

JOINT RESEARCH PROJECT “METROLOGY FOR BIOFUELS”

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Abstract – This paper describes the ongoing European research project “Metrology for Biofuels”, which deals with the development of metrological references for selected chemical parameters and physical properties of first generation liquid biofuels.

Keywords Biofuels; Traceability; Chemical parameters; Physical properties.

1. INTRODUCTION

The project “*Metrology for Biofuels*” is a so-called Joint Research Project (JRP) carried out as part of the European Metrology Research Programme (EMRP).

The European Metrology Research Programme (EMRP) is a metrology-focused European programme of coordinated R&D that facilitates closer integration of national research programmes. The EMRP is jointly supported by the European Commission and the participating countries within the European Association of National Metrology Institutes (EURAMET e.V.).

The science of measurement - metrology - is important for scientific research, industry and our everyday lives, as the demand for measurements with high accuracies and low uncertainties continues to increase.

The EMRP enables European metrology institutes, industrial organisations and academia to collaborate on joint research projects within specified fields.

These collaborative efforts will accelerate innovation in areas where shared resources and decision-making processes are desirable due to economic factors and the distribution of expertise across different countries and sectors.

2. AIMS OF THE PROJECT

For biofuels to penetrate a fuel market dominated by petroleum-based products, they need to be able to mix with traditional fuels and form blends that can be used without affecting vehicle engine performance, reliability or safety. More accurate measurements, and a greater understanding of biofuel properties, will allow this and improve public confidence in the low-carbon fuels.

The “White Paper on Internationally Compatible Biofuels Standards” published on 31 December 2007 by the Tripartite Task Force (BR, EU, USA) has highlighted that a series of biofuels specifications lack harmonization between geographic regions, as they are method or limit value dependent parameters. The Task Force recommends to “*support the development of internationally-accepted reference methods and certified reference materials for improving the accuracy of measurement results that*

underpin assessment of product quality, and help facilitate trade”.

Nowadays, many of the methods used by field laboratories are strongly linked with regional standard methods or parameters are method-dependent. However, in order to ensure long-term reliability and global comparability of analytical data, complete knowledge of the traceability chain to the International System of Units (SI) for measurement results of biofuel analyses is required.

This cooperation program aims to provide validated and reliable methods with ensured traceability of the measurement results for physical and chemical parameters of liquid biofuels, focusing on first generation materials. Besides, the JRP intends to have a dedicated task for the development of reference materials to be used as “tools” for method validation and instrument calibration, covering both chemical parameters and physical transport properties. Dissemination of the traceability concept to field laboratories through the metrology infrastructure put in place is obviously a major outcome of the project. The development of reference methods for chemical and physical parameters aims at the harmonization of measurement and written standards across borders, which is obviously essential for confidence in international quality assurance, needed to facilitate global trade, and will help ensure the sustainable contribution of biofuels to EU energy supply. Besides, the development of methods for tracing back the geographic and organic origin of biofuels will contribute to provide tools to prevent economic subsidy fraud.

3. PROJECT STRUCTURE

The JRP involves 14 participants from 9 countries [BAM (DE); DFM (DK); INRIM (IT); JRC-IRMM (EC); LGC (UK); LNE (FR); Metroser (EE); NPL (UK); PTB (DE); SP (SE); TUV NEL (UK); TUBITAK UME (TR); VSL (NL); University of Rostock (DE)]. The consortium brings together the largest European National Metrology Institutes having broad experience and expertise in physical and chemical metrology. The project is coordinated by LNE (France).

The JRP is structured in four technical workpackages, each dedicated to a specific task.

A component of this project aims to provide improved methodology for the characterisation of chemical parameters in biofuels. The work focuses on methods for those parameters where a need for improved comparability of the measurement results has been identified. The activities mostly focus on the development of reference methods for

(i) methanol in FAME, (ii) free glycerol and (iii) glycerides, and (iv) selected FAMES in rapeseed biodiesel.

Another component aims at the development of high quality metrology reference methods suitable for physical parameters biofuels. To address the legal demands for transport and trade of biofuels, very precise measurements of parameters such as volume and energy content (calorific value) will be developed. The volume measurement needs the knowledge of density for temperature correction and of viscosity. These data are necessary in a wide temperature range and at atmospheric pressure. Moreover, the technical demands for optimised control of injection into an engine, volatilisation, ignition and combustion require very precise knowledge of these parameters at high temperatures and for high pressures.

The quality assessment of biofuels carried out by the industry mainly concerns corrosion potential and inorganic contamination. Over-arching quantities such as the pH value of bioethanol, so-called “pHe”, and a biofuel’s electrolytic conductivity can provide a fast, cheap and flexible assessment of the quality. Nevertheless, serious metrological problems have been identified for these parameters. Particularly, pHe lacks traceability infrastructure and valid end-user test methods, such that it is being removed from the European bioethanol specification. SI traceability is being addressed via this project and the understanding of the sensitivities of the ASTM standard method to improve current test methods.

Finally, a feasibility study is being conducted to clearly identify whether it is possible to discriminate between biofuels of different origin and which analytical tools are required to do this. For instance, analytical procedures for the determination of bulk $\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{18}\text{O}$ values in biodiesel and raw materials will be developed, and their potential for discriminating biofuels from different biological origin, even in blends, will be investigated. Isotope and elemental fingerprint analysis and fingerprint analysis of organic traces/impurities will be also investigated. Moreover, methodology for compound-specific isotope analysis of $\delta^{13}\text{C}$ will be developed and its feasibility to identify biomarkers of origin (e.g. major fatty acid compounds) in selected biodiesel samples of different origin will be studied.

The expected outcomes of the project are shown in Fig. 1

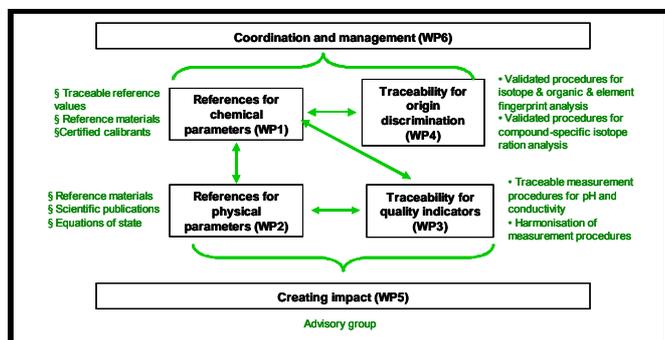


Fig. 1: Interactions between workpackages and main outcomes of the project “Metrology for Biofuels”

The outcomes of the project are discussed with an appropriate committee of stakeholders as well as the international standardisation bodies in order to provide tools to support defining international quality standards for protecting the European market and therefore to improve the EU competitiveness in the biofuels trade.

REFERENCES

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