INFORMATION

Deutsche Wissenschaftliche Gesellschaft
für Erdöl, Erdgas und Kohle e.V.

Hamburg, September 2015 10/2015

PROJECTS

DGMK-COMMITTEE

FUELS

2012 to 2015

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ABBREVIATIONS

IGF	Industrial Collective Research (Industrielle Gemeinschaftsforschung)
AiF	German Federation of Industrial Research Associations (Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" e.V.)

HYDROGENATED VEGETABLE OIL AS A SUBSTITUTE FOR LOW SULPHUR LIGHT HEATING OIL

DGMK Project **743**
(IGF 16787 BG)

Reason and objective

For ecological and political reasons, bio heating oil containing FAME is regionally already commercially available. Fulfilling the requirements of DIN SPEC 51603-6 an addition of up to 20 % (V/V) FAME is possible and mainly limited by the distillation properties. Based on its commercial availability, FAME is the only alternative fuel currently in use. The requirement for the biogenic portion of oil burning installations currently amounts to 50% for new buildings according to the Renewable Energies Heat Act (EE-Wärmegesetz), which is in effect nationwide. In order to make as little changes as possible to the heat generator, it is desirable that the fuel as such already provides a significant renewable share or that the requirements can be met completely by the bio heating oil. In order to achieve this objective, biogenic fuels other than FAME are required. Hydrogenated vegetable oil (HVO) appears to be promising, as it shows on the one hand physical-chemical properties similar to low sulphur light heating oil; on the other hand, it exhibits a higher possible savings of CO_2 emissions (5.0 t/ha) compared to FAME (3.0 t/ha).

Abstract

This project investigates the applicability of hydrogenated vegetable oil as a blend component for light heating oil. The production of HVO by hydrogenation shall be optimised with respect to the requirements of the heat market and the chain of economic value added. For the assessment of HVO as a substitute for light heating oil, a link between the production, the physical-chemical properties and the application technique is required. The project is composed of the investigations at the IEC with regard to the production of hydrogenated vegetable oils and the application-technological investigations carried out by OWI.

Status

The period of approval was extended by 3 months without additional cost. The project is in its final stage.

DURATION	2012 to 2015 (30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Sebastian Feldhoff
	TU Bergakademie Freiberg, Institut für Energieverfahrenstechnik und Chemieingenieurwesen Professur Reaktionstechnik, Dr.-Ing. Thomas Kuchling
PROJECT COORDINATION	Jan Ludzay, DGMK

DEPOSIT FORMATION IN PRE-MIXING BURNER SYSTEMS - INVESTIGATION OF THE CAUSE AND MINIMISATION BY MODIFYING THE EVAPORATOR SURFACE

DGMK Project **749**
(IGF 17600 N)

Reason and objective

The percentage of energy-efficient oil condensing boilers running on low sulphur heating oils and using pre-mixing, low-emission burners, like pre-evaporator burners, will increase in the future; just as the use of biogenic fuels by their addition to heating oil. Biogenic fuels particularly show a strong natural tendency to deposit formation when evaporated, which decreases with increasing temperature. As far as low sulphur heating oil is concerned, an increase of deposit formation with increasing temperature was surprisingly observed. The objective of the project is to minimise deposit formation on evaporator surfaces by means of a surface treatment so that in commercially available pre-mixing burners, low sulphur heating oils as well as FAME/heating oil blends can be applied without change of the operating conditions, especially without raising the evaporator temperature. Additionally, the influence of the composition of the boiling fraction of the mineral oil based fuels and the group of compounds contained in additives shall be detected.

Abstract

With idealised test methods, which have to be developed, the evaporation on different top layers formed by heat treatment of the surfaces and on ceramic coatings and a microstructure is studied. The results are verified by transfer to a real application. Additionally, the behaviour of the different boiling fractions of pure low sulphur heating oil and the influence of additives especially at high temperatures are investigated with the same test methods, in order to identify critical fractions or compounds.

Status

The project is in its final stage.

DURATION	2012 to 2015 (30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Dr. Helen Ackermann
PROJECT COORDINATION	Jan Ludzay, DGMK

INFLUENCE OF THE AGEING OF MIDDLE DISTILLATES WITH ALTERNATIVE COMPONENTS ON OPERABILITY AND ASSESSMENT OF ADDITIVES ACCORDING TO NO-HARM CRITERIA

DGMK Project **762**
(IGF 17139 N)

Reason and objective

Fuels, especially those with biogenic components, are always additised in the refineries and sometimes treated with performance additives additionally. After delivery to the end customer, the fuel is stored, often for several years, in a tank under environmental conditions. During storage, the fuel ages continuously, and ageing products can be formed. Typically, remainders of aged fuels are still present in the tank when fresh fuel is delivered to the consumer. It has to be investigated, whether and which interactions occur between ageing products formed and components of the newly delivered fuels - in this connection, especially additives and their mechanisms of action as well as impact on storage, compatibility of materials and combustion are in the focus of interest. Finally, it has to be examined, whether the ageing of fuels in the field can be reproduced by a standardised laboratory procedure.

Abstract

The ageing products formed in fuel oil/FAME blends during ageing are analysed, in order to identify the ageing products responsible for potentially negative interactions. Additionally, possible interactions between ageing products and additives shall be demonstrated. For this purpose, the situation of refueling is imitated by ageing a performance-additised fuel in the laboratory as well as on a pump test bench and then blend it with fresh fuel, which is also mixed with additives.

Status

The IGF project was approved by the BMWI on May 1st, 2015.

DURATION	2015 to 2017 (24 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Dr. Klaus Lucka
PROJECT COORDINATION	Jan Ludzay, DGMK

DEVELOPMENT OF A NEW TEST PROCEDURE FOR THE ASSESSMENT OF THE STABILITY OF HEATING OILS WITH BIOGENIC COMPONENTS

DGMK Project **763**
(IGF 17934 N)

Reason and objective

There are different analytical methods for the determination of the stability of mineral oil based products. When these methods were transferred to blends between mineral oil based and biogenic products, currently none of them could be used without limitations. For instance, the long-term behaviour of fuels can differ completely, even if they showed identical stabilities under fresh conditions. It is the objective of the project to develop an analytical method, which can unambiguously determine or predict the oxidation stability and the storage stability of fuel oil/FAME blends or fuel oil/vegetable oil blends, and which permits a transfer of the measured data into the application technique by interlinking the load types, like thermo- and photo oxidation.

Abstract

Initially, the stability test bench (KOMBIDEG-Test) for the combined degradation (thermo- and photo oxidation) of heating oils and fuels is assembled and put into operation. Afterwards, the procedural method is defined for the bench test in the framework of a parameter study, and investigations of reproducibility are executed. For this purpose, the reaction rates of different heating oils and biogenic heating oils (FAME, vegetable oils) and the degree of the photo-oxidative stress, the stress duration and catalytical effects through the input of metals are to be determined at different temperatures. Subsequently, the thermo-oxidative and photo oxidative stability is characterised with the KOMBIDEG-test for selected fuels with respect to standardised parameters. The influence of storage time and temperature on the storage stability is investigated in parallel.

Status

The project is on schedule.

DURATION	2014 to 2015 (24 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Martin Neulen
PROJECT COORDINATION	Jan Ludzay, DGMK

INFLUENCE OF THE EVAPORATION BEHAVIOR ON THE COKING TENDENCY OF LIQUID FUELS ON HOT SURFACES

DGMK Project **767**
(IGF 18675 N)

Reason and objective

The use of new technologies for the supply of renewable energy and improved standards for heat insulation resulted in a lower heat demand for domestic heating. Hereby, the requirements of modern burner technologies have changed. In the future, burner concepts meeting the following properties among other things: high power density and high modulation capability, while using very different fuels will be demanded (e.g. low sulphur light heating oil, light heating oil A and light heating oil A bio). Nevertheless, no consistent model of the evaporation behaviour of multi component fuels currently exists under combustion conditions. The objective is to develop a reproducible methodology, which under laboratory conditions characterises the evaporation behaviour of liquid multi component fuels with biogenic portions.

Abstract

In this project, a methodology reproducible under laboratory conditions shall be developed for the characterisation of the evaporation behaviour (boiling, evaporation) of liquid fuels under practical conditions. For this purpose, the evaporation properties on surfaces covered with fuel are investigated; thereby, fuel specific changes shall be analysed and a model conception of the evaporation behaviour shall be developed. Additionally, a database of the fuel properties relevant for the technical application will be established in consideration of damaging mechanisms by deposit formation. Furthermore, an evaporation model for fuels is developed.

Status

The IGF project was approved by the BMWI for April 1st, 2015.

DURATION	2015 to 2017 (30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Winfried Koch
	Universität Rostock, Institut für Chemie Abteilung Technische und Analytische Chemie Prof. Dr. Ralf Zimmermann
PROJECT COORDINATION	Jan Ludzay, DGMK

DEVELOPMENT OF MICRO EMULSIONS (WATER/OIL); THEIR STABILISING MECHANISMS AND THEIR INFLUENCE ON OPERATING SAFETY OF MIDDLE DISTILLATES, FOR EXAMPLE OF LIGHT HEATING OIL, HEATING OIL A AND BIO IN TECHNICAL APPLICATIONS

DGMK Project **770**
(IGF 18163 N)

Reason and objective

DGMK project 715 investigated the microbiological influence on biogenic fuels. In this process, the formation of micro emulsions (water in oil as well as oil in water) after microbial contamination could be observed. Project 770 shall characterise the properties of micro emulsions. Besides the potential formation mechanisms of the emulsions (additives, micro organisms) and their stability, the influence on the interaction with materials used in fuel oil burner systems and the change of the chemical and physical properties of the fuel shall be explored. Furthermore, the effect of emulsions on the formation of free water phases and the survival of micro organisms in the fuel matrix shall be clarified.

Abstract

First, a representative mix of micro organisms is prepared with the focus on organism utilizing FAME. Subsequently, fuels with biogenic components shall be exposed to an intensive ageing under defined conditions (with and without microbiological contamination). The emulsion stability shall be analysed by periodic measurements of the stored fuels. Interactions of the fuels with materials are examined with the steel pin corrosion test. The influence on the fuel oil burner pump and a possible water formation in the filter system shall be tested in a pump test rig.

Status

The IGF project was approved by the BMWI for December 1st, 2014. The project has started.

DURATION	2014 to 2017 (30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH Simon Eiden
	iAMB Institut für Angewandte Mikrobiologie der RWTH Aachen Bernd Leuchtle
PROJECT COORDINATION	Jan Ludzay, DGMK

INVESTIGATION ON THE PREVENTION OF HIGHER MOLECULAR AGEING PRODUCTS OF BIO FUELS UNDER APPLICATION TECHNOLOGICAL BASIC CONDITIONS

DGMK Project **778**
(IGF Application N03166/15)

Reason and objective

With respect to their stability, bio components can lead to technical challenges in different middle distillate applications (e.g. engines and heating appliances). The technical phenomena are surprisingly similar despite different technologies. Corrosion and polymer formation occur; operational disturbances can be the consequence of these ageing processes. Previous research activities have provided the possibility, to reproduce these phenomena under controlled conditions in the case of low sulphur light heating oil and also diesel fuels by the use of hardware-in-the-loop test rigs, which can examine fuel components, fuels and additives. However, a great ambiguity still exists about the deposit formation as such and its specific ageing mechanisms. This still results in an insufficient damage management in technical applications.

Abstract

In this project, construction components of fuel oil burner systems shall be examined with respect to their durability against ageing products of fuels with biogenic components; the results should be transferable to other middle distillates such as diesel or jet fuels. The focus lies mainly on the tolerance against blockade by developing sediments. Besides a long-term storage, a laboratory test method is developed to test individual components, and the total system is reviewed. In this way, the fuel as well as the construction components shall be tested in their interaction. It is a further objective to determine the influences of the heating oil components and the interactions with the used FAME and HVO on the tendency for sediment formation of blends. In this way, the blocking can be specifically examined and prevention strategies can be developed, which contribute to an increased operational safety of the heating oil burner systems.

Status

The IGF application was submitted to the AiF for appraisal.

DURATION	2015 to 2018 (planned, 30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH, Dr. Klaus Lucka
	ITMC Institut für Technische und Makromolekulare Chemie der RWTH Aachen, Prof. Dr. Dr. Bernhard Blümich
PROJECT COORDINATION	Jan Ludzay, DGMK

DEVELOPMENT OF A TEST PROCEDURE FOR THE ASSESSMENT OF MATERIAL DURABILITY OF CONSTRUCTION COMPONENTS IN MIDDLE DISTILLATE APPLICATIONS

DGMK Project **780**
(IGF Application N03209/15)

Reason and objective

Middle distillates are offered in the market with an addition of bio components. Due to possible interactions between fuel and construction components, especially non-ferrous metals like copper and brass, the industry of heating appliances approves an addition of up to 10 % (v/v) only. A sufficient stability and an exclusion of possible impairments of the long-term stability of the construction elements for corresponding equipment cannot be warranted for the time being for fuels with an amount of up to 20 % (v/v) bio component.

Abstract

Using the example of heating oil, potential interactions between commercially available biogenic fuels and relevant metal and plastic construction elements shall be studied in this project. The objective is the development of a new test procedure. By means of detailed analytical investigations, the metal concentration of fresh and aged fuels shall be determined and correlated with stability analyses like oxidation stability, acid number and water content. In this way, a potential catalytic effect can be detected. On one hand, different fuels shall be stressed realistically with the new test procedure; on the other hand, the operation conditions will be aggravated in order to generate basic material and fuel specific information by a semi-realistic stress within testing times as short as possible. The construction material will be examined microscopically, whereby potential effects on the surface condition of the used construction elements as a result of fuel contacts can be demonstrated. As an example, the swelling behaviour of plastic material after contact with the fuel will be investigated. Furthermore, the construction elements will be exposed to different mechanical endurance tests in order to detect possible destabilisations. Thereby, a prognosis of the life span of the used construction elements shall be developed.

Status

The IGF application was submitted to the AiF for appraisal.

DURATION	2015 to 2018 (planned, 30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH, Dr. Klaus Lucka
	BAM Bundesanstalt für Materialforschung und -prüfung, Dr. Ralph Bäßler
PROJECT COORDINATION	Jan Ludzay, DGMK

INVESTIGATION OF THE PRODUCTION OF HYDROGENATED BIO OILS AND THEIR APPLICATION-TECHNOLOGICAL PROPERTIES

DGMK Project **785**

Reason and objective

The hydrogenation of vegetable oils is a process of increasing importance for the production of high-quality heating oil and fuel components from renewable raw materials. DGMK project 743 showed the suitability of HVO (hydrogenated vegetable oil) as a substitute for low sulphur light heating oil in the area of domestic heating. The use of waste oils and other biogenic oils, which do not compete with food production, broadens the raw material base and is connected with an increased potential of greenhouse gas savings. Therefore, the use of secondary raw materials or waste materials (edible fats, animal fats, tall oil, etc.) for the production of synthetic fuels by hydrogenation shall be investigated in a subsequent project, and in addition, their utilisability in a modern modulating recirculation burner in a condensing boiler shall be demonstrated. At the same time, questionsarising during the above mentioned project, shall be answered in this subsequent project.

Abstract

On the one hand, the production of HVO from secondary raw materials, so far not used for this purpose, will be a challenge in the subsequent project. First investigations demonstrate a comparatively rapid deactivation of the catalysts used, which is probably caused by impurities contained in the secondary raw materials. Accordingly, catalysts must be adapted to new educt mass flows, and an upstream conditioning process must be developed. On the other hand, bifunctional catalysts shall be characterised and developed, which are effective for hydrogenation as well as isomerisation. The process step of isomerisation is necessary, since it improves the low temperature properties of the HVO significantly. With regard to stability and ageing, it is essential, to clarify possible interactions with fuels already present in the market and therefore the customer's fuel tank, like light heating oil and FAME as well as aged fuel still present from the prior refueling. The introduction of HVO predominantly composed of molecules with a linear structure (n-alkanes) - as a blending component or a chemically pure substance - also changes the physical and chemical properties of the fuel. In this connection, the material properties relevant for the application must be investigated, such as the laminar burning velocity, the ignition temperature and the evaporation properties, which can aggravate the use in commercially available heating oil equipment, especially in modulating recirculation burner and condensing boilers of low output.

Status

The IGF application is under preparation.

DURATION	2015 to 2018 (planned, 30 months)
RESEARCH INSTITUTE	OWI Oel-Wärme-Institut GmbH, Dr. Klaus Lucka
	TU Bergakademie Freiberg, Institut für Energieverfahrenstechnik und Chemieingenieurwesen, Professur Reaktionstechnik, Prof. Dr. Sven Kureti
PROJECT COORDINATION	Jan Ludzay, DGMK

APPLICATION CHARACTERISTICS OF FUELS WITH BIOGENIC COMPONENTS

DGMK Research Report **729**

Abstract

In the German heating oil standard DIN SPEC 51603 – part 6 several limits regarding the fuel quality are defined. These limits have to be strictly observed in order to ensure operability. Formation of acids, high-molecular molecules and water as aging products during storage lead to changes in the physico-chemical characteristics of fuels. Those long term changes are not detected sufficiently by the analysis at the beginning. In this project, a test rig which can in short time age fuels close to reality was developed. Fuels are tested together with commercially available burner components regarding their long term behavior. One aim of the project was to reduce the required operation time below 1,000 h. Furthermore, the significance of different aging parameters like temperature, light, water and cycle of operation was evaluated. Increasing the temperature in the drum and at the preheater the operation time was halved. Stressing the fuel with light reduces the operation time about 30 %, while a change in the operation cycle led to another 10 % decrease. Despite applying different aging parameters, the same aging products were formed, although in different shares. The sediments mainly originate from the FAME. It could be shown that the tendency of fuel to form sediments is the main factor for operability. In laboratory tests influences on the fuel were investigated directly. They showed that copper has a great, but zinc has no measurable influence on the fuel. Light, however, showed the predominant influence compared to the others. Waterphases had only small influence. Only the fuels were sampled in the laboratory tests. In the test rig tests, however, it could be shown that the sediment is relevant for operability.

DGMK-Forschungsbericht 729

Anwendungstechnische Eigenschaften flüssiger Brennstoffe mit biogenen Anteilen
(Application Characteristics of fuels with biogenic components)
Autoren: Martin Neulen, Sebastian Feldhoff, Winfried Koch, Hamburg, 2015
180 Seiten, 163 Abbildungen, 90 Tabellen, 12 Literaturstellen
ISBN 978-3-941721-53-1
EUR 50,00 zzgl. ges. MwSt. (DGMK-Mitglieder 50 %)

Das IGF-Vorhaben (16967 N) der Forschungsvereinigung DGMK Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e.V., Überseering 40, 22297 Hamburg wurde über die AiF im Rahmen des Programms zur Förderung der Industriellen Gemeinschaftsforschung (IGF) vom Bundesministerium für Wirtschaft und Energie aufgrund eines Beschlusses des Deutschen Bundestages gefördert.

DEVELOPMENT OF A METHOD FOR THE CHARACTERIZATION OF THE OXIDATION STABILITY OF DOMESTIC HEATING OIL AND DOMESTIC HEATING OIL WITH ALTERNATIVE COMPONENTS USING CHEMILUMINESCENCE

DGMK-Research Report **702**

Abstract

Modern burner systems for heating oils have a complex mixture preparation that is adapted specifically to a fuel according to DIN 51603 – Part 1. The focus of the domestic heating market lies – right after the introduction of heating oil low-sulphur – on the development of liquid fuels regarding their substitution with alternative and biogenic components. The quality and stability of the fuel has to be secured over long storage periods and represents a criterion for the operation safety of heating oil burner systems. Under the influence of atmospheric oxygen, temperature, light and further influencing factors a thermo-oxidative degradation of fuels can occur during the storage of fuels in the tank units of heating oil burner systems. In this case a formation of oil ageing products takes place and leads to changes of the chemical-physical characteristics of the fuels. The oxidation stability represents a parameter that serves to evaluate the stability of fuels. Several analysis methodologies exist for the determination of the oxidation stability of mineral oil based products. These standardized testing methodologies have been adapted to the respective application (lubricants, thermal oils, pure mineral oil based products, etc.). In recent years several methodologies have been developed in the fuel sector. Primarily they are applicable for the stability determination of pure products (diesel, heating oil, biodiesel, vegetable oil). But none of these methodologies have turned out to be suitable for blends of mineral oil based and biogenic, regenerative products without restrictions yet. Therefore, the project's aim was to develop a process that serves to determine the oxidation stability of heating oil – FAME-/ heating oil – vegetable oil-blends clearly. Due to a directed energy input by means of the process of chemiluminescence, statements about the storage stability and the thermal stability of blends can be made. During the process the ageing of blend components and of the heating oil are taken into consideration. As a result, ageing processes and products of pure heating oil as well as biogenic components can be determined. It was shown that the process is applicable to blends up to an admixture of at least 20 %(V/V) of biogenic components, whereby blends with higher admixture shares can be analyzed as well. According to DIN SPEC 51603 – 6 "Heating Oil Alternative" the admixture of FAME is limited to 20 %(V/V) and the admixture of vegetable oil to 5 %(V/V) because of the distillation range. On the basis of these investigations it could be shown how oxidation products influence the signal process of the chemiluminescence radiation and how they can be correlated by a measurable physical value. Moreover, a new evaluation criterion has been developed. By means of this criterion a good reproducibility – regarding the determination of the oxidation stability according to the chemiluminescence methodology for non-aged fuels – can be achieved. The fuel characteristic decrease in the stability of the tested fuels can be represented only partially by the chemiluminescence process, as the measured values are subject to fluctuations.

DGMK-Forschungsbericht 702

Entwicklung einer Analysemethode zur Charakterisierung der Oxidationsstabilität von Heizöl EL und Heizöl EL A mittels Chemilumineszenz
(Development of a method for the characterization of the oxidation stability of domestic heating oil and domestic heating oil with alternative components using chemiluminescence)
Autoren: Winfried Koch, M.Sc., Dr.-Ing. Jayadi Lukito, Dr.-Ing. Heide vom Schloß, 2013
118 Seiten, 63 Abbildungen, 8 Tabellen, 19 Literaturstellen, 1 Anhang
ISBN 978-3-941721-34-0
EUR 50,00 zzgl. ges. MwSt. (DGMK-Mitglieder 50 %)

Das IGF-Vorhaben (16342 N) der Forschungsvereinigung Erdöl, Erdgas und Kohle wurde über die AiF im Rahmen des Programms zur Förderung der industriellen Gemeinschaftsforschung und -entwicklung (IGF) vom Bundesministerium für Wirtschaft und Technologie aufgrund eines Beschlusses des Deutschen Bundestages gefördert.

MICROBIOLOGICAL CONTAMINATION OF BIOGENIC FUELS

DGMK Research Report **715**

Abstract

The project's aim was to clarify, which microorganisms can occur in heating oil EL, in FAME and in their mixtures (heating oil EL A bio) and in how far the risk of microbiological growth is increased by using biogenic fuels. Heating oil samples of various end customer storage tanks with a FAME content of up to 20 % (V/V) were investigated, whereas microbes could be isolated and identified. Moreover, the chemical-physical characteristics of heating oil EL, FAME and their mixtures could be determined in more detail by means of laboratory investigations. The hygroscopic characteristics of fuels and their emulsion formation or degradation as well as the corrosive characteristics could be investigated in detail. On the basis of the collected data, exposure tests could be carried out afterwards. Purposefully, the different fuels and their mixtures were microbiologically contaminated and incubated under various storage conditions. As inoculum a mixed population, which was isolated from a diesel fuel, was used. It could be shown that FAME is decisive for an increased water absorption capacity of the fuel phase because of its hygroscopic effect. The general formation of a micro-emulsion due to FAME-admixture could not be shown. Due to the increased water absorption capacity and the reinforced nutrients inflow through FAME an increased microbiological growth could be demonstrated. The formation of a free aqueous phase is essential for the growth of microorganisms. During the incubation biofilms were formed; i.e. a mixed population of different microorganisms. In the course of the project different microorganisms could be isolated and identified. Yarrowia lipolytica could be identified as yeast most frequently. The genres Pseudomonas, Burkholderia und Sphingomonas were the most frequent bacteria. All isolated or identified organisms were able to exploit FAME. Investigating microbiologically contaminated fuels in an electron microscope, a micro-emulsion with a drop size of about 100 nm could be proven. The steel pin corrosion test showed that none of the steel pins had corrosive conspicuities, as long as no free water was present in the testing apparatus. A free aqueous phase reinforces the introduction of copper into the fuel. By means of a pump test bench, the influence of the fuels on the operating safety in customary fuel pumps from typical heating oil fuel systems was investigated. The used heating oil EL with 20 % (V/V) FAME did not show any disorders over 500 hours of operation. During the trial period, the micro-emulsion set up by a detergent and a dehazer lead to water accumulations in the filter in dependence of the flow conditions. The used pumps did not show any significant effect in their starting torques.

DGMK-Forschungsbericht 715

Wechselwirkungen zwischen Mikroorganismen und Heizöl EL A Bio
(Microbiological contamination of biogenic fuels)
Autoren: Simon Eiden, Winfried Koch, Dr. Heide vom Schloß, Bernd Leuchtle, Wei Xie, Dr. Martin Zimmermann, Prof. Lars M. Blank, 2013
129 Seiten, 76 Abbildungen, 15 Tabellen, 25 Literaturstellen
ISBN 978-3-941721-39-5
EUR 50,00 zzgl. ges. MwSt. (DGMK-Mitglieder 50 %)

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DEPOSIT FORMATION BY 20 % (V/V) FAME FUELS IN PREMIX BURNER SYSTEMS

DGMK Research Report **714**

Abstract

In the domestic heating market the development and use of fuels with an increasing share of biogenic or alternative fuels is propagated. Due to the fact, that modern fuel oil burner feature a complex carburation techniques and combustion, changes on the fuel properties and composition can lead to increased emissions or deposit formation therein. Furthermore, the different fuel properties may result in decreased storage stability, which has to be evaluated before introducing them into the market. The scope of the project was to investigate the performance of low-sulfur domestic heating oil (DHO) with up to 20 % v/v FAME on the storage stability and on the use in oil-fired heating systems. The project was split into two major parts. The first part covered a two-year storage of the fuels including sampling and analysis of the fuels every half year. The analysis was conducted according to DIN 51603-1 for the pure DHO and according to DIN SPEC 51603-6 for the blends. It has been shown, that low sulphur domestic heating oil with up to 20 % (V/V) of FAME after two years of storage fits the parameter of the corresponding standards. Furthermore, a new testing method, called “DGMK-714” derived from the PetroOxy-test (EN 16091) has been defined. With this method for the determination of oxidation stability the fuels can be characterized being comparable to the standardized testing methods of modified Rancimat or PetroOxy. The higher sample volume of the method allows further analysis of the fuel sample after testing for characterization of the fuels. The second part of the project investigated the deposit formation tendencies of the fuels in an idealized testing apparatus and in three different kinds of oil burners. Using the idealized testing apparatus proved an increased tendency of deposit formation during evaporation for an increasing FAME content. However, this tendency could not be observed in the three commercial oil-fired heating systems. A precise fuel specific failure could not be observed. Hence the results of this project sustain the future introduction of bio heating oil with a content of FAME of up to 20 % v/v.

DGMK-Forschungsbericht 714

Ablagerungsbildung durch 20 % (V/V) FAME-Brennstoffe in Vormischbrennersystemen
(Deposit formation by 20 % (V/V) FAME fuels in premix burner systems)
Autoren: Dipl.-Ing. Christian Jaschinski, Dr.-Ing. Oliver van Rheinberg, 2012
71 Seiten, 49 Abbildungen, 9 Tabellen
ISBN 978-3-941721-28-9
EUR 50,00 zzgl. ges. MwSt. (DGMK-Mitglieder 50 %)

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