fuel	Application type	Sales 2005		Potential
Biodiesel	Admixing	(DIN EN 590)	600,000 t	1,500,000 t
	Public filling stations	Passenger cars	244,000 t	?
		Haevy duty cars	276,000 t	
	Fleet filling stations	Haevy duty cars	590,000 t	
		Agriculture	90,000 t	400,000 t
Plant oil (rape seed oil)		Agriculture	50,000 t	
		Haevy duty cars	150,000 t	?
Bioethanol		(DIN EN 228)	180,000 t	1,150,000 t

Source: collected data [UFOP, AGQM, VDB, TFZ und LAB], as 01/2006

Industrial car warranties for Biodiesel (DIN EN 14214)

Warranties for B 100:

-Passanger cars:	VW[12], Audi[2], Seat, Skoda[12] (about 3 million cars)
-heavy-duty-vehicles: (buses, lorries)	DaimlerChrysler, MAN EURO IV and V (incl. EURO III)
-agricultures-vehicles: (tractors)	SameDeutz-Fahr, AGCO, John Deere, Fendt, Case, Massey-Ferguson, Steyr

[1] EURO IV: Biodiesel-Sensor available

[2] Not available in combination with system integrated particle filters

Warranties for B 5: (as a component in fossil Diesel: EN 590)

-Automotive Industry: Car/hvd- Manufactures, Diesel Fuel Injection Pump Manufactures

No warranties for mixtures containing Biodiesel according to ASTM D 6751 or other Biodiesel specifications!

Possible causes for problems or damages while using Biodiesel

Damages or problems may be caused by

- inapplicable car technology (materials, improper interaction of components)
  ► origin: car producer
- missing specials knowledge about Biodiesel
  ► origin: trader, customer
- improper quality
  ► origin: producer, trader
- (recently not well detected problems)

Important requirements and test procedures of DIN EN 14214

Characteristics	Units	Limit values		Test procedures
		Min.	Max.	
Ester	% (m/m)	96.5		pr EN 14103
Density at 15 °C	kg/m³	860	900	EN ISO 3675 EN ISO 12185
Kinematic viscosity at 40 °C	mm²/s	3.5	5.0	EN ISO 3104
Flash point	°C	> 120		ISO/CD 3679
Sulphur content	mg/kg		10	
Carbon residue (from 10 % of distillation residue)	% (m/m)		0.3	EN ISO 10370
Cetane index		51.0		EN ISO 5165
Ash (sulphurous ash)	% (m/m)		0.02	ISO 3987
Water content	mg/kg		500	EN ISO 12937
Total pollution	mg/kg		24	EN 12662
Corrosive effect on copper (3 h at 50 °C)	corrosion grade	1		DIN ISO 2160
Thermal stability				
Oxidation stability, 110 °C	hours	6.0		pr EN 14112

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Important requirements and test procedures of DIN EN 14214

Characteristics	Units	Limit values		Test procedures
		Min.	Max.	
Acid number	mg KOH/g		0.5	pr EN 14104
Iodine number			120	pr EN 14111
Content of Linolenic-Acid-Methylester	% (m/m)		12	pr EN 14103
Content of fatty acid-methyl esters with more than 3 double bonds	% (m/m)		1	
Methanol content	% (m/m)		0.2	pr EN 14110
Monoglyceride	% (m/m)		0.8	pr EN 14105
Diglyceride	% (m/m)		0.2	pr EN 14105
Triglyceride	% (m/m)		0.2	pr EN 14105
Free glycerine	% (m/m)		0.02	pr EN 14105 pr EN 14105
Total glycerine	% (m/m)		0.25	pr EN 14105
Alkali content (Na + K)	mg/kg		5	pr EN 14108 pr EN 14109
Phosphorous content	mg/kg		10	pr EN 14107

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

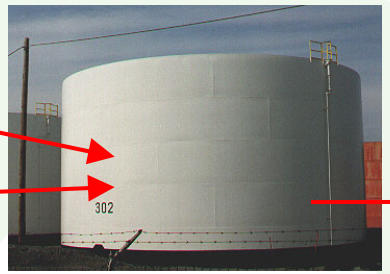
Influence of different flow improvers

Former (possible) situation:

(Quality according specification)

Biodiesel + Additiv I

Biodiesel + Additiv II



Product doesn‘t match the specification

► Cooperation between Biodiesel producers and additive producers organized by AGQM

Today:

✓3 basic types of proven flow improvers in the market

✓Mixtures of Biodiesel with different flow improvers (from the proven types) don’t lead to a degradation of the Biodiesel properties.

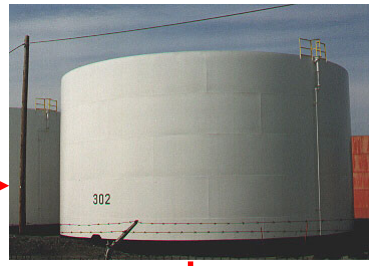
Disturbance of the oxidation stability by transportation and storage (example)

9,5 h

10,5 h

8,5 h

9,5 h



7,5 h

9,0 h

RME without oxidation stabilizer

RME with oxidation stabilizer

5,0 h

7,0 h

6,5 h

8,0 h

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Measures for quality management

Step	Concept of the quality manage-ment	Un-announced checks of the product	QA-audit	Round robin tests	Advanced training for QA and laboratory staff	Special inform. about handling of Biodiesel	Licence agreement (sign)
Production	√	√	√	√	√		
Intermediate storage	√	√	√				
Transpor-tation/Trade						√	
Pump station		√				√	√

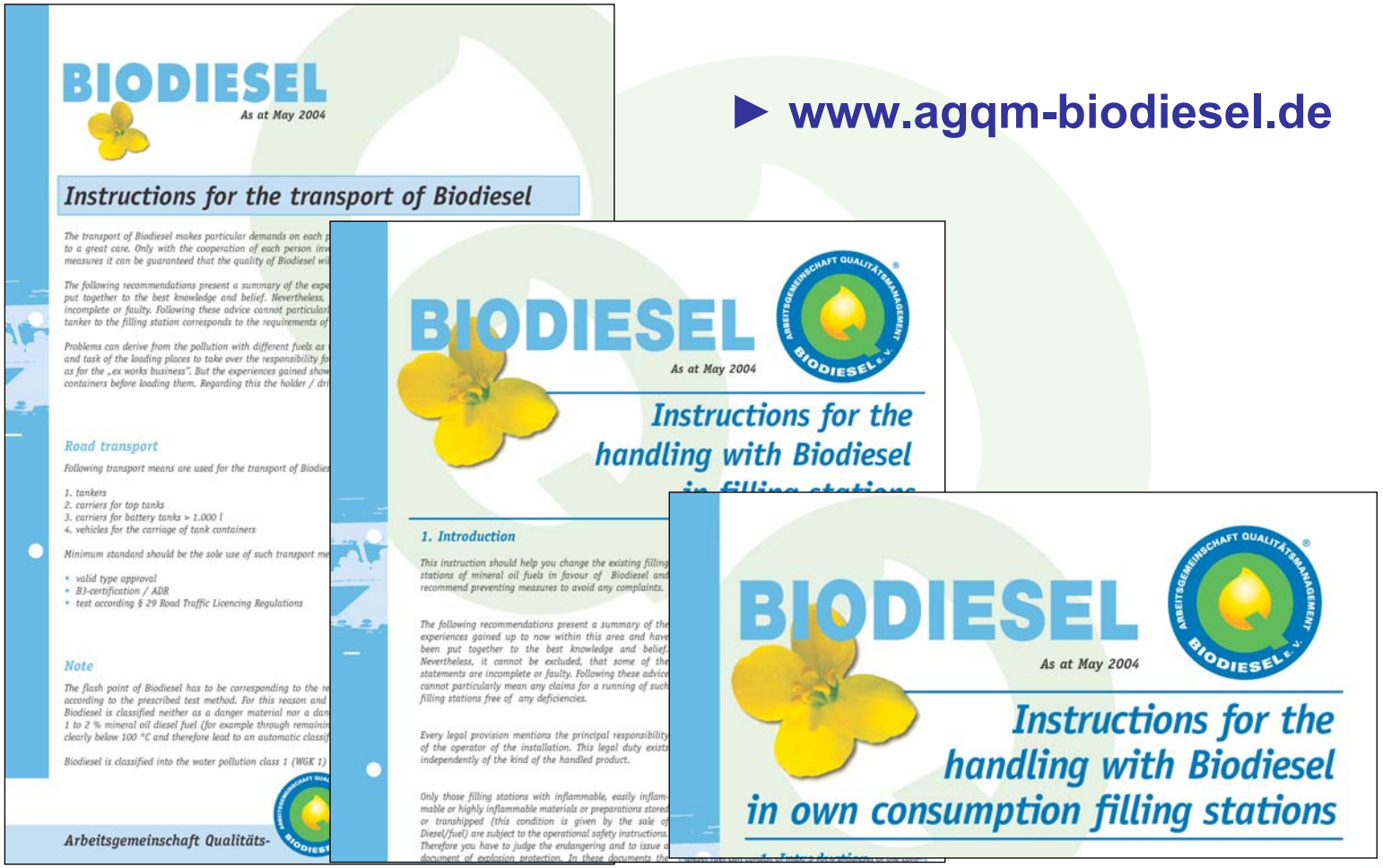
QM concept: additional requirements

► related subjects: - Production (including raw materials) - Loading - Transportation - (Intermediate) storage	► Requirements exceeding the DIN EN 14214 ► will be adapted on new requirements permanently

Property	Unit	Limits		Responsible:	Method
		min.	max.		
Water content	mg/kg		220 300	Producers All members	EN ISO 12937
Total contamination	mg/kg		20	All members	EN 12662
Oxidation stability, 110 °C	h	6*		All members	EN 14112
CFPP: 19/10 to 28/02 (in leap years to 29/02)	°C		-20	Producers	EN 116
Fatty acid profile	% (m/m)	like rape seed		For selling at public pump stations	EN 14103

* Biodiesel producers have to add and to declare oxidation stabilizers.

Basic information for handling of Biodiesel



► **www.agqm-biodiesel.de**

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.

Identification of Biodiesel

Evaluation: effect of the violation of limits (I)

Property (DIN EN 14214)	Effect / Evaluation
Density at 15 °C	**Incorrect injection amount of fuel (?), detection for the kind of the fuel**
Kinematic viscosity at 40 °C	**Pumping problems (fuel pump, injection pump)**
Flash point	**May cause „dangerous good“**
Cold filter plugging point (CFPP)	**Problems in cold periods (also in autumn!)**
Sulfur content (mass ratio)	**RME: value is always keept**
Coke residue (mass ratio)	**Result of a to high content of glycerol/glycerids and/or double/multiple C-C-bonds**
Ignitability (cetane number)	**RME: the value is kept always**
Sulfate ash (mass ratio)	**If alkaline/earth alkaline content OK => also OK**
Water content (mass ratio)	**Corrosion, clouding (mixtures DK/FAME), fall out**
Total contamination (mass ratio)	**Filter plugging, also harmfull for injection pump**
Copper corrosion	**RME: the value is keept (but: acid number…)**

Evaluation: effect of the violation of limits (II)

Property (DIN EN 14214)	Effect / Evaluation
Oxidation stability (induction time)	**Filter plugging, deposition of polymers in case of mixtures DK/FAME**
Acid number	**Corrosion**
Methanol content	**No recent problem**
Mono-, di- and triglycerids	**Triglycerids = primery loading: rape seed oil?**
Free glycerol	**Formation of coke (also in case of glycerids)**
Total glycerol	**Calculated parameter**
Iodine number	**Formal, more information: fatty acid profile**
Phosphor content	**No recent problem**
Alkaline content (Na + K)	**Filter plugging**
Earth alkaline content (Ca + Mg)	**Filter plugging (effect higher then alkaline!)**
(Fatty acid profile)	**Multiple diagnostics**

Research & development

Further R&D necessary in following fields:

- Biodiesel use in systems operating with particle filters
- Biodiesel use in systems operating with SCR catalysts
- Additives (to secure CFPP in the case of fatty acid profiles other then rape seed)
- Behavior of mixtures of „classic“ sulfurfree mineral oil diesel and Biodiesel
- Research on B10 influences (materials, emission situation)
- Properties and benefits for mixtures between synthetic fuels and Biodiesel

Conclusions

International co-operation has to be improved:

- Improvement of the test methods (standards), also for mixtures (e.g. B10)
- Organisation of the quality management and international collaboration
  (level: producer, country)
- Agreement of a world-wide standard of biodiesel
- P+R work for the consumer acceptance and policy

Contact:

AGQM
Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V.
(Association Quality Management Biodiesel reg. Ass.)

Claire-Waldoff-Str. 7
10117 Berlin

Tel.: +49 (30) 31 90 44 33
Fax: +49 (30) 31 90 44 35
e-Mail: j.haupt@agqm-biodiesel.de

BIODIESEL

Running vehicles successfully on bio-diesel

Product quality requirements for FAME

Dr. Jens Haupt and Dieter Bockey, Bio-Diesel Quality Management Work Group (AGQM, registered association)

Arbeitsgemeinschaft Qualitäts- management Biodiesel e. V.

Running vehicles successfully on bio-diesel

Product quality requirements for FAME

Dr. Jens Haupt and Dieter Bockey, Bio-Diesel Quality Management Work Group (AGQM, registered association).

Introduction

Within the space of a decade, bio-diesel has turned from a virtually unknown product into a significant fuel on the market. Germany's bio-diesel turnover accounted for just 45,000 t in 1995, but had risen to about 1,800,000 t in 2005.

Although the emergence of bio-diesel in Germany is undoubtedly a success story, questions continue to arise with regards to the fuel's potential applications, problems and properties. The diversity of expressions "Bio-diesel", "FAME", "PME", "RME" and "AME" is causing increasingly confusion among sellers and buyers. Bio-diesel is often mistaken for vegetable-oil fuel, although both products differ in terms of basic properties. This article is intended to improve the reader's understanding of this topic.

Market situation

Up until the end of 2003, bio-diesel sold to public filling stations and fleet operators was tax-deductible only as a pure fuel. However, at the beginning of 2004 a modified petroleum law was introduced. According to this, bio-diesel is also tax-deductible when used in mixtures, if permission for petroleum processing has been granted (bonded warehouse) or if the mixture is manufactured by the final user. This modified legal framework prompted many petroleum companies to add bio-diesel of up to 5% by volume to petroleum diesel.

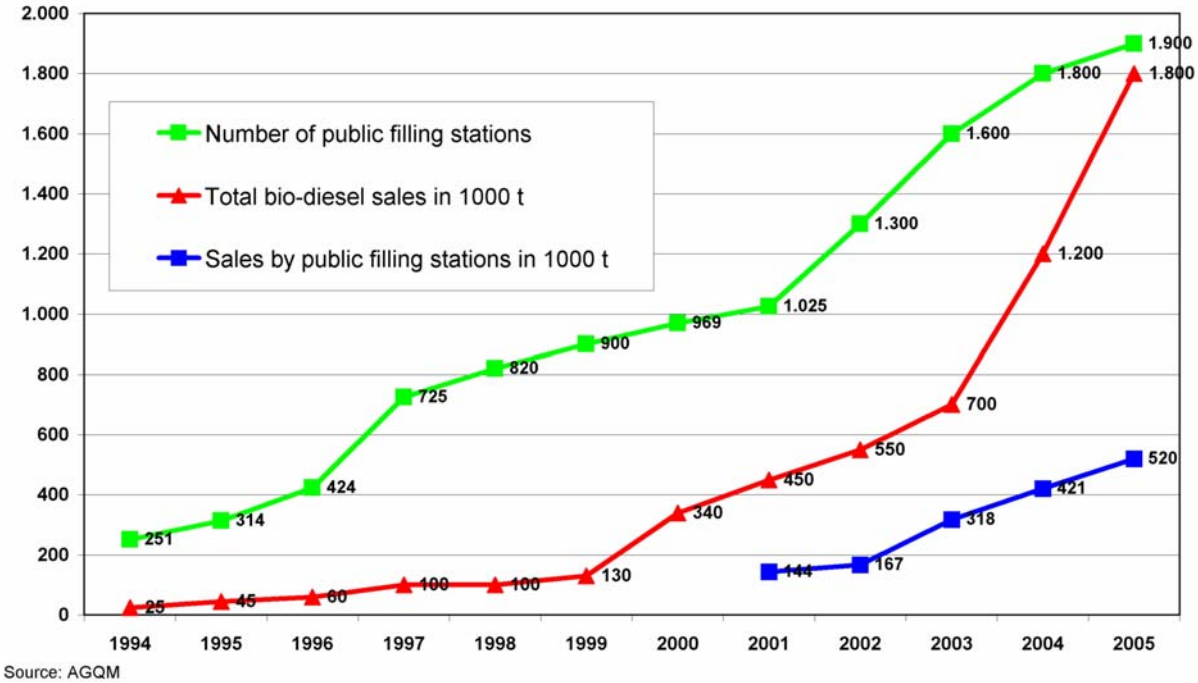


Figure 1: Development of the bio-diesel market in Germany.

Bio-diesel is currently used in about equal measure for the following purposes:

- Admixture to petroleum diesel (bio-diesel proportion of up to 5% by volume according to DIN EN 590; the added bio-diesel must also comply with EN 14214)
- Pure fuel for operating fleets of commercial vehicles (DIN EN 14214)
- Pure fuel for sale at public filling stations (DIN EN 14214). Commercial vehicles account for a significant proportion - about 40% - of the bio-diesel sold at public filling stations. This proportion is expected to increase yet further.

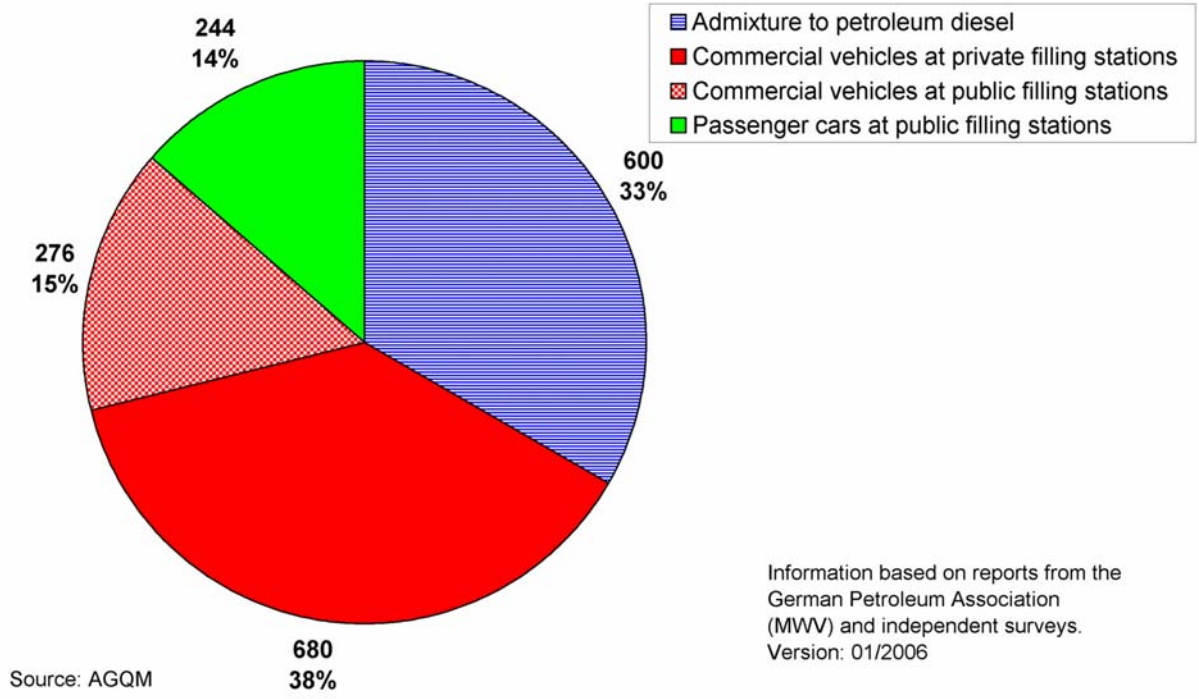


Figure 2: Applications of bio-diesel according to user groups (in 1000 t for 2005).

Sharp petroleum price rises since spring 2005 have led many operators of in particular vehicle fleets to increasingly use bio-diesel. This has resulted in a notable scarcity of bio-diesel on the market.

New establishments of bio-diesel facilities are expected to ease the situation from the middle of 2006 onwards, and are likely to cover further possible increases in demand.

However, uncertainty remains over what effects a possible introduction of a tax rate of 10 cents/litre may have on markets. The currently discussed introduction of this tax is intended to compensate for tax relief bio-diesel enjoyed over the past years and is in accordance with §2a of the petroleum law, (possibly accompanied by drops in diesel prices).

Comparison of properties of important liquid bio-fuels

Bio-diesel is currently the most widely used bio-fuel. In addition vegetable oils (especially rapeseed oil) are increasingly employed directly as fuel. Mixtures of petrol and ethanol are being discussed as petrol-based fuels. Table 1 provides an overview of the manufacture and deployment of these fuels:

Table 1: Manufacture and deployment of bio-fuels

	Bio-diesel (FAME)		**Rapeseed oil**	**Ethanol**	
Manufacture	Interestification of vegetable oils with methanol in the presence of a catalyst to form fatty-acid methylester.		Production with the help of cold-pressing or extraction mills, crude-oil refining.	Fermentation of grain, 2-stage dehydration to result in absolute alcohol.	
Basic raw materials	Rapeseed, soya, other vegetable oils, biogenetically recyclable oils (from restaurants and households), animal fat in limited quantities.		Rapeseed.	Grain, maize, sugar, also lignocellulose in future.	
Application	Pure fuel.	Admixture, max. 5% by volume.	Pure fuel.	E85 (mixture of 15% petrol and 85% ethanol by volume.	Admixture, max. 5% by volume.
Vehicle requirements	Serial vehicles with factory approval for bio-diesel.	Serial vehicles.	Vehicle retrofitting required.	Some passenger car types are available internationally.	Serial vehicles.
Standard	DIN EN 14214	DIN EN 590	E DIN V 51605	No standard as yet.	DIN EN 228

Source: Bio-Diesel Quality Management Work Group

Manufacturing fuel techniques from biomass, involving the production of synthetic gases followed by Fischer-Tropsch reaction to form liquid hydrocarbons (BTL) are currently being researched. Such processes for converting biomass are expected to become marketable within 8-10 years,

"Bio-fuels" which can supposedly be manufactured by small facilities using biomass of any type (or other organic residue) in a catalytic pyrolysis process have been also promoted for some time. However, many of these technological concepts fail to pass simple material balance tests, and it is extremely doubtful whether the resultant fuels are able to consistently exhibit the assured properties.

The following table compares certain properties of bio-diesel (FAME) and rapeseed-oil fuel in more detail.

Table 2: Comparison between selected properties of bio-diesel and rapeseed-oil fuel

	Bio-diesel (FAME) according to DIN EN 14214	**Rapeseed-oil fuel** according to E DIN V 51605
Density	860 to 900 mg/kg	900 to 930 kg/m³
Viscosity at 40 °C	3.50 mm²/s to 5.00 mm²/s	36 mm²/s
Flash point [1]	Min. 120 °C	Min. 220 °C
Lower calorific value	Typical: 38,000 kJ/kg [2]	Min. 36,000 kJ/kg (typically around 37,500 kJ/kg)
Proportion of alkaline elements (Na + K)	Max. 5.0 mg/kg	Not specified

[1] Different test techniques

[2] No standard parameters

Table 2 continued

Proportion of alkaline earth elements (Mg + Ca)	Max. 5.0 mg/kg	Max. 20 mg/kg [3]
Phosphorous content	Max. 10.0 mg/kg	Max. 12.0 mg/kg [3]
Ash content [1]	Max. 0.02 %	Max. 0.01 %
Total contamination	Max. 24 mg/kg	Max. 24 mg/kg
Acid value	Max. 0.5 mg KOH/g	Max. 2.0 mg KOH/g
Cetane value	Min. 51	Min. 39 [4]
CFPP	0 °C, -10 °C, -20 °C [5]	Not determinable [6]

Source: Bio-Diesel Quality Management Work Group

A comparison between the properties of bio-diesel and rapeseed oil reveals notable differences between the two products. Bio-diesel is similar to petroleum diesel in terms of many parameters, whereas rapeseed oil is extremely viscous, thus proving more difficult to handle at low temperatures. The high permissible proportion of ash-forming substances compared with bio-diesel can pose problems in modern exhaust-gas re-treatment systems. As a result conversions for rapeseed-oil fuel need to meet technical prerequisites preventing these variations in properties from impairing vehicle operation. This also applies to the effects on passenger cars and commercial vehicles with diesel particle filters and other modern exhaust-gas re-treatment systems currently being introduced to the market.

The properties of bio-diesel depend decisively on the selected raw materials. In principle, bio-diesel produced from initial materials with a high content of saturated fatty acids (for example, palm oil or animal fat) has poor low-temperature properties. Experience shows that in several cases, mixtures of palm oil and methylester have been known to clog filters and thus cause problems for users as well as filling-station operators.

Bio-diesel made from raw materials with a high content of multiple unsaturated fatty acids (for example, sunflower oil) typically exhibits an excessively low oxidation stability. Rapeseed oil is an excellent raw material for the manufacture of bio-diesel, making it possible to achieve a CFPP of -10 to -12°C as well as an oxidation stability of 9 h or more even without additives.

It is also worth noting that the majority of additives have so far only been tested for the use with rapeseed methylester. For chemical and physical reasons, methylesters with a very high (unfavourable) CFPP content - for instance palm-oil methylester and mixtures containing large proportions of palm methylester - cannot be expected to attain specified winter handling properties through mixing with additives.

---

[3] Limiting values still under discussion

[4] Use of a special test technique, if necessary

[5] Seasonal

[6] Application below -5°C is severely restricted by high viscosity.

Whether esters comprising highly unsaturated oils such as soya methylester can achieve a sufficient (and durable) oxidation stability through mixing with additives is currently not known.

The selected interestification technique also determines the requirements needed from the raw materials and the residual proportions of undesirable substances, e.g. water, alkaline metals, alkaline earth metals and phosphorous in the product. Handling and transport conditions can also notably influence a product's quality-related parameters.

Requirements for rapeseed oil as a fuel in accordance with draft standard E DIN V 51605 at any rate include a thorough conditioning of the rapeseed oil. In contrast to refined phases and specially filtered oils, crude oil from the cold-pressing phase often fails to meet the standard as demonstrated by attendant chemical analyses of fuel samples as part of the *100 Tractor Project*.

Effects of inadequate quality

Following the pressure of rising petroleum prices, the market has shown a broad acceptance of alternative fuels not governed by any standards. Although poor quality fuels have resulted in considerable damage, experimentation in this area continues. This is facilitated by the fact that damage caused directly or indirectly by deficient or inadequate fuels only becomes evident after long periods of usage. By this stage, the correlation between the damage and its source is no longer apparent to users.

Table 3 displays selected standard parameters for bio-diesel to show how transgressions of limiting values affect vehicle components.

Table 3: Effects of limit transgression in the case of bio-diesel

Property (DIN EN 14214)	**Effect / Comment**
Kinematic viscosity at 40 °C	Fuel conveyance problems (fuel pump, injection pump).
Flash point	A flash point of less than 100°C renders the product hazardous.
CFPP (filtration limit)	Machine standstill through crystallization of fuel in the pipes and the fuel filter at low temperature.
Residual coke	Coke deposits on the injection pump and piston rings. Problematic in the case of FAME with a high content of multiple bonds or glycerine/glycerides.
Ash content	Damage to exhaust-gas re-treatment systems.
Water content	Corrosion problems, turbidity of DK/FAME mixtures (resulting in separation of the water phase in the worst case).
Total contamination	Machine standstill through filter backfill, potential consequential damage to the injection pump as a result of insufficient lubrication / cooling by circulating fuel.
Oxidation stability (induction period)	Filter backfill, precipitation of polymers in diesel / bio-diesel mixtures throughout the fuel supply system.
Acid number	Corrosion problems.
Glycerine and glycerides	Coke deposition on the injection pump and piston rings; possible reason for increased coke residue.

Table 3 continued

Iodine number	Indicates unfavourable fatty acid properties, deviations can affect oxidation stability and CFPP.
Alkaline content (Na + K) Alkaline earth content (Ca + Mg)	Machine standstill through filter backfill; possible reason for increased ash content.

Source: Bio-Diesel Quality Management Work Group

Figures 3 and 4 show damage on injection pumps to demonstrate the long-term effects of bio-diesel with an insufficient oxidation stability or non-compliant proportions of alkaline and alkaline earth elements.

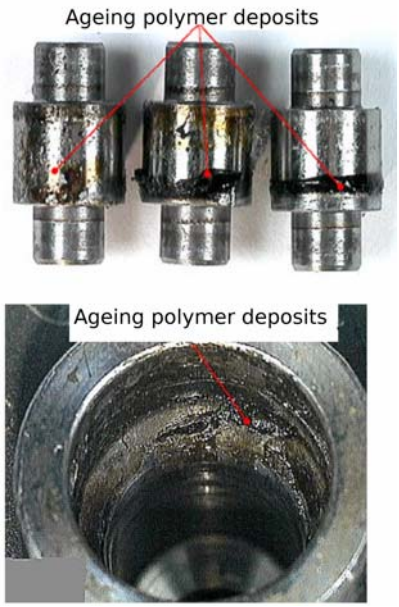


Figure 3: Polymer deposition resulting from a use of bio-diesel with an inadequate oxidation stability.

Source: Robert Bosch GmbH.

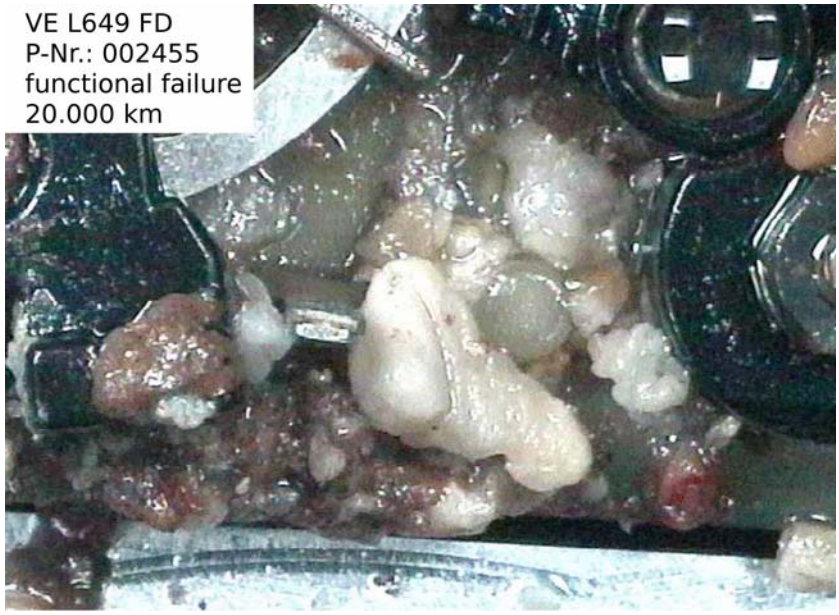


Figure 4: Damage resulting from soap deposition (bio-diesel with an excessively high alkaline or alkaline earth content).

Often seemingly minor initial damage leads to further, grave consequences. For instance, operating a vehicle for extended periods with a backfilled fuel filter can lead to inadequate fuel circulation, resulting in the failure of the injection pump's lubrication and cooling system and, ultimately serious wear.

Technological requirements

Bio-diesel is basically compatible with all diesel engines and tanks designed originally for petroleum-based fuels , thanks to its chemical similarity to petroleum diesel. Despite this, bio-diesel possesses certain special features which necessitates technological adaptations.

Vehicles

Adaptation of automotive technology to obtain serial approval for bio-diesel primarily involves the aspects described in the following. Release conditions must also account for changes in maintenance requirements.

- Bio-diesel poses different material-related requirements compared with petroleum diesel. All parts coming into contact with media (for example, hoses and seals) must be resistant to bio-diesel.
- The combustion process is different compared with petroleum diesel. To ensure adherence to all emission limits, the engine and exhaust-gas re-treatment system must ideally be matched by the fuel parameters (as in the case of petroleum diesel).
- Because bio-diesel is very hard to evaporate, it can accumulate in engine oil especially during low-load operation by commercial vehicles. Consequently, all manufacturers of commercial vehicles prescribe shorter oil-change intervals in order to avoid damage by diluted engine oil.
- After extended periods of running on pure petroleum diesel vehicles converted to bio-diesel should undergo a one-time fuel filter replacement after 2-3 tankfuls of bio-diesel outside the regular service intervals. This prevents old depositions of petroleum diesel removed by the flow of bio-diesel through the fuel system from blocking the new fuel filter.

Vehicle approval is based on DIN EN 14214, including certain restrictions related to the exclusive approval of rapeseed methylester. To preserve vehicle functionality and uphold guarantee terms, it is absolutely necessary to fulfil these requirements as well as the relevant operating and maintenance conditions. A list of all approvals can be found at www.ufop.de.

Public and private filling stations

In principle, bio-diesel filling stations need to fulfil largely the same legal requirements as filling stations selling petroleum-based fuel. These will dependent on the individual states' requirements concerning facilities for filling and transferring water-endangering substances; the details can differ from state to state. General technical conditions for tank systems at motor-vehicle filling stations are explained in related technical regulations for water-endangering substances. Filling stations for low, private consumption receive exemptions but still need to fulfil minimum requirements.

Filling stations dealing in moderately or highly inflammable substances as well as bio-diesel are subject to operational safety regulations, requiring extensive documentation. Only filling stations dealing exclusively in bio-diesel are exempt from these regulations, due to bio-diesel's high flash point.

Specific requirements are needed during establishment or conversion of filling stations to bio-diesel outlets:

1. The sealing surface should be made of concrete of at least grade B35. Large slabs or in-situ concrete have preference over other variants. The joint material should be resistant to bio-diesel.
2. The storage tank should have a collecting reservoir (if the capacity exceeds 1000 litres and double-walls are not part of the design).
3. Rainwater accumulating on the sealing surface together with droplets resulting from leakage and discharge resulting from accidents is to be channelled off via a light-liquid separator. Until publication of a technical regulation adapted to bio-diesel, the requirements mentioned in the DIN report titled "Bio-diesel and Separation Facilities …DIN 1999 and DIN EN 858" (01/2004) should apply to all new filling stations.
4. The stability of tank coatings (especially those installed as part of repair measures) should be checked. Manufacturers should receive certification of appropriate materials from recognized institutes.
5. Tanks converted from petroleum diesel to bio-diesel should be fully emptied and cleaned in the dry state. Tanks should be cleaned every 2 years to prevent an accumulation of residue in the tank sump.

6. All seals on fuel pump components and screw connections should be made of material resistant to bio-diesel. Mesh widths prescribed for the suction filter and fuel pump filter should not be changed.
7. The fuel nozzle and hose should be made of material resistant to bio-diesel. Important: A standard hose's outer jacket is often not lastingly resistant to bio-diesel.
8. Avoid a use of components made of zinc, copper and copper alloys. Bio-diesel can decompose some zinc layers and result in a formation of soap, as in the case of bio-diesel with an insufficient alkaline (earth) content. Copper acts as an oxidation catalyst and accelerates drops in oxidation stability.

Correct handling of bio-diesel includes its clear identification. This applies in particular to legally specified stickers for petrol pumps and filling-station supply connections in order to avoid inadvertent filling with different products.

Users of privately owned filling stations often want to run their vehicles on mixtures of bio-diesel and petroleum diesel in which the proportion of bio-diesel far exceeds 5% by volume. It should be noted that the manufacture of such mixtures outside bonded warehouses is only approved for end users (commercial production of such mixtures for sale is otherwise considered illegal by petroleum tax legislation). Furthermore, the filling stations must be equipped with appropriate technical facilities permitting homogeneous mixing (the differing densities of petroleum diesel and bio-diesel otherwise lead to stratification in tanks containing highly variable proportions of diesel / bio-diesel).

Assurance of high product quality

Bio-diesel according to DIN EN 14214 is now being produced and sold by numerous manufacturers in Germany and neighbouring EU countries. However, practices for monitoring the quality of these products vary widely.

The Bio-Diesel Quality Management Work Group (AGQM), a registered association, was founded 6 years ago to raise users' confidence in bio-diesel. This association comprises a voluntary group of bio-diesel manufacturers and commercial enterprises implementing consistent quality assurance as a leading corporate policy and assisting other market participants in supplying high-quality bio-diesel to users. The AGQM's network now includes about 1400 public filling stations offering consumers bio-diesel of an assured quality and guaranteeing that batches can be traced if they ever prove deficient (further details on the AGQM's activities and members are available at www.agqm-biodiesel.de).

To monitor and improve quality, the AGQM is continuously advancing their quality management system. This includes spot checks of products ranging from the manufacturer's outlet through to intermediate warehouses and to filling stations, annual audits, provision of information and educational courses. And, in particular, ensuring adherence to limiting values agreed beyond those specified by DIN EN 14214. For example, the bio-diesel manufacturers organized under AGQM guarantee that winter consignments are delivered already 4 weeks prior to the deadlines specified in the related standard. Stricter requirements are also imposed on water content and total contamination. Bio-diesel intended for public filling stations must comprise rapeseed methylester furnished with an oxidation stabilizer. Every batch is delivered together with a factory certificate or analysis indicating the batch's test values.

Bio-diesel in AGQM quality has become synonymous for successful quality assurance of bio-diesel.

Contracts regarding a supply of bio-diesel should

1. contain mandatory and testable specifications on product quality
2. specify procedures agreed by both parties in response to actual or presumed deviations from standards

This includes clear labelling of supplied products: The designation "bio-diesel" alone is not sufficient and must be accompanied by at least a reference to DIN EN 14214. Deliveries required to comprise exclusively rapeseed methylester must be declared explicitly as such. Suppliers should clearly describe their internal quality assurance measures (especially as regards to batch tracing).

All products intended for sales at public filling stations should be furnished with oxidation stabilizer. Assurance of high oxidation stability ex works alone does not guarantee fulfilment of specifications on transfer of the product to the final customer. Delivery quality should be borne out by an updated, concise, batch-specific factory certificate or analysis. In the case of bio-diesel intended simultaneously for several suppliers, it is advisable to determine, for example, whether different flow improvers for adjusting low-temperature stability are in use in order to assess the potential for incompatibility.

As part of their product-related responsibilities, AGQM members ensure a continuous supply of all necessary information to users. Further details on incorporation of quality aspects into supply contracts are provided by a corresponding instruction leaflet available and can be downloaded from our homepage.

Outlook

The federal German government intends to uphold successful policies for promoting bio-fuels, possibly in a modified legal framework.

As always, however, a prerequisite for continued market presence and development of new application types is assurance of a constant and reliable quality of these alternative fuels for users. The example of bio-diesel proves that commitment by all participants allows very rapid establishment of an effective quality assurance system. Bio-diesel will continue to play an important role as an alternative fuel, both in pure form and in mixtures with petroleum diesel.

Short glossary of terms

AGQM product

Bio-diesel according to DIN EN 14214, produced or distributed via the AGQM's quality assurance system ("Bio-diesel in AGQM Quality"). Detailed documentation and evidence are required, some parameters needing to meet stricter standards than those specified in DIN EN 14214. Public filling stations are to receive only rapeseed methylester (RME) to which oxidation stabilizer has been added. These specifications are based on current vehicle approvals, the fact that independent tests currently only provide reliable outcomes concerning a use of additives for RME, as well as results of independent tests on oxidation stability and the influence of oxidation stabilizers.

Alkaline elements

A generic expression for the elements of the periodic system's first main group; sodium and potassium are implied in the case of bio-diesel. These elements form salts (soaps) which can result in filter backfill.

AME

AME is a frequently used acronym for Acid MethylEster obtained from recyclable fats or oils. Depending on the type of raw material and plant technology, such products are able to meet the requirements of DIN EN 14214. A high proportion of recyclable fats in raw materials typically poses problems in terms of CFPP (low-temperature stability) and total contamination.

Factory certificate / analysis

A bio-diesel manufacturer's report describing a current batch's *measured* properties in terms of adherence to DIN EN 14214. Qualified factory certificates and analyses also indicate whether the product is rapeseed methylester and whether it has been furnished with oxidation stabilizer, for instance.

Bio-diesel

Bio-diesel is a generic term for fatty-acid methylester intended for use as fuel. In Germany, this term as defined in the *10th Decree on Implementation of the Federal Emission Protection Law Concerning the State and Indication of Fuel Quality* must only be used for fuels compliant with DIN EN 14214.

Vegetable oils and their mixtures with fossil fuels or other organic ingredients are not bio-diesel.

CFPP

Acronym for "Cold Filter Plugging Point", a parameter for testing a fuel's low-temperature stability.

Alkaline earth elements

A generic term for the elements of the period table's second main group; magnesium and calcium are implied in the case of bio-diesel. These elements form salts (soaps) which can result in filter backfill.

FAME

FAME is an acronym for Fatty-Acid MethylEster. European standard EN 14214 and the derived German standard DIN EN 14214 specify properties of FAME needed for approving this material class as diesel fuel. These standards do not directly specify types of raw material for manufacturing the required fatty-acid methylesters. However, limiting values for certain parameters (like oxidation stability, iodine number, proportion of multiple unsaturated fatty acids, coke residue) indirectly restrict the range of raw materials. In addition, releases by automobile manufacturers explicitly specify permissible types of raw material.

Accordingly FAME is a generic term for all types of fatty-acid methylester made of various raw materials, including rapeseed-oil (fatty-acid) methylester. Especially in the commercial sector, the designation FAME is often incorrectly used for bio-diesels not comprising RME.

Fatty acid

The chemically bound proportion of natural fats and oils. Fatty acids can have different chain lengths and might exhibit double bonds. Fatty acids without double bonds are termed "saturated fatty acid". By contrast, unsaturated fatty acids contain at least one double bond per molecule.

Total contamination

A test parameter commonly used for petroleum products and bio-diesel to indicate the presence of non-specific contamination not assignable to any other test parameter.

Oxidation stability

A test parameter characterizing resistance of fuels to the damaging effects of atmospheric oxygen during transport and storage. Inadequate oxidation stability leads to a formation of polymers which can settle in the fuel supply system and fuel injection pump.

RME

RME is the standard acronym for Rapeseed-oil (fatty-acid) MethylEster. The basic materials here result in a specific distribution of individual fatty-acid content (also termed fatty-acid *profile* or *spectrum*) which can be used to check whether or not a FAME was made from rapeseed oil. Most releases issued by automobile manufacturers refer to a use of RME. Current knowledge of the effects of additives (for example, flow improvers) and their mutual interactions is also limited largely to RME.

The declaration that a product comprises RME does not automatically mean that it also complies with DIN EN 14214. This compliance needs to be verified by a factory certificate or analysis.

Safety data sheet

A safety data sheet describes product properties relevant in terms of health risks, water / soil protection, fire / explosion protection, as well as necessary / authorized measures in the event of damage. This sheet is a declaration of responsibility by the manufacturer / distributor of a product.

Technical regulations for water-endangering substances at motor-vehicle filling stations

§19g of the Water Resource Laws serves as a basis for stipulating special water-protection requirements at filling stations; some of these requirements vary from state to state. The technical regulations for water-endangering substances at motor-vehicle filling stations standardize requirements on the basis of currently available findings.

Requirements concerning facilities for filling and transferring water-endangering substances

Governing the handling of water-endangering substances, these requirements are stipulated at the state level as part of the water-resource laws (refer to §19g).

The following **instruction leaflets** and additional items of information can be downloaded from www.aggm-biodiesel.de:

- Instruction leaflet on the transport of bio-diesel
- Instruction leaflet on handling bio-diesel at public filling stations
- Instruction leaflet on handling bio-diesel at private filling stations
- Notes on defining product quality in supply contracts
- Definition of terms related to bio-diesel
- Removal of reserve and quality-control samples from bio-diesel products
- Equipment for bio-diesel filling stations

Facts about the AGQM

Founded and registered as Bio-Diesel Quality Management Work Group (AGQM) in 1999.

Conclusion of brand licensing contracts with filling stations since 2002.

Members: 14 bio-diesel manufacturers
27 commercial enterprises
12 sponsoring members and associations

Areas of activity:

- Establishment of a bio-diesel quality management system
- Regular quality monitoring of manufacturers, warehouses and filling stations
- Organization of cooperative laboratory tests for bio-diesel quality assurance
- Advanced training courses for quality-assurance and laboratory staff
- Provision of information on handling bio-diesel
- Cooperation with the automotive and petroleum industries
- Implementation and attendance of R&D projects

MBW

The manufacturer / distributor must clearly be indicated.

Muster Biodieselwerke GmbH
Biodieselstraße 13
08151 Esteringen

Phone: +49-0815-1234
Fax: +49-0815-1235

MBW bio-diesel company certificate (SAMPLE)

Date: 23.11.2005

Sampling date: 23.11.2005

Weighing note: X83-15

These details should clearly identify consignment .

AGQM manufacturers use their QM concept to test <u>every batch</u> in terms of at least 11 characteristic parameters listed below.

Measurement results should be specific numbers wherever possible; no vague entries like "Within Limit".

Parameter	**Test**	**Unit**		**DIN EN 14214**	**MBW bio-diesel**
Acid value	EN 14104	mg KOH/g	max.	0.5	0.25
Water content	EN ISO 12937	mg/kg	max.	500	145
Total contamination	EN 12662	mg/kg	max.	24	5
Free glycerine	EN 14105			0.02	0.001
Monoglycerides	EN 14105	% (m/m)	max.	0.8	0.42
Diglycerides	EN 14105	% (m/m)	max.	0.2	0.15
Triglycerides	EN 14105	% (m/m)	max.	0.2	0.09
Total glycerine	EN 14105	% (m/m)	max.	0.25	0.14
Alkaline content (Na+K)	EN 14108(9)	mg/kg	max.	5	0.73
Alkaline earth content (Ca+Mg)	prEN 14538	mg/kg	max.	5	0.93
Filtration limit	EN 116	°C	max.	- 20	-22

Assured use of an oxidation stabilizer for rapeseed methylester.

The standard specifies different, seasonal limiting values for low-temperature stability.

The supplied rapeseed methylester (RME) is furnished with an oxidation stabilizer.

Intended for customer information, this factory certificate refers specifically to the delivered consignment. The certificate's use for later product identification is only permitted if the received consignment is transferred to the next trading stage without any modifications. This applies particularly to those resulting from mixing with other substances or damage during transport / storage.

Person responsible for issuing the company certificate.

(Signature)

Tester
Laboratory director

BIODIESEL

As at February 2004

Instructions for the transport of Biodiesel

The transport of Biodiesel makes particular demands on each person involved of the Biodiesel economy and obliges each to a great care. Only with the cooperation of each person involved and the consequent translation of quality assuring measures it can be guaranteed that the quality of Biodiesel will not be influenced negatively by transport.

The following recommendations present a summary of the experiences gained up to now within this area and have been put together to the best knowledge and belief. Nevertheless, it cannot be excluded, that some of the statements are incomplete or faulty. Following these advice cannot particularly mean any claims that the goods handed over from the tanker to the filling station corresponds to the requirements of DIN EN 14214.

Problems can derive from the pollution with different fuels as well as from the entry of water. It is not namely the duty and task of the loading places to take over the responsibility for the suitability / cleanliness of the used transport means as for the „ex works business". But the experience gained show that it is necessary to examine the transport vehicles and containers before loading them. Regarding this the holder / driver of the tanker is to remind of his duty.

Road transport

Following transport means are used for the transport of Biodiesel:

1. *tankers*
2. *carriers for top tanks*
3. *carriers for battery tanks > 1.000 l*
4. *vehicles for the carriage of tank containers*

Minimum standard should be the sole use of such transport means additionally having

- *valid type approval*
- *B3-certification / ADR*
- *test according § 29 Road Traffic Licencing Regulations*

Note

The flash point of Biodiesel has to be corresponding to the requirements of the standard DIN EN 14214 at least 120° according to the prescribed test method. For this reason and in view of further features as for the safety regulations Biodiesel is classified neither as a danger material nor a danger goods road / railway. Even, however, the addition of 1 to 2 % mineral oil diesel fuel (for example through remaining quantities of a prior loading) can lower the flash point clearly below 100 °C and therefore lead to an automatic classification as danger material or danger goods respectively.

Biodiesel is classified into the water pollution class 1 (WGK 1) that means weakly water endangering.

BIODIESEL

Measures

- *Transport containers or vehicles having beforehand transported any products with a flash point < 55 °C must definitely be refused for safety reasons, if a cleaning is impossible.*
- *A mixing of Biodiesel with mineral combustibles or fuels has to be excluded.*
- *The system and the measured length included of the tankers with a full-hose-system must be rinsed with a sufficient quantity before loading.*

The control of this measure is effected by the voucher which must be presented for evidence reasons in case of a objection.

- *The chambers / tanks of the transport mean must have no water and no pollution. This also applies for those chambers / tanks which should not be filled.*
- *Any such transport means with the following prior loading(s), without any cleaning, must be excluded from transport:*

  1. *Acids or alkaline solutions of any nature – also as mixings –*
  2. *Glycerine, plant oils*
  3. *Products with a flash point < 55 °C (highly or easily inflammable as well as inflammable, formerly designed as „danger class A I or II").*

The measures for the quality assurance during the transport of Biodiesel are consequently focussed on no having system rests and above all product rests of any earlier loadings which would lead to a mixing and thus a deterioration of the quality of Biodiesel. The unintentional filling of tanks with different fuels can be avoided by suitable markings.

If during the loading of the Biodiesel into the tanker or during the unloading of the goods with the customer any restoring samples are taken, a sampling protocol signed by both parties is to issue documenting the traceability of the circumstances of the sampling. It is recommended to sample at least 3 control samples that an unopened third sample is available for a possible arbitrary analysis. During the sampling the rules of DIN 51750 have to be kept to take a representative sample.

Note:

Carry always with you the updated and batch-related certificate of the works of the Biodiesel-producer. This one has to show that it deals of Biodiesel corresponding to DIN EN 14214.

Supreme law

Each person involved in the transport chain has to pay attention to that point that the entry of water is excluded during the loading, transport and unloading. Make sure that in the moment of handing over the goods at the filling station the dome shaft is free of water. It principally applies that unnecessary transfer proceedings should be avoided in the interest of the fuel quality.

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V.
(Association of Quality Management Biodiesel reg. Ass.)
Reinhardtstraße 18 • D-10117 Berlin
Fax: 0 30/31 90 4 - 43 5
www.agqm-biodiesel.de • info@agqm-biodiesel.de

BIODIESEL

As at May 2004

Instructions for the handling with Biodiesel in own consumption filling stations

1. Introduction

This instruction should help you change the existing own consumption filling stations of mineral oil fuels in favour of Biodiesel and recommend preventing measures to avoid any complaints. These instructions can also be applied for a reestablishment.

The following recommendations present a summary of the experiences gained up to now within this area and have been put together to the best knowledge and belief. Nevertheless, it cannot be excluded, that some of the statements are incomplete or faulty. Following these advice cannot particularly mean any claims for a running of such filling stations free of any deficiencies.

Every legal provision mentions the principal responsibility of the operator of the installation. This legal duty exists independently of the kind of the handled product.

Only those filling stations with inflammable, easily inflammable or highly inflammable materials or preparations stored or transhipped (this condition is given by storing/sale of Diesel/fuel) are subject to the operational safety instructions with very far-reaching duties of documentation. Own consumption filling stations with exceptionally handled Biodiesel are not subject to these requirements due to the high flash point of Biodiesel.

Biodiesel is produced out of plant oils in a chemical process, in Germany typically out of rape oil. Biodiesel (internationally also called FAME = fatty acid methyl ester) is subject to DIN EN 14214 concerning its parameters.

Biodiesel is a biological well decomposable product and therefore classified into the water pollution class 1 (WGK 1).

However, concerning the storing of Biodiesel according to DIN EN 14214 and fuel according to DIN EN 590 nearly the same legal regulations apply.

The legal provisions of each federal state can differ in detail from other federal state. Consider these specific requirements.

Note

Since the beginning of 2004 a revised mineral oil tax law applies. This results in a general possibility of a mixture of diesel fuel and Biodiesel in the storing tank of the end consumer (the resale of the mixture is illegal) which is harmless to the mineral oil tax law. Though, it is to consider that this mixture leads to a new fuel corresponding to neither DIN EN 590 (for diesel fuel) nor DIN EN 14214 (for Biodiesel) and that because of that the end consumer is responsible for the suitability of the mixed fuel. Furthermore, it is to consider that conventional storing facilities can typically not produce homogeneous mixtures out of the components.

For this, any possibilities have to be arranged either by product circulation (consider tank geometry!) or by using special mixture petrol pumps.

(Continuation see final page)

2. Product change of diesel fuel in Biodiesel

It is assumed that the existing own consumption filling station can present an official authorization.

The intentioned product change is to announce to the competent administration before.

You have to turn your particular attention to the structure

a) of the sealing surface (roadway impermeable to the product with joints material included) and
b) of the collecting pan for the storing tank(s) (with battery tanks or single-truss storing tanks with a capacity of more than 1.000 l).

Should the sealing surfaces be not any concrete of at least class B 35, you can assume that a product change does not lead to a further operating permit. In general it is to examine if the suitability of every component of the building (stones, protective coatings of paint and primers, sealing bands, etc.) is given for Biodiesel

The permitted active area is absolutely to keep. Suitable measures for a possible correction are the shortening of the hose of the petrol pump (but this restricts the handling) or the installation of active area limits (e.g. walls, dividing walls being firmly connected with the ground etc.)

What is to do or to consider in detail? Who can execute what kind of work?

2.1 Storing tank

1. The following works have to be executed by a specialised firm with authorization according to § 19 1 WHG (German Water Resources Act).

2. The present storing quantity of the diesel fuel is to remove completely from the plant. The „healthy quantity" of the bottom content is to separate.
***Recommendation:** use of the fuel in the own fleet, as possibly some quality parameters of the fuel rests exclude a public sale.*

3. Remove the remaining bottom content and give it to the proper waste disposal.
***Attention:** waste disposal as special waste necessary! Your special firm will assist you here.*

4. Cleaning of the tank in dry condition.
5. Reactive anodes (if applicable) are always to remove.

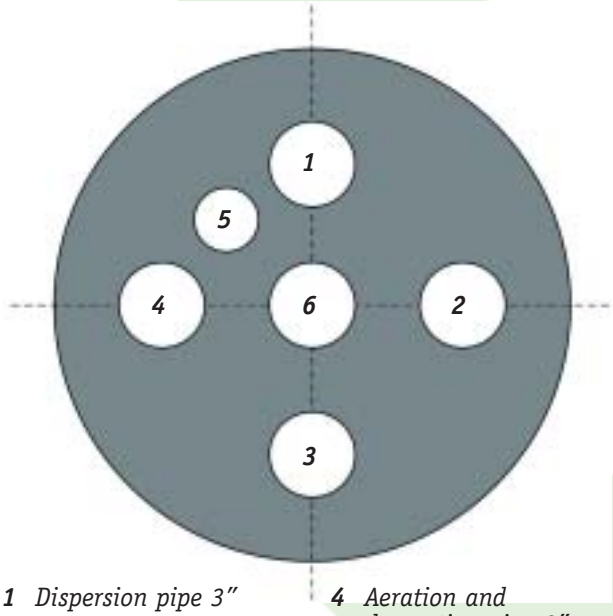
6. If „feeding wholes" at the inner container are found during the cleaning of the tank necessary to be treated, then during the use of a coating you have to check if its resistance against Biodiesel is guaranteed. Have the corresponding proofs presented.

7. Safety device against overcharging with storing facilities bigger than 1.000 l is to check concerning the usability evidence as for the building regulations and the built-in depth (see operating instructions). Follow the particular requirements concerning the mounting of safety devices against overcharging in battery tanks.

8. Exchange of sealings against those being resistant to Biodiesel.

Recommendations
Enclose the operating instructions of the safety devices against overcharging and every test report / evidence of the plant to the documentations of the operating permit. On this occasion you also check, if a copy of the type approval or the test documentations for the storing container respectively are completely included in.

Dome cover (example)

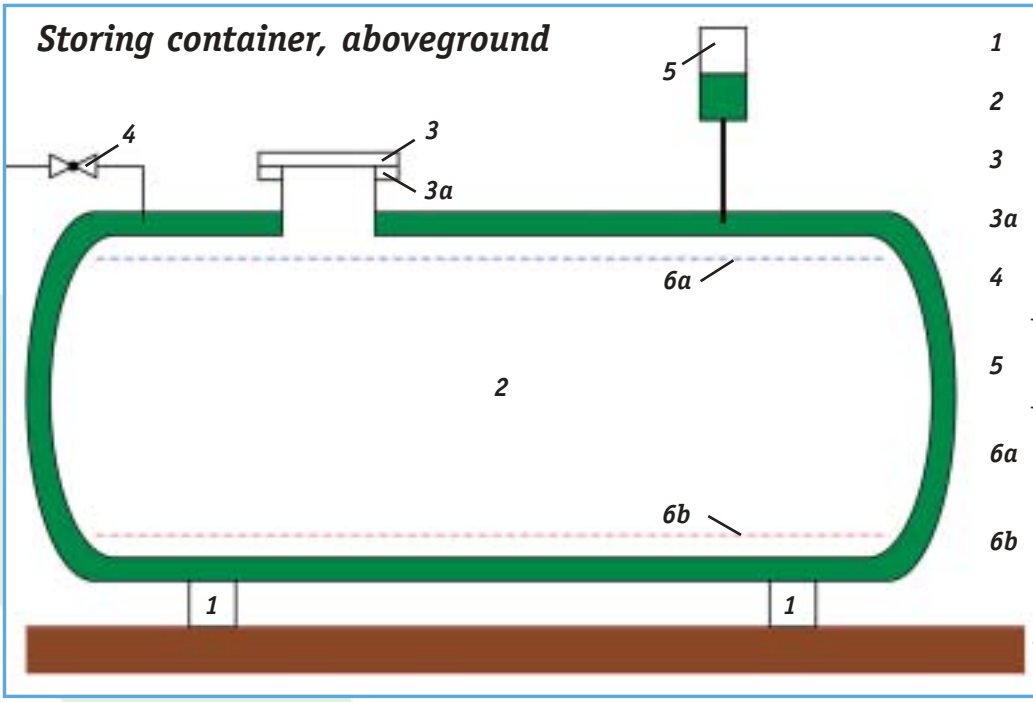


1 *Dispersion pipe 3"*
2 *Dislocation pipe 2" (suction pipe of the pump)*
3 *Reserve pipe 2" (better 3") for sampling and water test*
4 *Aeration and deaeration pipe 2" with air dome*
5 *Safety device against overcharging, for example limiting value transmitter*
6 *Level measuring system*

Independently from its storing volume the aboveground storing containers have to be equipped either with a double wall and a leak detector or to be placed in a sufficiently dimensioned, sealed and resistant collection place.

As for aboveground tanks < 1.000 l capacity a safety device against overcharging or a limit indicator can be omitted.

Storing container, aboveground



1 *Saddle feet*

2 *Container*

3 *Dome cover*

3a *Dome cover seal*

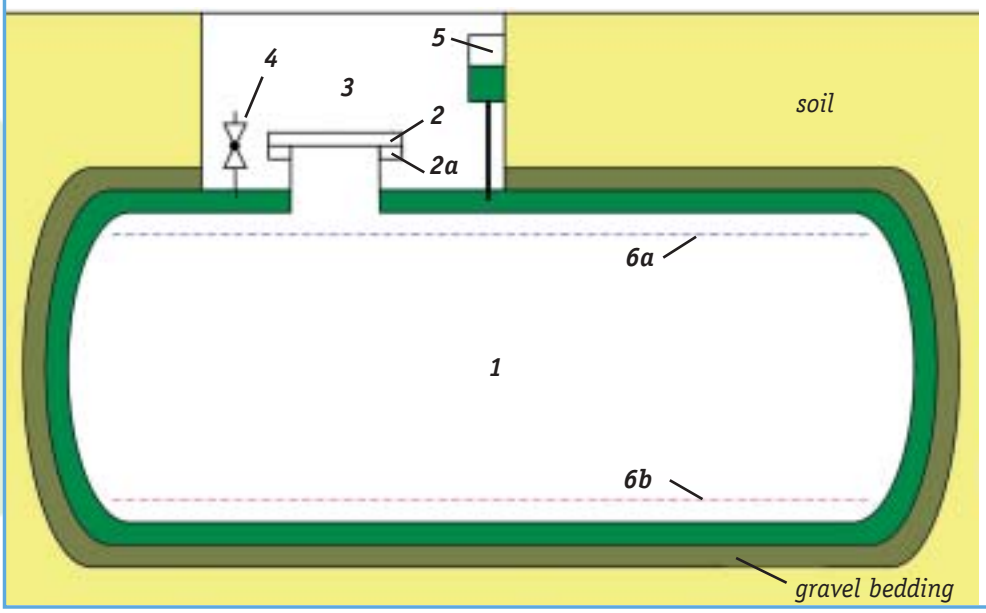
4 *Stop valve for the control liquid*

5 *Container for control liquid*

6a *Max. filling level 95 % of the volume*

6b *Min. filling level: corresponding to the building of the suction pipe*

Storing container, subterranean



1 *Container*

2 *Dome cover*

2a *Sealing ring*

3 *Dome shaft*

4 *Stop valve for the control liquid*

5 *Container for control liquid*

6a *Max. filling level 97 % of the volume (if earth cover is less than 0,8 m, then max. filling level is 95 %)*

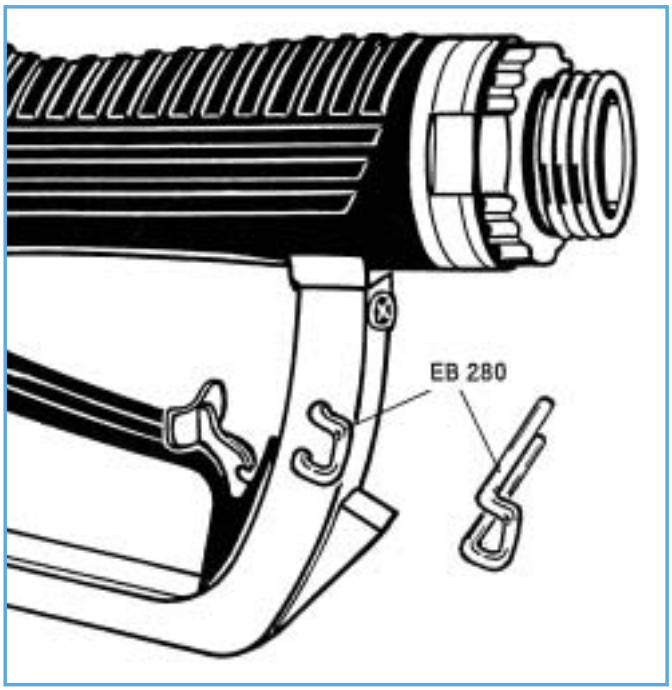
6b *Min. filling level: corresponding to the building of the suction pipe*

The size of the storing container in dependency on the specific regulations of a federal state determines, if you have to apply for a building or if an operator's notice is sufficient.

2.2 Pipelines

The pipelines in the storing tank area generally consist of C-steel (St 37). Any built-in or added parts of nonferrous heavy metal (copper, brass, bronze) or any zinc coated materials have to be substituted by equivalent parts of steel or, if applicable, to be removed (latter, if possible as for the function or if permitted). These measures avoid any corrosion signs with a subsequent formation of metal soaps which can deteriorate the quality of Biodiesel.

2.3 Distributing device



2.3.1 Fuel dispenser

1. Exchange of filter.

***Recommendation:** only use the filter laid down by the respective producer. Substitute the O-ring sealing in the filter housing. No operation without this filter.*

2. Substitute the hose of the petrol pump for one being resistant against Biodiesel.

*3. Check petrol pump pistol, facility according to specifications of the producer.**

** In the case of pump pistols made by ELAFLEX please remove the snap in plug EB 280 (refer figure). A new type of pistol working properly with all types of fuel will be developed.*

***Recommendation:** visual check of the cleanliness of the micro filter in the petrol pump pistol, if applicable clean it.*

2.3.2 Loading pump

1. Remove the residues before you clean the tank (also see 2.1).

2. Exchange the seals in favour of those being resistant against Biodiesel.

3. Handle any parts of nonferrous heavy metal as described in 2.1.1.

2.4 Sealing surfaces and deviating facilities

The functionality of the sealing surfaces (stones/sealing joints) is to check visually and if applicable, any defects should be repaired professionally.

Please check, if the built-in separator for light liquids and the other deviating facilities are suitable for the use of Biodiesel due to their type or size and the used materials. Besides, the setting is to adjust to an apparent product volume of 0,95 g/cm³, that the automatic locking device works correctly and the separator can be used as an additional retaining volume. If applicable, you should advice the producers of the building products here (this particularly concerns the separator).

From the documentation concerning the sealing surface (if applicable in cooperation with the producer/executing company) you have to check, if the used materials are suitable for Biodiesel. For example, some plates with a layer of fine mortar did not prove very worthwhile for the operation with Biodiesel and a few primers for sealing joints are not resistant against Biodiesel or work lose.

2.5 Further measures when changing the product

Above-named activities:

- Change of the product identification signs
  - at the storing tank
  - at the pipes taking the product
  - at the pump
  - at the petrol pump(s)

Recommendation: the necessary signs should be produced before cleaning the tank.

- First filling after tank cleaning of the storing container.

Recommendation: permanent test of consistency of the screw connection of the dispersion pipe as well as the manhole cover during the first filling. There at the same time function control of the limiting value transmitter (turning off with max. allowed filling height in the storing container).

- Filling of the pipes and hoses of the dislocation device(s).

- Filling of the pump and suction pipe, if the pump itself is not a priming one.

Comment

During the first filling permanent control of the facility parts for consistency. Additionally with aboveground storing: check of the functionality of the magnet valve for the automatic aeration of the suction pipe.

3. Operation of the own consumption filling station

It is most definitely permitted to fill only Biodiesel according to DIN EN 14214 into the storing facility.

Dislocation facilities for the public traffic are subject to the duty of calibration.

The calibration duty does not apply for the in-house use, if this facility only occurs for the reason of cost assignment.

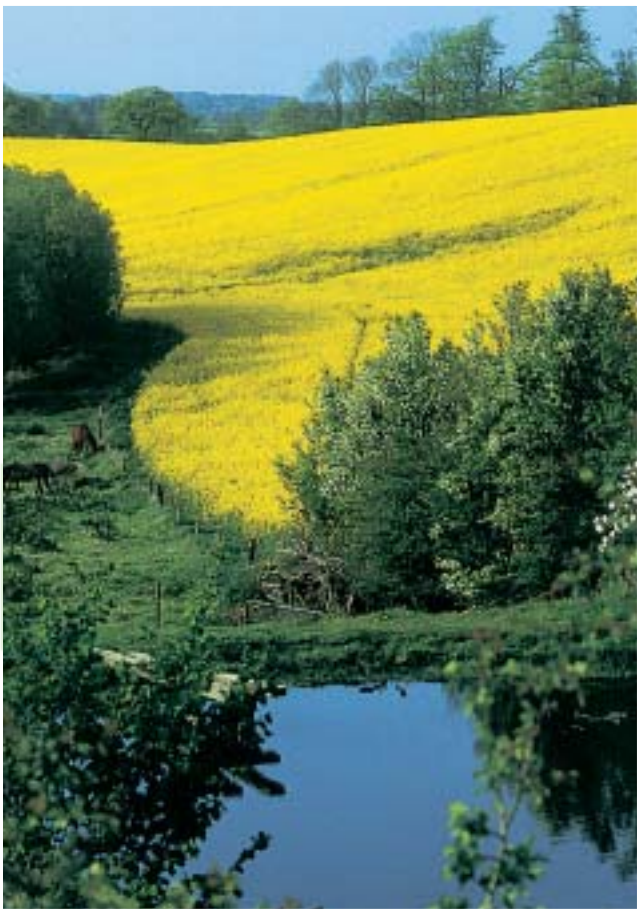
Provide some oil binding agents and prepare a tightly closing metallic collection container for used binding agents.

The plant operator is responsible for the keeping of the test duties.

Beyond this, he has to execute independent checks, for example a permanent visual control of the functionality of the sealing surfaces.

Recommendation: even though due to any legal facts in general any tank revisions are still required after 5 years (which necessarily have not to be connected with a prior tank cleaning), you should keep a tank cleaning interval of 2 years to avoid any cases of product liability and in the interest of a permanently good quality of Biodiesel.

Literary reference:
Summarizing information on the aspects of approval law in each federal state concerning the tank facilities can be found under:
www.pflanzenoelinitiative.de



Note *(Continuation to front page)*
With reference to the requirements to the storing of fuels in the case of a legal possibility of mixture the principle applies that then the requirements to the storing of a fuel component each classified in a higher class of water danger – here that of diesel fuel – are to keep.

The following instructions and recommendations refer exclusively to the change of product in favour to Biodiesel as a pure fuel. Information concerning the storing stability or product quality with the different quantity relations of diesel fuel / Biodiesel is presently not available.

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V.
(Association of Quality Management Biodiesel reg. Ass.)
Reinhardtstraße 18 • D-10117 Berlin
Telephone (0 30) 3 19 04 - 4 33 • Fax (0 30) 3 19 04 - 4 35
Internet www.agqm-biodiesel.de

BIODIESEL

As at May 2004

Instructions for the handling with Biodiesel in filling stations

1. Introduction

This instruction should help you change the existing filling stations of mineral oil fuels in favour of Biodiesel and recommend preventing measures to avoid any complaints.

The following recommendations present a summary of the experiences gained up to now within this area and have been put together to the best knowledge and belief. Nevertheless, it cannot be excluded, that some of the statements are incomplete or faulty. Following these advice cannot particularly mean any claims for a running of such filling stations free of any deficiencies.

Every legal provision mentions the principal responsibility of the operator of the installation. This legal duty exists independently of the kind of the handled product.

Only those filling stations with inflammable, easily inflammable or highly inflammable materials or preparations stored or transhipped (this condition is given by the sale of Diesel/fuel) are subject to the operational safety instructions. Therefore you have to judge the endangering and to issue a document of explosion protection. In these documents the handling of Biodiesel is to consider as well even if due to the flash point Biodiesel itself is not regarded as a flammable product. Therefore these documents are to update with changing the product.

Biodiesel is produced out of plant oils in a chemical process, in Germany typically out of rape oil. Biodiesel (internationally also called FAME = fatty acid methyl ester) is subject to DIN EN 14214 concerning its parameters.

Biodiesel is a biological well decomposable product and therefore classified into the danger class 1 (WGK 1). However, concerning the storing of Biodiesel according to DIN EN 14214 and fuel according to DIN EN 590 nearly the same legal regulations apply.

The legal provisions of each federal state can differ in detail to other federal state. Consider these specific requirements.

Note

Since the beginning of 2004 a revised mineral oil tax law applies. This results in a general possibility of a mixture of diesel fuel and Biodiesel in the storing tank being harmless to the mineral oil tax law. This has no consequences for public filling stations as in connection with the entry of Biodiesel into the 10th Immission Protection Regulation (Regulation on Fuel Quality and Identification) the filling station will be obliged to offer either any fuel according to DIN EN 590 or Biodiesel according to DIN EN 14214. The requirements of these standards will already not be kept with small mixing parts of each of the other components. According to DIN EN 590 the possibility is given that diesel fuel can consist of max. 5 vol% Biodiesel of the components. For this, any possibilities have to be arranged either by product circulation (consider tank geometry !) or by using special mixture petrol pumps.

The following instructions and recommendations refer exclusively to the change of product in favour to Biodiesel as a pure fuel.

2. Product change of diesel fuel in Biodiesel

It is assumed that the existing installation with a dislocation facility can present an official authorization. It is to check, if any particular conditions are prescribed for the diesel fuel as a product in the authorization note of the competent administration. These conditions have to be adjusted when changing the product.

The intentioned product change is to announce to the competent administration before.

What is to do or to consider in detail? Who can execute what kind of work?

2.1 Storing tank

The following works have to be executed by a specialised firm with authorization according to § 19 1 WHG (German Water Resources Act).

2. The present storing quantity of the diesel fuel is to remove completely from the plant. The „healthy quantity" of the bottom content is to separate.
***Recommendation:** use of the fuel in the own fleet, as possibly some quality parameters of the fuel rests exclude a public sale*

3. Remove the remaining bottom content and give it to the proper waste disposal.
***Attention:** waste disposal as special waste necessary! Your special firm will assist you here.*

4. Cleaning of the tank in dry condition.

5. Reactive anodes (if applicable) are always to remove.

6. If „feeding wholes" at the inner container are found during the cleaning of the tank necessary to be treated, then during the use of a coating you have to check if its resistance against Biodiesel is guaranteed. Have the corresponding proofs presented.

7. Safety device against overcharging with storing facilities is to check concerning the usability evidence as for the building regulations and the built-in depth (see operating instructions).

8. Exchange of manhole cover seal.

Recommendation
Make sure that the exchange of the manhole cover seal is part of the works of the executing company. Enclose the operating instructions of the safety devices against overcharging and every test report / evidence of the plant to the documentations of the operating permit. On this occasion you also check, if a copy of the type approval or the test documentations for the storing container respectively are completely included in.

2.2 Pipelines

The pipelines in the storing tank area generally consist of C-steel (St 37). Any built-in or added parts of nonferrous heavy metal (copper, brass, bronze) or any zinc coated materials have to be substituted by equivalent parts of steel or, if applicable, to be removed (latter, if possible as for the function or if permitted). These measures avoid any corrosion signs with a subsequent formation of metal soaps which can deteriorate the quality of Biodiesel.

2.3 Distributing device

2.3.1 Fuel dispenser

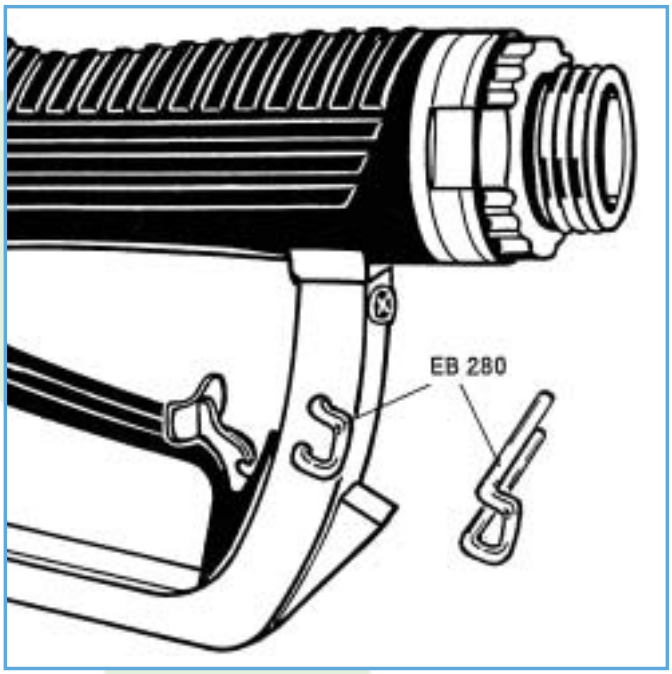
1. Exchange of filter.

Recommendation: *only use the filter laid down by the respective producer. Substitute the O-ring sealing in the filter housing*

2. Substitute the hose of the petrol pump for one being resistant against Biodiesel.

*3. Check petrol pump pistol, facility according to specifications of the producer.**

Recommendation: *visual check of the cleanliness of the micro filter in the petrol pump pistol, if applicable clean it.*



2.3.2 Loading pump

1. Remove the residues before you clean the tank (also see 2.1).

2. Exchange the seals in favour of those being resistant against Biodiesel.

3. Handle any parts of nonferrous heavy metal as described in 2.1.1.

2.4 Sealing surfaces and deviating facilities

The functionality of the sealing surfaces (stones/sealing joints) is to check visually and if applicable, any defects should be repaired professionally.

** In the case of pump pistols made by ELAFLEX please remove the snap-in plug EB 280 (refer figure). A new type of pistol working properly with all types of fuel will be developed.*

Please check, if the built-in separator for light liquids and the other deviating facilities are suitable for the use of Biodiesel due to their type or size and the used materials. Besides, the setting is to adjust to an apparent product volume of 0,95 g/cm³ , that the automatic locking device works correctly and the separator can be used as an additional retaining volume. If applicable, you should advice the producers of the building products here (this particularly concerns the separator).

From the documentation concerning the sealing surface (if applicable in cooperation with the producer/executing company) you have to check, if the used materials are suitable for Biodiesel. For example, some plates with a layer of fine mortar did not prove very worthwhile for the operation with Biodiesel and a few primers for sealing joints are not resistant against Biodiesel or work lose.

2.5 Further measures when changing the product

Above-named activities:

- Change of the product identification signs

- *at the storing tank*
- *at the pipes taking the product*
- *at the pump*
- *at the petrol pump(s)*

Recommendation: *the necessary signs should be produced before cleaning the tank.*

- First filling after tank cleaning of the storing container.

Recommendation:
permanent test of consistency of the screw connection of the dispersion pipe as well as the manhole cover during the first filling. There at the same time function check of the limiting value transmitter (turning off with max. allowed filling height in the storing container).

- Filling of the pipes and hoses of the dislocation device(s).

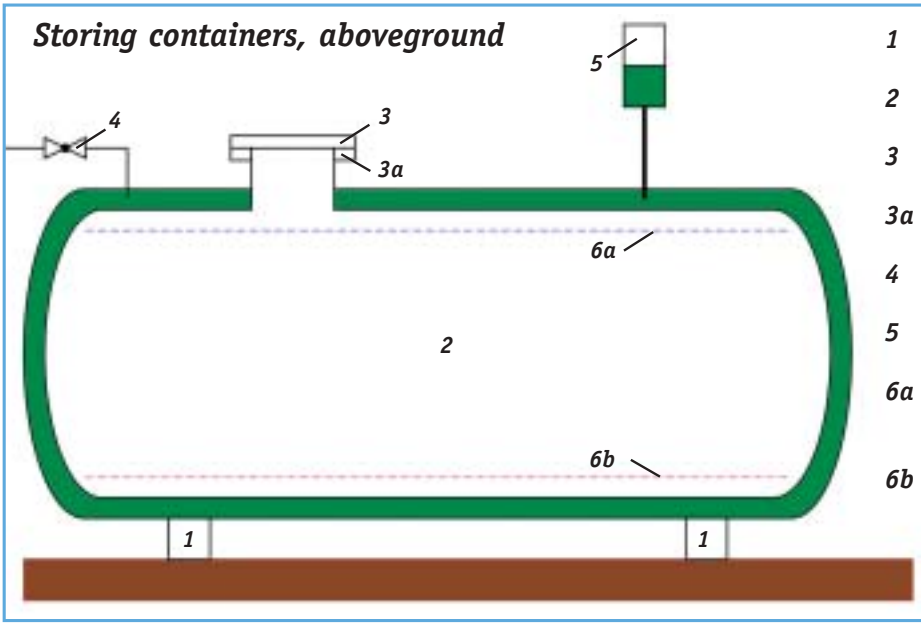
Comment
During the first filling permanent control of the facility parts for consistency. Additionally with aboveground storing: check of the functionality of the magnetic valve for the automatic aeration of the suction pipe.

3. New erection

Orientation value of the storing volume to be created is 1/4 of the planned annual turnover. In comparison with the turnover of big storing capacities smaller transhipment turnover rates occur which can disadvantageous influence the product quality on the one hand and which impede the swift change in favour of the winter goods on the other hand.

Independently from its storing volume the aboveground storing containers have to be equipped either with a double wall and a leak detector or to be placed in a sufficiently dimensioned, sealed and resistant collection place. As for aboveground tanks < 1.000 l capacity a safety device against overcharging or a limit indicator can be omitted.

Storing containers, aboveground



1 *Saddle feet*

2 *Container*

3 *Dome cover*

3a *Dome cover seal*

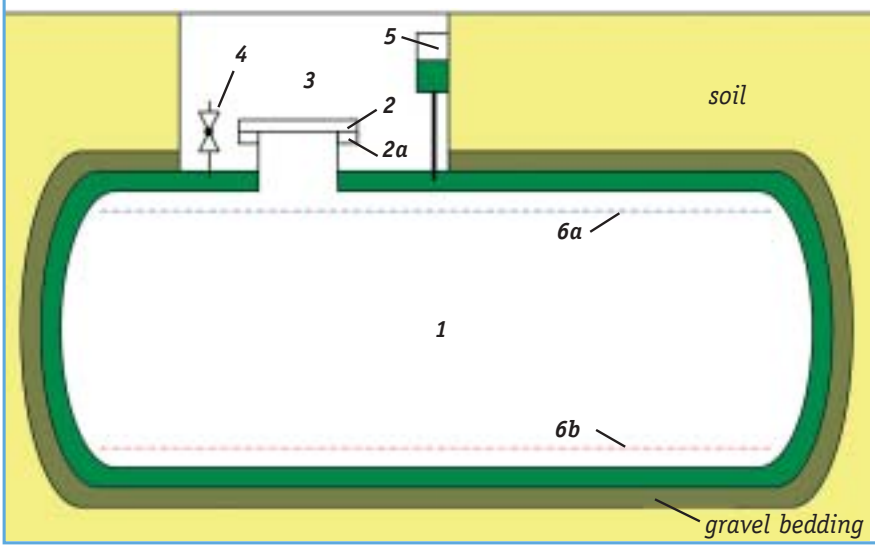
4 *Stop valve for control liquid*

5 *Container for control liquid*

6a *Max. filling level 95 % of the volume*

6b *Min. filling level: corresponding to the building of the suction pipe*

Storing containers, subterranean



1 *Container*

2 *Dome cover*

2a *Sealing ring*

3 *Dome shaft*

4 *Stop valve for control liquid*

5 *Container for control liquid*

6a *Max. filling level 97 % of the volume (if earth cover is less than 0,8 m, then max. filling level is 95 %)*

6b *Min. filling level: corresponding to the building of the suction pipe*

The size of the storing container in dependency on the specific regulations of a federal state determines, if you have to apply for a building or if an operator's notice is sufficient.

The judgement is based upon:

- *Water Resources Act*
- *Regulation on installations concerning the dealing with water endangering materials and on expert companies*

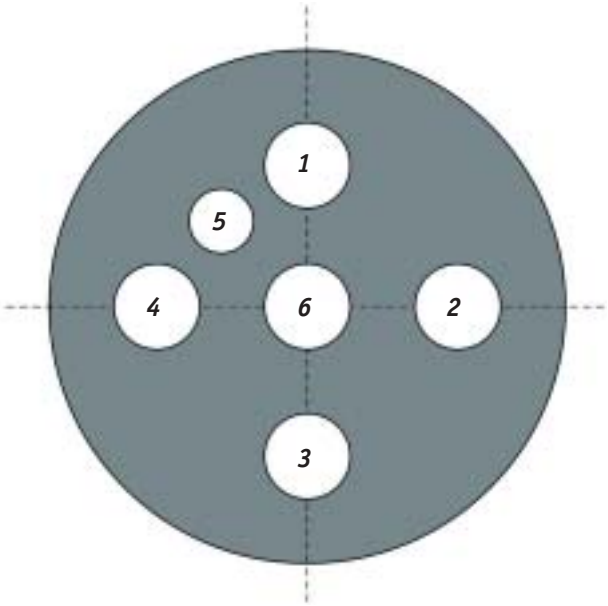
Note
A facility or a part of a facility (for ex.: storing container) is considered as subterranean, if it is partly or completely bedded in the earth. All the other facilities or parts of such ones – even any such ones in accessible subterranean rooms are seen as aerial. Battery tanks are regarded as one storing container, if they are operationally connected to each other and an exchange of liquid is possible. There it is of no importance, if this connection is lockable by any manual or automatic fittings.

Only type-approved containers must be operated.

Additional facilities like safety devices against overcharging (limit indicator), leak detecting devices for hulls and/or pipelines, liquid indicators in collection basins, electric level indicators have to be issued together with the suitability proof as for each building regulation law. The dislocation facilities for the public traffic have to be appropriate for verification and have to be calibrated at the beginning of the actual distribution.

The used building products have to be suitable for Biodiesel. This applies for example for the materials of sealing joints (primer and sealing band) and for concrete stones for sealing surfaces. Stones with a separately deposited layer of fine mortar have turned out to be unsuitable.

Dome cover (example)



1 *Dispersion pipe 3"*

2 *Dislocation pipe 2" (suction pipe of the pump)*

3 *Reserve pipe 2" (better 3") for sampling and water test*

4 *Aeration and deaeration pipe 2" with air dome*

5 *Safety device against overcharging, for example limiting value transmitter*

6 *Level measuring system*

4. Operation of the filling stations

It is most definitely permitted to fill only Biodiesel according to DIN EN 14214 into the storing facility.

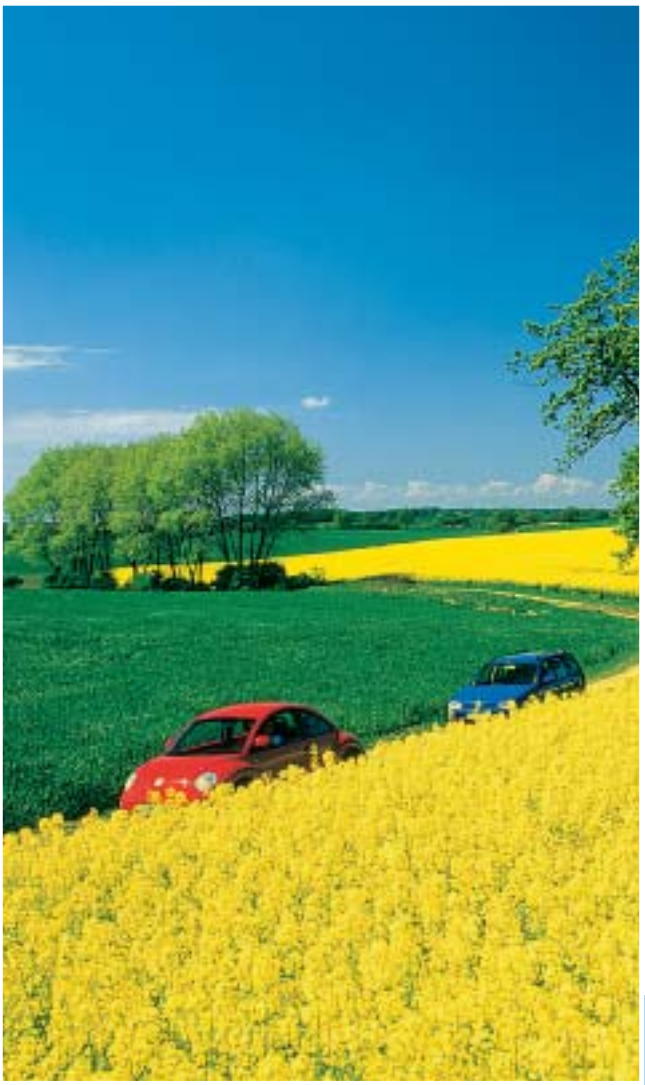
Dislocation facilities for the public traffic are subject to the calibration duty.

Provide some oil binding agents and prepare a tightly closing metallic collection container for used binding agents.

The plant operator is responsible for the keeping of the test duties. Beyond this, he has to execute independent checks, for example a permanent visual control of the functionality of the sealing surfaces.

Recommendation: even though due to any legal facts in general any tank revisions are still required after 5 years (which necessarily have not to be connected with a prior tank cleaning), you should keep a tank cleaning interval of 2 years to avoid any cases of product liability and in the interest of a permanently good quality of Biodiesel.

Literary reference:
Summarizing information on the aspects of approval law in each federal state concerning the tank facilities can be found under:
www.pflanzenoelinitiative.de



Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V.
(Association of Quality Management Biodiesel reg. Ass.)
Reinhardtstraße 18 • D-10117 Berlin
Telephone (0 30) 3 19 04 - 4 33 • Fax (0 30) 3 19 04 - 4 35
Internet www.agqm-biodiesel.de

ARBEITSGEMEINSCHAFT QUALITÄTSMANAGEMENT BIODIESEL E.V.
(BIODIESEL QUALITY MANAGEMENT ASSOCIATION EV)
REINHARDTSTRAßE 18, 10117 BERLIN

Truths about Biodiesel

Typical Assertions – and Objective Answers

Biodiesel is not an ecologically and economically attractive product.

The often quoted report of the Federal Environmental Office (UBA) does **not** come to the conclusion that RME should not be approved as a substitute for diesel fuel. The examination reveals much more differentiated statements since even with the most unfavorable assumptions, there is only a partial consumption of ecological benefits, never a reversal of benefits in favor of diesel fuel. In any case, the economic evaluations on the use of RME mentioned in the report are to be doubted because they are based on out-of-date data.

It is, however, generally known that this UBA report as a whole is often represented in distorted form in order to give reasons not to use biodiesel. On the other hand, a more current economic balance sheet from the Institute for Waste Management and Environmental Engineering (ifeu Institute) (2003) has shown that using one liter of biodiesel saves 2.2 kg of hothouse gases.

In addition, the Munich Institute for Economic Research (ifo Institut) published a study (2002) on the topic “General Economic Effects of Biodiesel” and comes to a positive general economic balance sheet. This positive evaluation even took into account tax losses through biodiesel favored by petroleum tax preferences.

Essential ecological arguments for using biodiesel, on the other hand, are its good biodegradability and the consequent low risk to water.

There is no binding standard for biodiesel.

After the introduction of a prestandard, E DIN 51606 defined from 1997 on the characteristics of biodiesel in Germany. It had the status of a draft standard but was still completely valid and represented the technical basis for almost all clearances from motor vehicle manufacturers.

In November 2003 the previous standard was replaced by the Euorpean standard EN14214 – corresponding in Germany to DIN EN 14214. Some parameters of this standard are stricter than the previous one, and the standard also contains additional requirements. In respect to biodiesel, DIN EN 14214 is the technical basis for the amended Fuel, Quality and Identification Law (10.BImSchV). Biodiesel offered as a fuel must be conform to the specifications of DIN EN 14214.

This is why at the pump biodiesel is expressly identified with a sticker according to the current standard.

You cannot rely on biodiesel quality.

Biodiesel has become one of the most intensively controlled fuels. Throughout Germany the Biodiesel Quality Management Association e.V. (AGQM) uses a five-step control system, which checks biodiesel quality from manufacturer to pump. In addition, in enforcement of 10. BImSchV, the responsible departments for each state carry out inspections. If violations are found, then legal measures are taken.

Of 1,700 biodiesel filling stations, more than 1,300 have joined the inspection system that guarantees the quality and traceability of the product. These filling stations are thus also reliable partners for car drivers.

ARBEITSGEMEINSCHAFT QUALITÄTSMANAGEMENT BIODIESEL E.V.
(BIODIESEL QUALITY MANAGEMENT ASSOCIATION EV)
REINHARDTSTRAßE 18, 10117 BERLIN

The requirements for the producers in the AGQM are “stricter” than those of the European standard and extend to the organization of plant quality assurance.

In addition to a purely controlling function, the AGQM carries out a number of activities that contribute directly to the stabilization of quality (publishing information on the proper handling of biodiesel, training of employees on quality assurance in companies, round-robin tests, publications and lectures in technical committees and for users, consulting to solve quality problems).

Biodiesel is not winter hardy.

The biodiesel standard requires cold hardiness of –20 ºC (-4 ºF). This value is achieved – as it is with petroleum diesel – through additives at the time of manufacture.

The AGQM has an agreement with its members that the production of winter diesel begin four weeks before the date required by the standard so the consumer actually purchases a winter-hardy product at the needed time.

Biodiesel leads to clogged filters.

If vehicles are changed over to biodiesel after operating for some time on petroleum, it is possible that the old sediments from the petroleum diesel will dissolve and move into the fuel filter. Experts, therefore, recommend that after two to three tanks of biodiesel, the fuel filter be changed outside of the regular service period to prevent old deposits from clogging the filter. Biodiesel that conforms to standard does not itself produce premature clogging of filters.

Using Biodiesel leads to a loss of performance and to increase of 10 to 15% in consumption.

An increase in consumption is to be expected due to the low specific energy content of biodiesel. But in practical operations, this increase is significantly lower than the formal calculation since other favorable characteristics of biodiesel permit more efficient engine operation. In fleet tests an increased consumption of zero to five percent was determined compared to diesel fuel. Increased consumption of ten percent and more is unknown and could not be technically justified.

Shorter intervals between oil changes on commercial vehicles negate the economic advantage of biodiesel.

When biodiesel is used, many commercial vehicle manufacturers do indeed specify shorter intervals between oil changes for safety reasons. With the present pricing structure for fuels, however, there are in the end significant economic advantages for biodiesel. Large transport companies, who operate their fleets with biodiesel, are the practical proof.

Microbiological Processes in biodiesel lead to clogged filters

It has been postulated that microbiological processes take place in fuel hoses, but until now there has not been a single case of this kind of damage (not even in biodiesel operation in boots). In any case, for the development of microbiological processes a free-water phase as a boundary layer is needed to offer the micro-organisms suitable living conditions. With standardized biodiesel this can never occur, even in a mixture with standardized petroleum diesel.

ARBEITSGEMEINSCHAFT QUALITÄTSMANAGEMENT BIODIESEL E.V.
(BIODIESEL QUALITY MANAGEMENT ASSOCIATION EV)
REINHARDTSTRAßE 18, 10117 BERLIN

If there are technical problems with the injection system, the customer is stuck with the damages.

Unfortunately, the qualifications at local service stations on the subject of biodiesel vary considerably. Sometimes the impression arises that technical or wear problems are “loaded off” on biodiesel use, just to be on the safe side, without proof of a connection. Customers are always well advised if they can show that they have always purchased and used quality certified products.

Biodiesel has always been an ecologically, economically and technically attractive alternative to petroleum diesel!

There is much more to be said about the subject of biodiesel. Take advantage of the expertise of the members of the Biodiesel Quality Management Association e.V. You’ll find a contact in the Internet at www.aqqm-biodiesel.de .

Invitation

1. International Conference for Biodiesel Producers

24th and 25th November 2006
Biodiesel Quality Management Workgroup (AGQM), Berlin

Biodiesel has now attained the most significant position amongst biofuels in Europe. Production is constantly increasing world-wide. However, the markets which biodiesel can approach depend on the respective general conditions. Apart from favourable political conditions, the consistent assurance of the high standard of quality of the biodiesel is prerequisite to a successful approach and survival on the market.

The changes in the energy tax legislation planned for 1st January 2007 in Germany and the introduction of quotas for biofuels will probably include compliance with product standards as a condition for tax benefits and acknowledgement of fulfilment of the quota. Strict requirements will be made on proof of compliance with the standards. It is anticipated that other countries in Europe will adopt this principle.

With the 1st international conference for biodiesel producers, the Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V. (AGQM) wishes to enter into an exchange of ideas with all interested parties on the topics of "Political conditions", "Standardisation and quality assurance" and "Quality assurance in companies and in the supply chain".

The conference is addressed to the company managers of biodiesel producers, the people responsible for production and sales, and staff assigned to quality assurance within companies.

Lectures, 24th Nov 2006

As an introduction, the AGQM will report on its experience in quality assurance for biodiesel in Germany. The high share of biodiesel in marketing as a pure fuel makes high requirements on the properties of the product. The experience gained in this, including quality assurance of the analytical methods themselves, is a good basis for the marketing of biodiesel as a blend component. This will be followed by a description of the political conditions in Germany and Europe, which will address subsidisation aspects as well as product monitoring by statutory rulings.

Further topics will address the relationships between the quality properties of the biodiesel and the technical usefulness and acceptance by vehicle producers. The

technical consequences of inadequacies in the properties of biodiesel will be described as seen by vehicle producers and OEMs – and also from a scientific point of view.

The conference will also contribute to transparency in work on standardisation and provide an overview of the current activities in the field of fuel standardisation in Europe. The practical implementation and verification of the requirements of standards will also be presented.

Substantial time will be dedicated to a discussion of practical experience and the suitability of different methods for quality assurance in companies. The AGQM will present the certification system developed specifically for biodiesel producers on an international scale for the first time. An industrial insurer will also portray his view of the topics of product quality and product liability.

Overview of topics:

- *Report on experience in quality assurance for biodiesel in Germany*
- *Political conditions for biodiesel in Germany and Europe*
- *Product properties and technical effects of inadequate fuels as seen by the automotive industry and OEMs*
- *Interaction of standardisation and quality assurance*
- *Successful methods of quality assurance by companies*

Related programme, 25th Nov 2006

Excursion to the biodiesel producers Bio-Ölwerk Magdeburg GmbH. A tour through the biodiesel plant and the company's own oil mill is planned. It will also be possible to speak to the people responsible for production, quality assurance and the test laboratory and to exchange experience.

Bio-Ölwerk Magdeburg GmbH currently has a biodiesel capacity of 75,000 t/a. In a further stage of extension now taking place, the production capacity will be increased by 200,000 t/a. The new facility is anticipated to begin operation in 2007.

The 1st international conference for biodiesel producers will be conducted in advance of the 4th international congress for biofuels, which will take place on the 27th and 28th of November 2006 in Berlin and will provide an up-to-date overview of the overall field of biofuels.

Both events are intended to further develop the network in the biofuels branch and to improve the opportunities on the market for biofuels by reciprocal, practical inspiration.

General information

Bookings

Please book using the application form at the AGQM homepage: www.agqm-biodiesel.de. You will then receive a confirmation of your attendance and an invoice.

The closing date for applications is the 7th November 2006.

Attendance fees

The attendance fee is as follows (including conference literature, beverages during breaks, joint dinner on November 24, 2006, lunch and bus transfer to the excursion):

- *750.00 EUR*
- *100.00 EUR for AGQM members*

(All prices subject to 16% VAT.)

Please transfer the attendance fee, stating the attendance number specified in the confirming e-mail, to the AGQM account:

- *Bank: Volksbank Bonn Rhein-Sieg, 53175, Germany*
  Account: 210 280 101 9
  IBAN: DE60 380 601 86 210 280 101 9
  BLZ: 380 601 86 (for transfers from Germany)

For cancellations until 7th November 2006, a handling fee of 50.00 EUR (plus VAT) will be charged. After this date, the full attendance fee is payable. The nomination of a different participant is free of charge.

Further information

Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V. (AGQM)
Claire-Waldoff-Str. 7
10117 Berlin
Germany
Tel: +49 (0)30 31 90 44 33
Fax: +49 (0)30 31 90 44 35
E-mail: info@agqm-biodiesel.de
www.agqm-biodiesel.de

Venue

Haus der Land- und Ernährungswirtschaft (HdLE)
Claire-Waldoff-Str. 7
10117 Berlin
Germany

Arrival by car

Arrival by car is not advisable as no parking spaces are available in close proximity to the HdLE.

Arrival by train/local transport

Disembark at the Hauptbahnhof or Ostbahnhof. Take the urban railway (S 5, 7, 9, 75) towards Friedrichstraße and disembark at the Friedrichstraße urban railway station. Change to the underground (U 6) and travel one station further to the underground station Oranienburger Tor.

Arrival by air

Airport Berlin Tegel

Take bus number 128 to the Kurt-Schumacher-Platz underground station, change to the underground (U 6), disembark at the Oranienburger Tor underground station.

Airport Berlin Tempelhof

Take the underground (U 6) to the Oranienburger Tor underground station.

Airport Berlin Schönefeld

Take the Airport Express or urban railway (S 9) to the Friedrichstraße urban railway station. Change to the underground (U 6) and travel one station further to the underground station Oranienburger Tor.

Accommodation

We have reserved a limited number of rooms in two hotels:

*Hotel Lindner*****	*single: 95.00 EUR*
Kurfürstendamm 24	*double: 131.00 EUR*
10719 Berlin	*(valid until 29th Oct 2006)*
Tel. +49 (0)30 81 82 50	
www.lindner.de	

*Hotel Excelsior*****	*single: 90.00 EUR*
Hardenbergstrasse 14	*double: 109.00 EUR*
10623 Berlin	*(valid until 27th Oct 2006)*
Tel. +49 (0)30 3 15 50	
www.hotel-excelsior.de	

(All prices per night, including breakfast and 16% VAT.)

You can book your own room stating the codeword "Kraftstoffe der Zukunft 2006". For further inquiries on room reservations, the number of free rooms and other requests regarding hotel reservations, please consult:

topselect
CONFERENCES EVENTS INCENTIVES

Top Select GmbH
Stefan Geyer
Dahlienstr. 32, 42477 Radevormwald, Germany
Tel: +49 (0)2195 599332
E-mail: stefan.geyer@topselect-gmbh.de
www.topselect-gmbh.de

Agenda

1. International Conference for Biodiesel Producers

24th and 25th November 2006
Biodiesel Quality Management Workgroup (AGQM), Berlin

24th November 2006

09:00 ***Registration***

Introduction

10:00 ***6 years of experience in quality assurance of biodiesel (AGQM) – quality and long-term market access***
Dr. Jürgen Fischer, Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V., Chaiman of the Board

10:30 ***Political conditions (in Germany and Europe)***
Dieter Bockey, Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V., General Manager

Quality situation of biodiesel and technical problems

11:00 ***Requirements on the quality of (bio)fuels as seen by a car manufacturer***
Dr. Thomas Garbe, Volkswagen AG

11:30 ***10 years of experience with utility vehicles approved for biodiesel***
N.N., DaimlerChrysler AG

12:00 ***Requirements placed by the Fuel Injection System on the Quality of Biodiesel and Biodiesel Blends***
Dr. Jörg Ullmann, Robert Bosch GmbH

12:30 ***Effects of the properties of biodiesel on exhaust treatment systems***
Prof. Dr. Jürgen Krahl, Steinbeis Transferzentrum Biokraftstoffe

13:00 ***Lunch Break***

Standardisation and quality assurance - an inseparable couple

14:00 ***How does standardisation operate in the CEN area?***
Carel Stapel, former chair of CEN/TC 19

14:30 ***Overview of current standardisation activities in the fuel sector***
Dr. Thomas Feuerhelm, FAM (DIN), Head of the office

15:00 ***3 years of working with EN 14214 - a critical assessment of the test methods***
Prof. Dr. Martin Mittelbach, Institut für Organische Chemie der Karl-Franzens-Universität Graz

15:30 ***Test methods, precision data, decisions, requirements on sampling***
Dr. Thomas Wilharm, Analytik Service GmbH, General Manager

16:00 ***Coffee Break***

Methods of quality assurance

16:30 ***Quality and product liability***
Harald Wüsteney, Allianz Global Corporate & Speciality AG, Allianz Risk Consulting Liability

17:00 ***Requirements on technical and organisatorial procedures in quality assurance for biodiesel in companies***
Dr. Jens Haupt, Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V.

17:30 ***Audits - just inconvenient side-effects of quality assurance or a genuine aid?***
Dr. Georg Pollert, Mitteldeutsche Umesterungswerke, General Manager

18:00 ***Presentation and requirements for AGQM certification and the procedure***
Dieter Bockey, Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e. V.

25th November 2006

Accompanying programme

9:00 ***Visit to a biodiesel plant (with laboratory), exchange of experience between production manager, quality manager and analytical staff***

15:00 ***Ending***

附件二 MITSUBISHI

1. **MITSUBISHI CORPORATION**

   BIODIESEL ACTIVITY

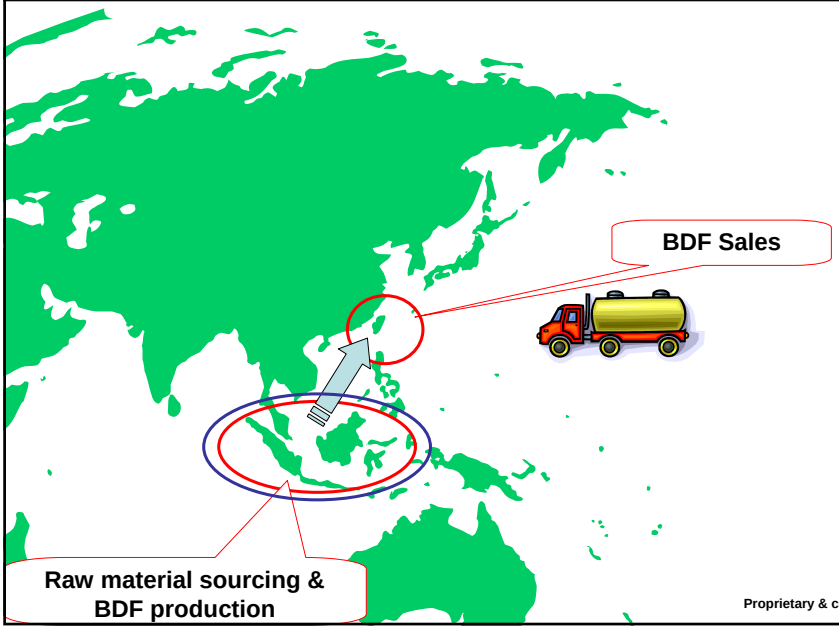
2. **German Biofuel Market**

Mitsubishi Corporation

MITSUBISHI CORPORATION
BIODIESEL ACTIVITY

November, 2006
MITSUBISHI CORPORATION

MITSUBISHI CORPORATION 's BDF Activity(1)



MITSUBISHI CORPORATION 's BDF Activity(2)

■ Product 1: POME from existing supplier

* MITSUBISHI can supply POME from Japan or Malaysia which can meet EN14214 quality from now.

■ **Product 2: POME from future production plant**

* MITSUBISHI is under study to start production from own POME plant from end of 2008.

【MITSUBISHI's STRENGTH】

As MITSUBISHI has an alliance with reliable POME producer, who has an experience to produce POME for detergent purpose more than 15 years. (Nobody has such long history of POME production)

Therefore, MITSUBISHI can offer you reliable quality and also stable supply.

BIODIESEL Quality Standard Study

Even after the chemical reaction, several specs should be controlled.

BIODIESEL QUALITY varies depending on…

RAW MATERIAL	PROCESSING	BLENDING
 High pour point  Bad oxidation stability	Insufficient processing, methanol, raw material(tri-gliceride), metal, water etc remains at high level	Blending different type of BIODIESEL and diesel, products specification would also vary.

These factors also affect engine operationability and gas emission quality, etc.

(Controlling these factors would be more difficult in case of vegetable oil direct blending.)

Mitsubishi International GmbH

MITSUBISHI INTERNATIONAL GMBH

ENERGY BUSINESS DIVISION

German Biofuel Market

(November 2006)

Mitsubishi International GmbH

Biofuel ratio: Plans by the German government

Year	total	Diesel	Gasoline
2007	-	4.4%	1.2%
2008	-	4.4%	2.0%
2009	6.25%	4.4%	2.8%
2010	6.75%	4.4%	3.6%
2011	7.0%	4.4%	3.6%

Mitsubishi International GmbH

Ethanol/ETBE Blending in Germany

Current market (1st half 2006):

Gasoline market 23.4 mio t

ETBE consumption 400,000 t (will not reach more than 500,000 t)

Blended alcohol 50,000 t (so far only for niche markets)

Outlook:

Blending quota as of 1st Jan, 2007

ETBE production capacities are not sufficient, therefore blending with Ethanol needed

Technical issues remain (gas pressure etc.)

Mitsubishi International GmbH

Ethanol/ETBE Blending in Germany

Quality Issues:

Gasoline is rated in highest danger category with regard to pollution prevention laws in Germany.

Thus it does not matter whether ethanol is blended in or not.

Measures:

-Underground tanks double-walled

-Aboveground tanks double bottom

-Etc.

-Compliance necessity without state aid (because of obligation)

附件三 **PCK** 煉油廠簡報

PCK Raffinerie GmbH
Schwedt/Oder

Biofuels and refining

History of PCK

- Jan. 1959

  Legal foundation as Erdölverarbeitungswerk Schwedt (EVW)

- 11. Nov.1960

  Laying of the foundation stone

- 01. April 1964

  Commissioning of the first stage of the crude-oil processing plant

- 1966-1969

  Extension of crude-oil processing , a. o. by two additional crude-oil distillation units, refining plants for gas, petrol and Diesel fuel, plants for petrol production and sulphur extraction

History of PCK

- 1981/1982

  Commissioning of the cracking and aromatics complex (a catalytic cracking plant) for the conversion of vacuum distillates to petrol and Diesel fuel components

- 1991-1995

  Conversion and modernisation of the Schwedt refinery after privatisation by the shareholders (July 1991) to one of the most modern and efficient in Europe.

- 1998

  Commissioning of a new industrial power plant with two boilers, two turbines and a three-stage flue-gas cleaning unit,

History of PCK

- 1998-2002

  Implementation of the Clean Fuel Program for the production of sulphurless fuels beginning in autumn 2002

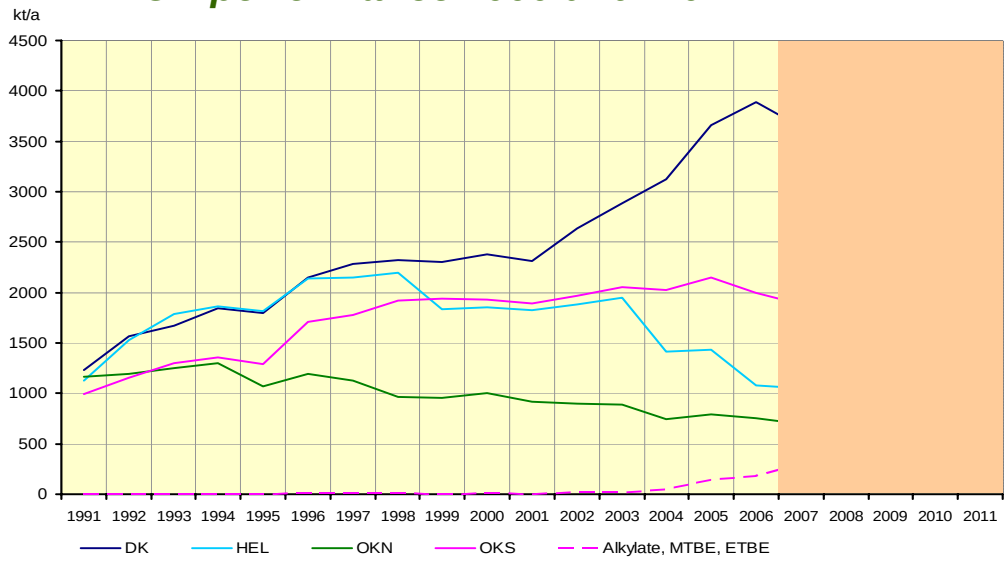
- 2002 – 2004

  Profit improvement programm

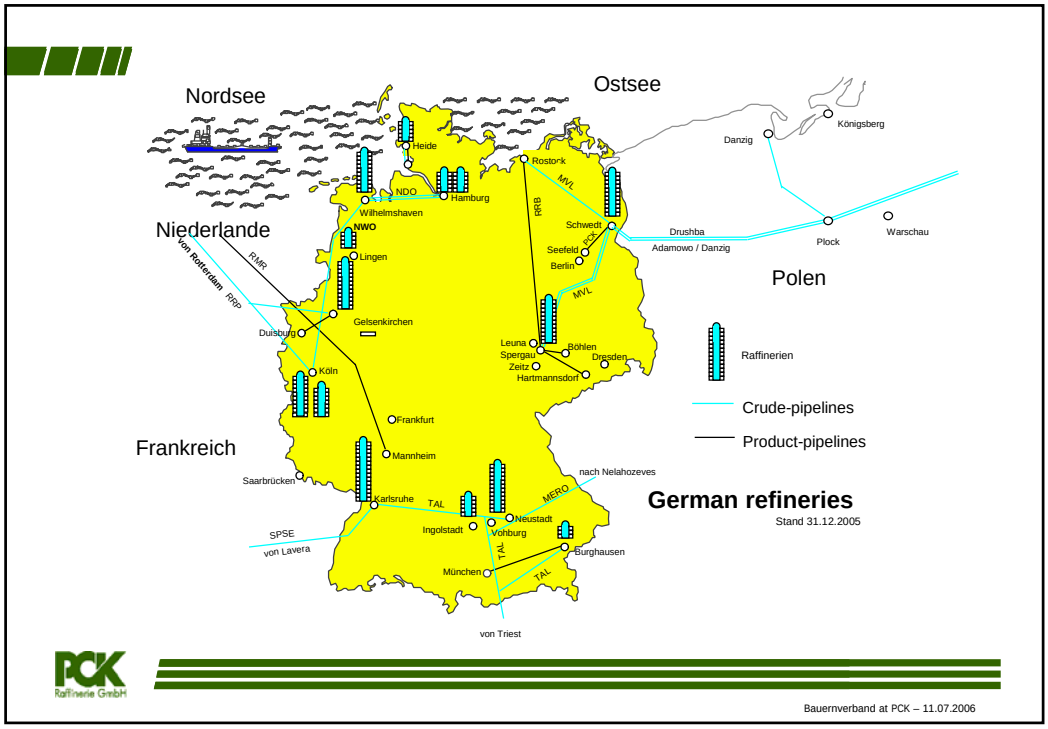
- 2003

  start of biofuels activities

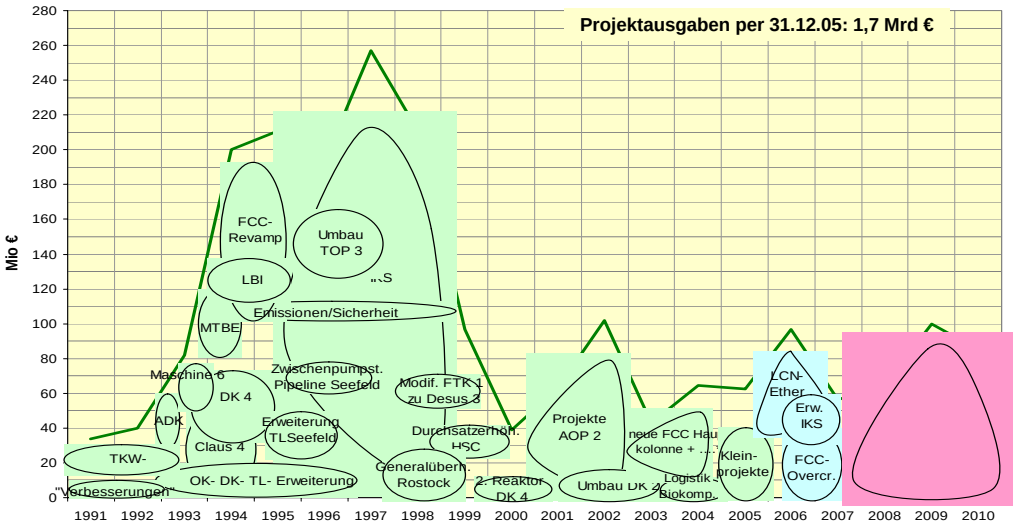
PCK performance 1990 until 2011



Bauernverband at PCK – 11.07.2006

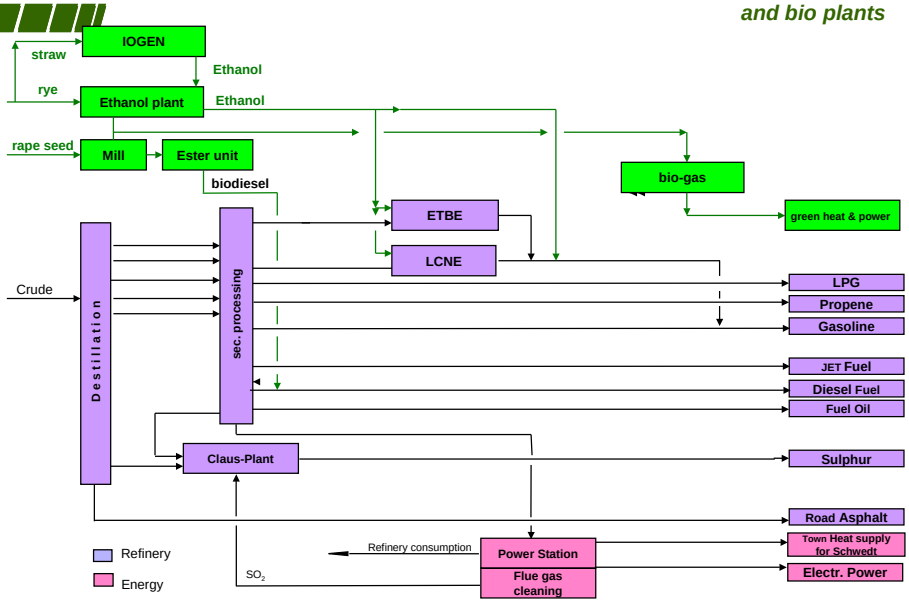


Project activities 1990 until 2011



Bauernverband at PCK – 11.07.2006

Flow Scheme of PCK and bio plants



Biofuels activities

- 10/2003 10 days test run ETBE production
- 01/2004 switch over from MTBE to ETBE production (only 75 % unit capacity)
- 02/2004 test run FAME direct blending to the diesel pool
- 04/2004 revamp MTBE-unit to ETBE (1,7 Mio €)
- 05/2004 start up ETBE unit (cap. 95.000 t/year)
- 05/2004 project FAME logistics and blending (4,0 Mio €)
- 05/2004 start up permanent FAME blending 4,0 – 4,8 Vol.-%
- 07/2004 project ethanol logistics (4,8 Mio €)
- 12/2004 Ethanol direct blending test via Seefeld
- 08/2005 Ethanol plant Schwedt on stream (Sauter group)
- 04/2006 Biodiesel plant Schwedt on stream (Sauter group)

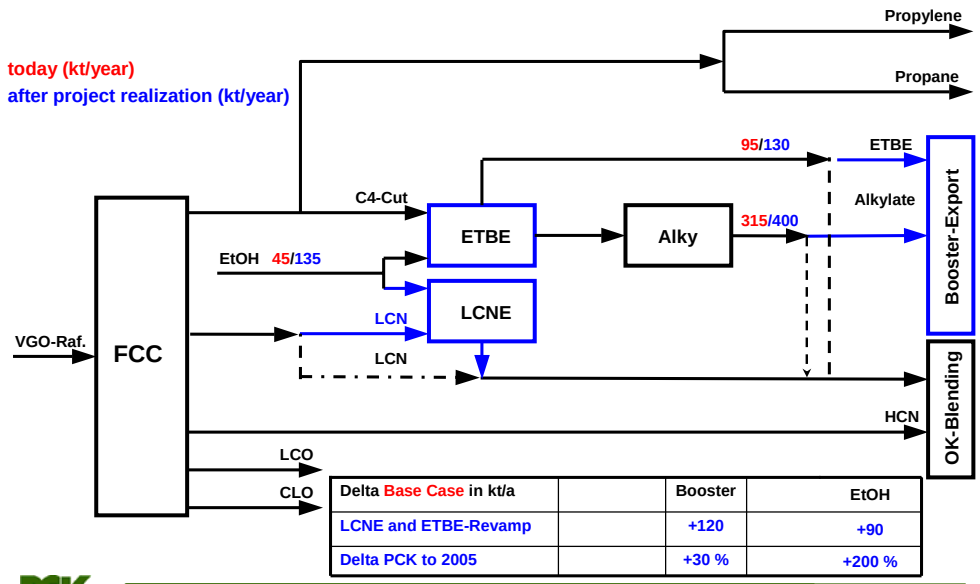
Investment 2003 – 2004: 10,5 Mio €

Biofuels activities

- 09/2006 start up of LCN-etherification unit (26 Mio €)
- 05/2007 FCC-overcracking and ETBE-Revamp (3 Mio €)

Investment 2005 – 2007: 29 Mio €

Biofuels Projects 2006/07 (28 Mio. €)



Delta Base Case in kt/a		Booster	EtOH
LCNE and ETBE-Revamp		+120	+90
Delta PCK to 2005		+30 %	+200 %

Biofuels strategy up to 2010 (gasoline)

- **Consumption of bio-ethanol**

  to ETBE: 71,4 kt/a
  to LCNE: 63,6 kt/a **135 kt/yr**
- **Option: mogas direct blending Seefeld** **18 kt/yr**

  Ethanol PCK **153 kt/yr**

Bio-Energy content gasoline > 3,4 %
Bio-Energy content gasoline with option > 3,8 %

PCK is able to export ETBE

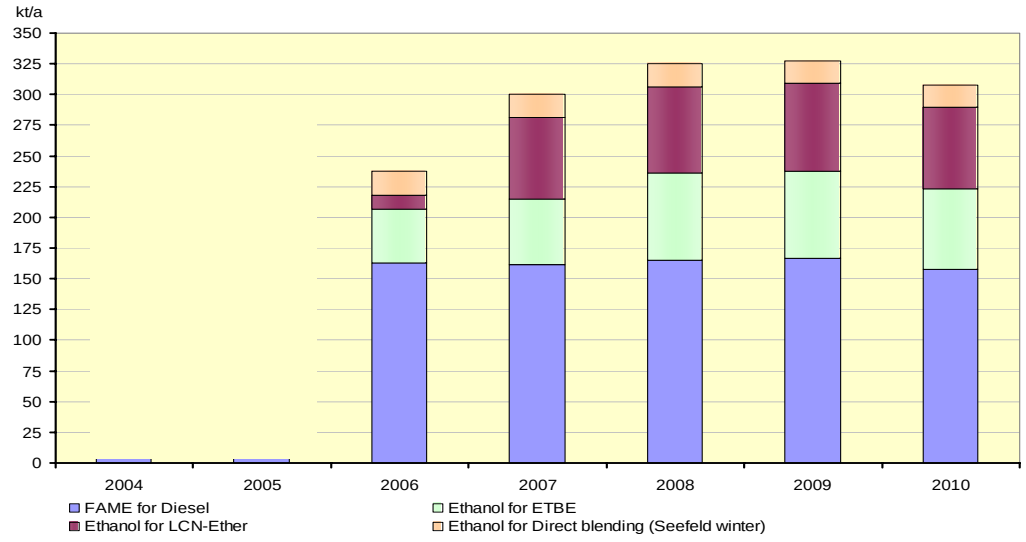
Biofuels strategy up to 2010 (diesel)

- **FAME direct blending to Diesel max. 5 vol.-%** **175 kt/yr**
- **Option: up to 10 vol.-% FAME** **175 kt/yr**
  (change of Diesel specification) **----------**
- **FAME PCK** **350 kt/a**

- **Bio-Energy content diesel** **4,40 %**
- **Bio-Energy content diesel with options** **> 5,75 %**

Today PCK is able to fulfil the EU guideline

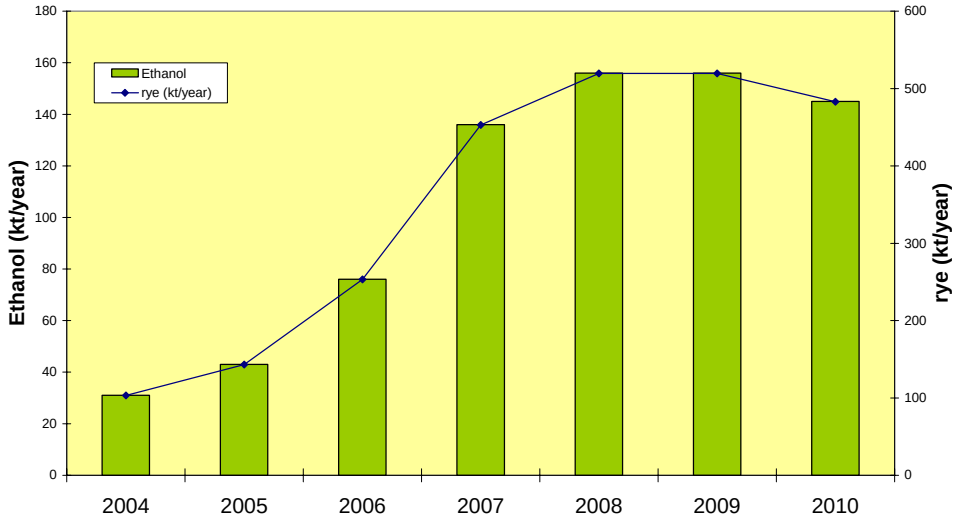
Utilization of Bio-Components



PCK RaffinerieGmbH

Bauernverband at PCK – 11.07.2006

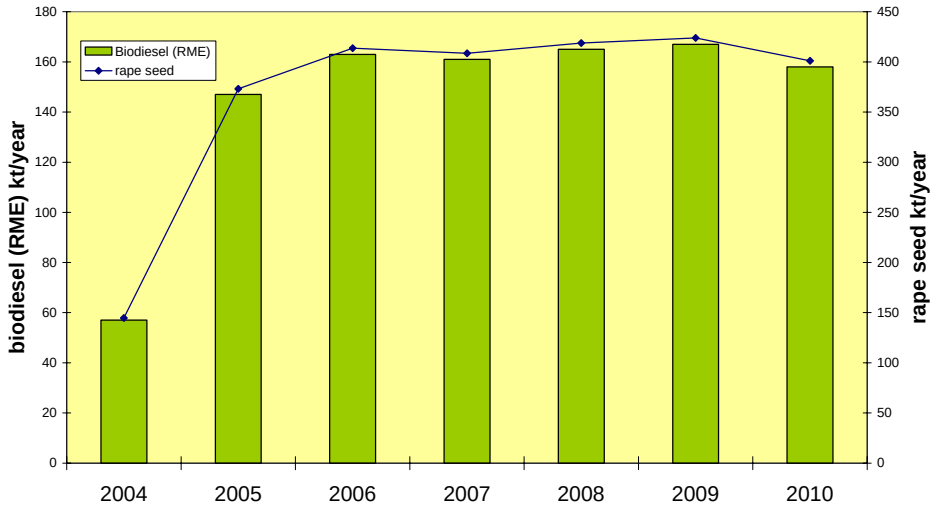
Ethanol consumption PCK



PCK RaffinerieGmbH

Bauernverband at PCK – 11.07.2006

Biodiesel consumption PCK



Summary

- **PCK is the german pacesetter in biofuel activities**
- **total investment in biofuels will be 39,5 Mio € until 2007**
- **investment is calculated with tax incentive**
- **tax incentive will change over to mandate in 2007**
- **first generation of biofuels will change from an innovative part of energy supply to more expensive fuel for consumers**
- **governmental framework changed biofuels from high value product to expensive components**
- **in case of negative results (depends of price scenario) , PCK will change back from ethanol to methanol (ETBE to MTBE) to prevent losses**