Raw Material Basis for Biodiesel Components in Diesel Fuels

Filling station trial for "standard" diesel fuels throughout Germany (summer products 2013)

Report updated, 08/2013

Sample selection

1. Only "standard" diesel fuels were analysed as samples, because so-called premium fuels do not usually contain biodiesel components (fatty acid methyl esters, FAME).
2. The samples – 60 filling stations in total – were taken from the areas surrounding various refinery locations, in order to gain a representative picture of the fuel composition in Germany.
3. In addition, the sampling was conducted corresponding to the market relevance of the fuel suppliers (cf. source).

Analytical methods

1. In an initial analysis step, the biodiesel components of the samples were determined according to DIN EN 14078.
2. Samples with a biodiesel content greater than 1.5 % (V/V) were then treated in accordance with DIN EN 14331. This implies a separation of the diesel matrix from the biodiesel.
3. Finally, the fatty acid samples of the gained biodiesel fractions were determined according to DIN EN 14103.
4. The obtained fatty acid patterns were compared with fatty acid patterns of known oils such as rapeseed, soya, palm and coconut.
5. Ideally, an identification of the analysed raw material basis was realised by a simulation calculation.
6. Samples with a fatty acid methyl ester content of max. 0.1 % vol. (five samples were affected) were tested for carbon 14 content in accordance with DIN EN 15440 (composite sample). For the biomass validation, the utilised method serves to determine the proportion of hydrated vegetable oil (HVO) in diesel fuel.

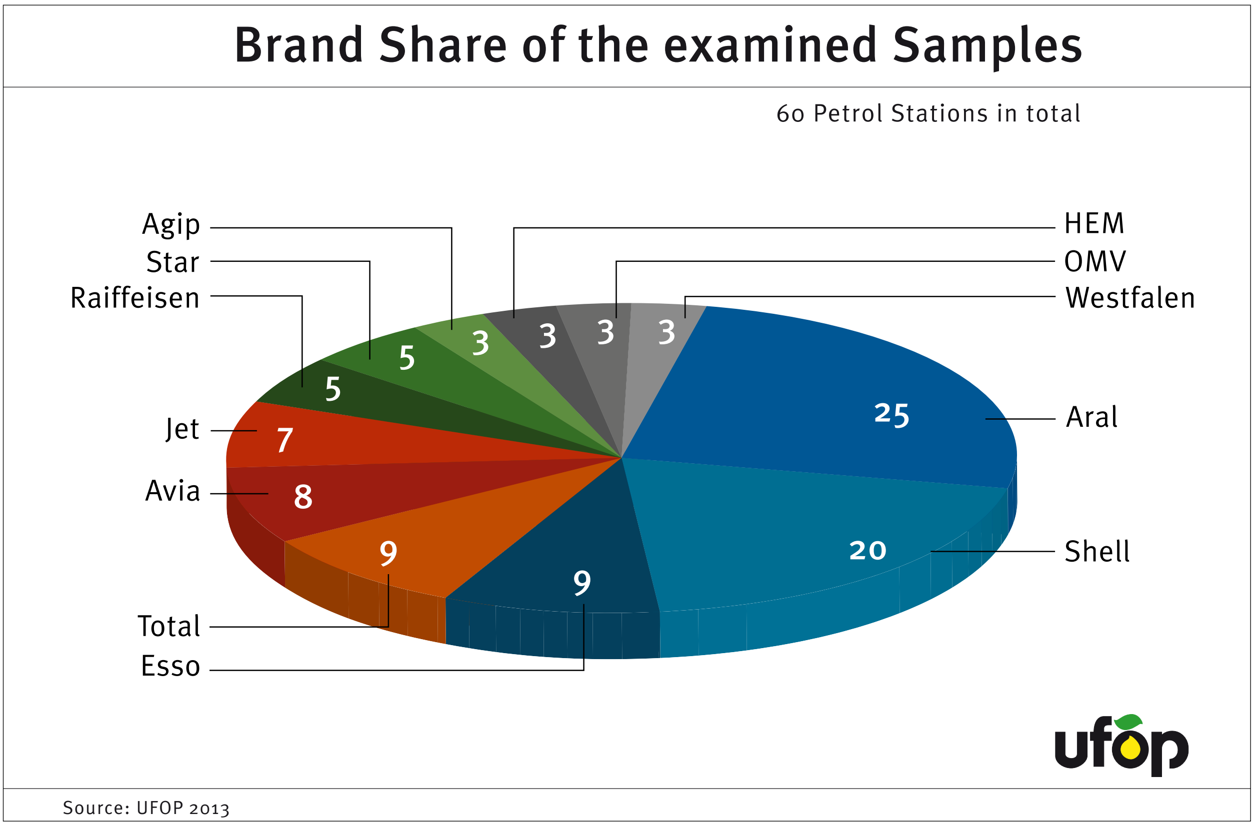

Figure 1: Representation of the brand share of the examined samples in the total sample scope

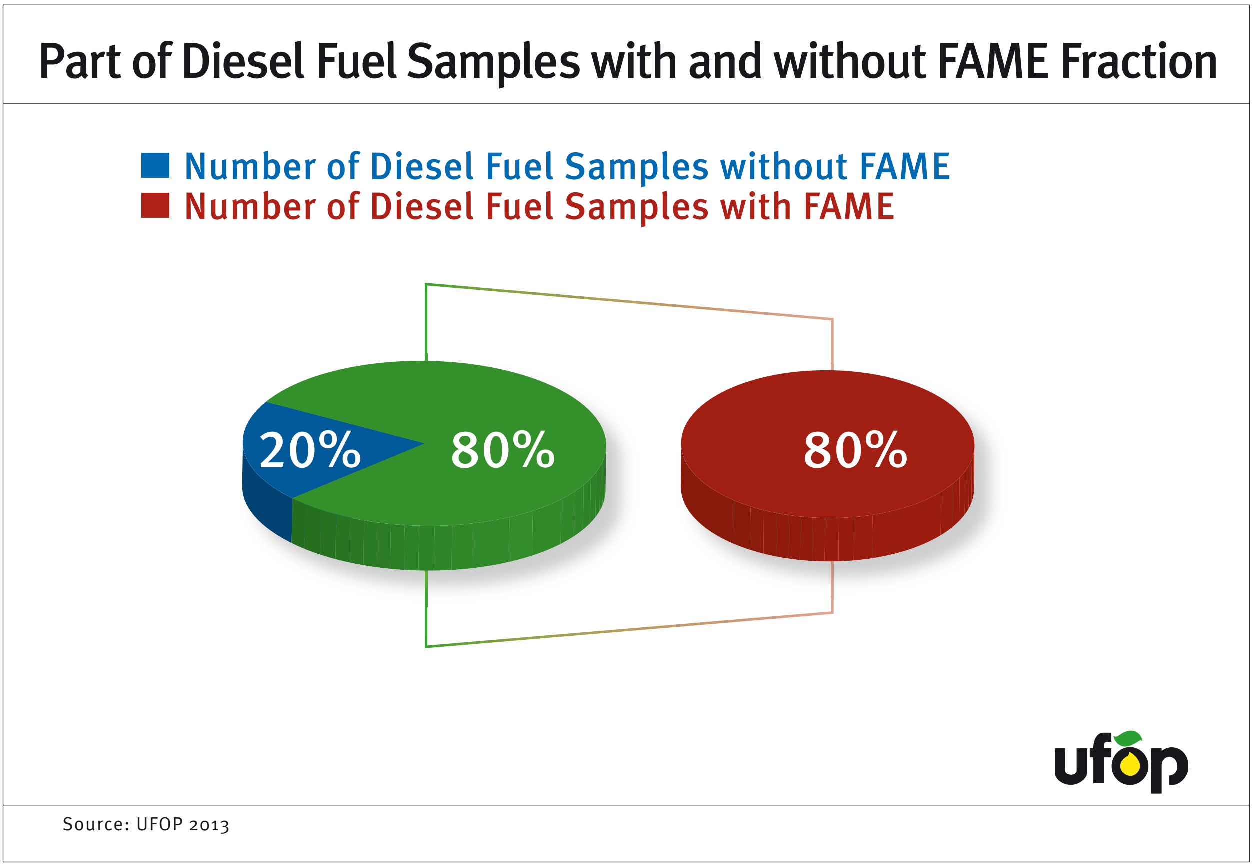

Figure 2: Representation of the percentage shares of diesel fuel samples with and without FAME

Results

All samples with a biodiesel content of less than 1.4 % (V/V) were designated as diesel fuels without FAME component. This corresponds to a total number of 12 samples (out of 60 overall). Of these 12 samples, 10 samples had a biodiesel content of less than 1.0 % (V/V) respectively 5 samples less than 0.5 % (V/V). It remains to be noted here that biogenic components for fulfilment of the quota obligation, which are present in the fuel based on hydrated vegetable oils, cannot be validated with the test methods applied here.

The carbon 14 content was determined in the composite sample as 7.6 ∓ 1.2 %. This result is based on the total carbon content in the tested sample. In conventional diesel fuels, the carbon content is approximately 85.0 % (m/m). This average value was used to determine the aforementioned biomass content. If, for example, hydrated vegetable oil (HVO) was added to the diesel fuels, based on an average density of about 780 kg/m^3, a proportion by volume of HVO of about 8.3 % (V/V) results. Raw material classification is not possible using this method. It is to be assumed that palm oil is the raw material basis for reasons of price, but this has not been taken into account in the representation of the raw material composition (diagram 3).

The evaluation of the regional distribution (by postcode areas) is roughly oriented to the refinery locations in Germany. Based on the 12 diesel fuel samples without FAME component and 3 fatty acid samples of biodiesel components that could not be clearly assigned to a definite raw material combination, Figures 3 and 4 represent a sample scope of 45 (instead of 60). Drifts in the fatty acid samples primarily occur due to thermally induced oxidations and/or hydrations (for example: deep-frying processes, fat hardening etc.). "Drifted" fatty acid samples can be found in used cooking oil fatty acid methyl esters in particular. Table 1 illustrates the assignment between postcode area and refinery location.

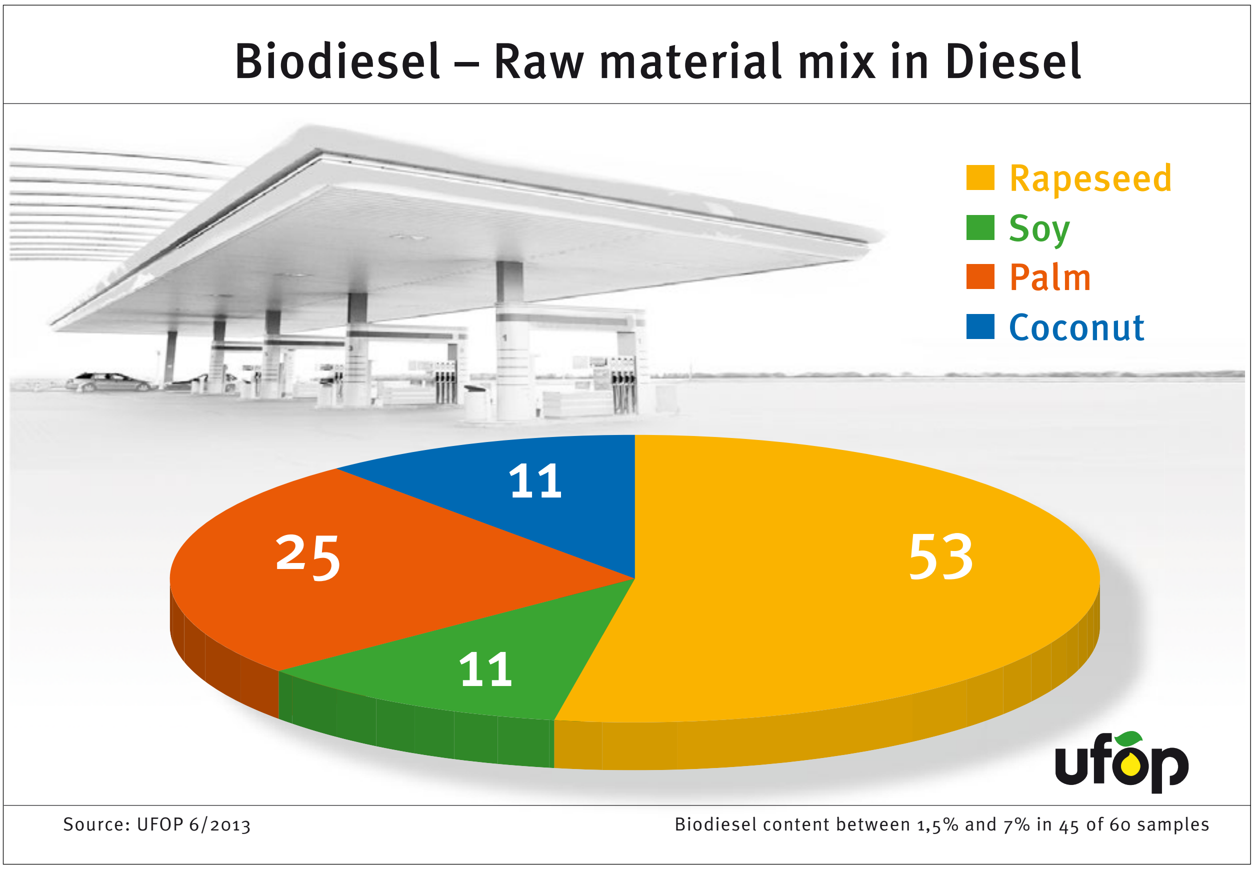

Figure 3: Raw material mix in the analysed biodiesel components

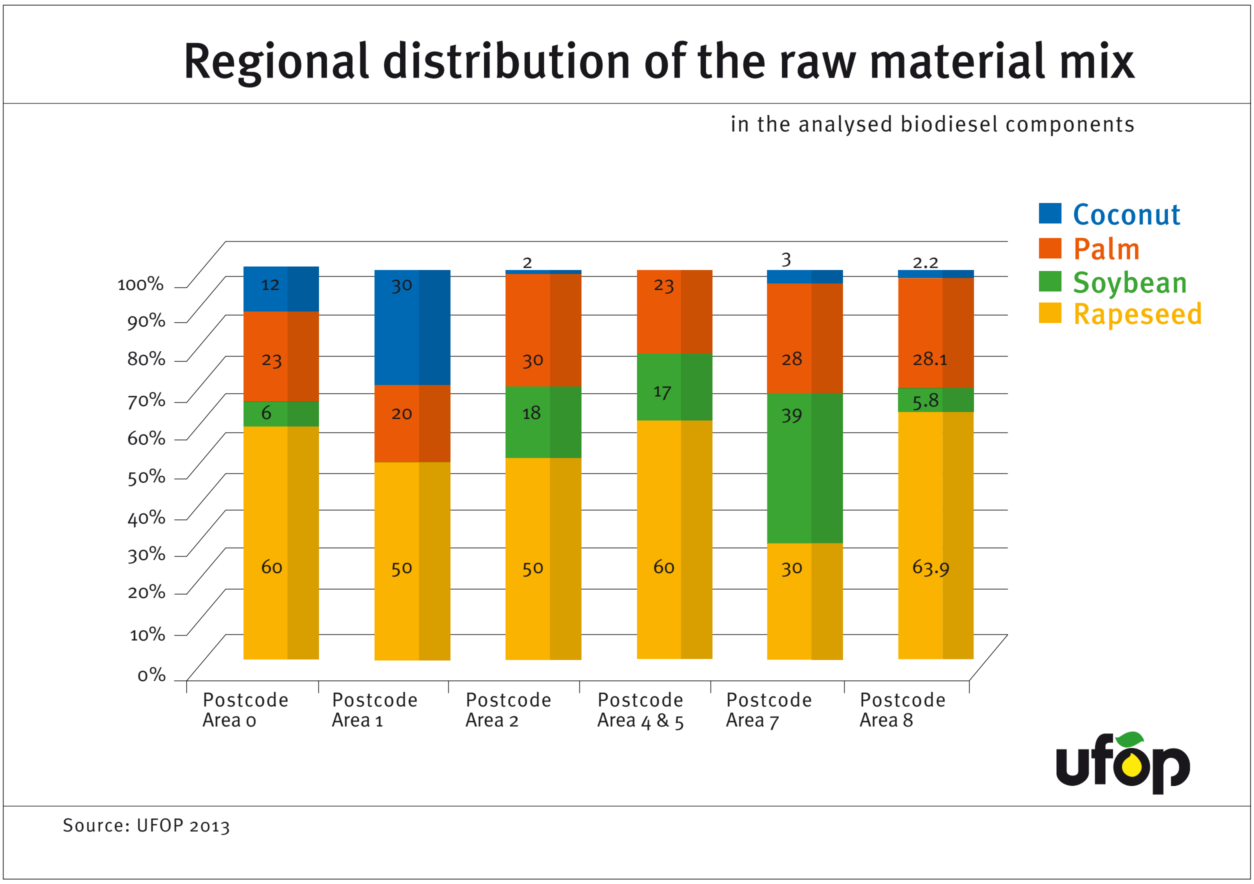

Figure 4: Regional distribution of the raw material mix in the analysed biodiesel components

Table 1: Assignment of the postcode areas to the refinery locations

Postcode Area	Location of RefineryIndustry
0	Leuna
1	Schwedt
3	Hamburg and Heide
4 und 5	Gelsenkirchen and Köln
7	Karlsruhe
8	Burghausen, Ingolstadt and Vohburg

Evaluation and commentary of the results

1. The determined raw material mix in the biodiesel reflects the composition at the time of sampling. As a rule, the results of the study commissioned by Greenpeace are confirmed.
2. Conclusions in respect to the raw material composition for the production of biodiesel in German plants are not possible. According to the Verbandes der Deutschen Biokraftstoffindustrie (Association of the German Biofuel Industry), almost exclusively rapeseed from domestic cultivation is used for the production of biodiesel (press release of 16.04.2013). Nor can the content of old fat methyl esters be validated in biodiesel with existing methods in a legally certain way. The corresponding amounts should therefore be identified in the biofuel statistics. A validation of hydrated vegetable oils (HVO) is possible, but a validation of their raw material composition is not.
3. The Renewable Energies Directive (2009/28/EC) was applied within national law in Germany as early as 2010. This speeded up the introduction of the certification systems ISCC and REDcert, with the result that no other certified raw material was available due to the failure to implement certification systems in other EU member states or in countries outside the EU (Asia, South America) apart from German rapeseed in the years 2010 and 2011 in particular.
4. The EU Commission has meanwhile recognised 13 international certification systems. These were not implemented across the board, in contrast to rapeseed cultivation in Germany. Rather, the implementation was based on the relevant plantations or soya cultivation areas of the company producing the raw material.
5. The distributors or the quota obligatory parties (the companies in the mineral oil business) are responsible for the raw material composition at the public filling stations. The quality of the certification systems, the certification bodies and ultimately the sustainability validations must be formulated so that a traceability of the raw materials is ensured. The corresponding sustainability validations are incorporated in the "nabisy" database of the Federal Office for Agriculture and Food (BLE) and can be viewed via the responsible bodies of the customs administration for auditing the sustainability regulations as a prerequisite for tax concessions or for apportioning to the quota obligation.
6. The BLE provides information annually with its Evaluation and Empirical Report.
7. Biofuels assume a pioneering role for the introduction of sustainability indicators, beginning with raw material cultivation and marketing through to the end use. Nevertheless, biofuel production from imported vegetable oils, measured in terms of the international raw material requirement, plays a subordinate role.
   Palm oil production worldwide 2010: 53 million tonnes,
   Utilisation areas: 71 % food industry, 24 % material use (soaps, cosmetic industrial products), 4.7 % energy use (electricity, heat and fuel production). Source: 18/12 Lebensmittelpraxis.
8. The introduction of certification systems as a prerequisite for market access or for participation in the funding framework of the quota obligations or tax concessions has established an economic incentive for the implementation of certification systems in other countries. The quality involved in the implementation of certification systems must be at the forefront in future, and these will have to be oriented internationally to the environmental and social standards of the European Union. However, a problem is posed by the fact that an utilisation-relevant certification (only for biofuel use) is not constructive, as this ultimately creates legalised means of bypassing the circumstances.
9. A continuous evaluation of the certification systems and certification bodies is a prerequisite for the requisite acceptance on the part of the processing industry and consumers. Minimum criteria in regard to the sustainability can already be anchored in the procurement provisions of the food, chemical and biofuel industry so as to avoid bypassing measures.

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