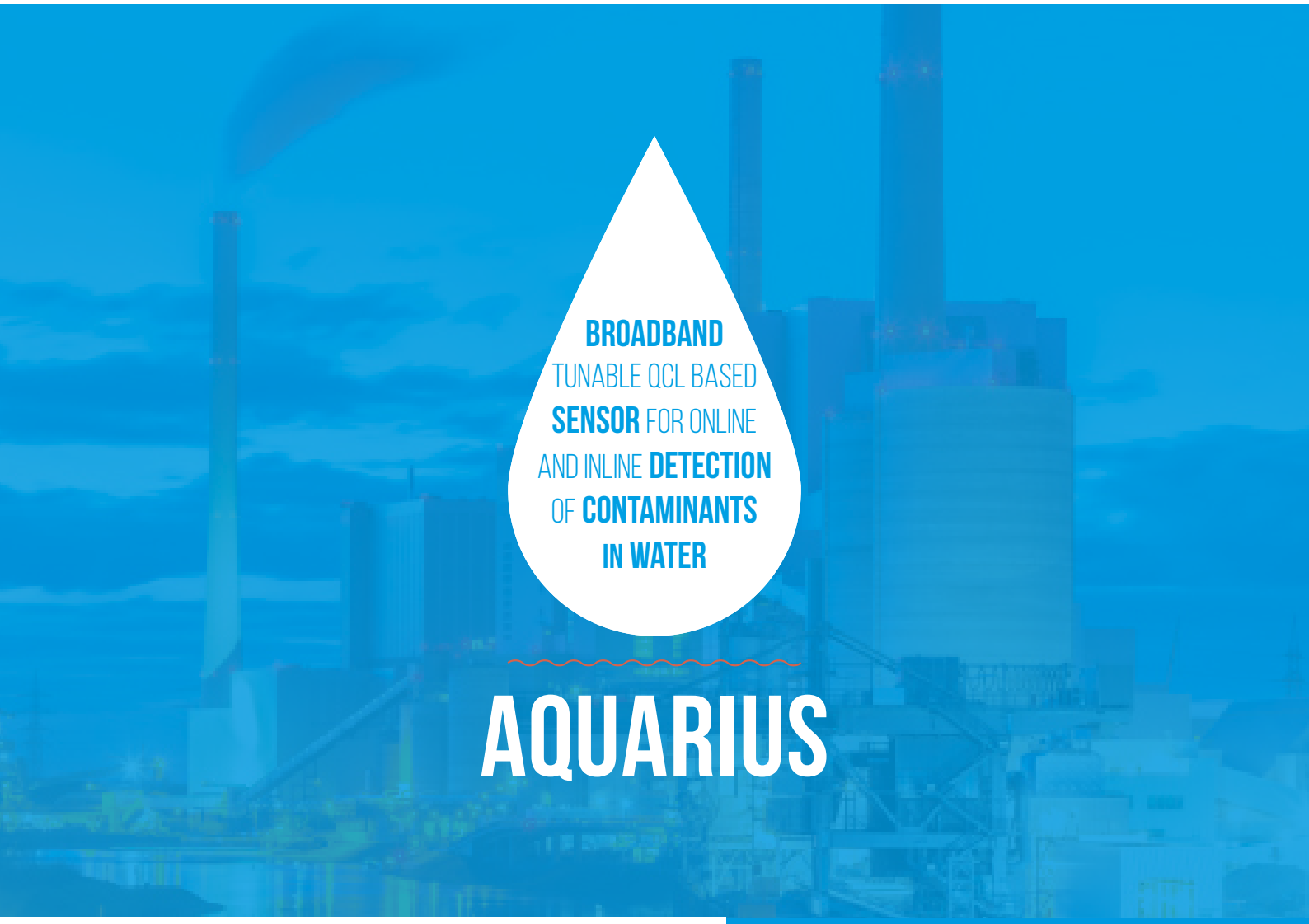

AQUARIUS

MESSAGE FROM THE COORDINATOR

With this fifth issue of the AQUARIUS newsletter, we once again continue the series of technical reports focusing on the research undertaken within the project. This time, the newsletter focusses on input of partner QRT (Quantared).

QRT will provide an analysis on Oil-in-water measurement and compare the state-of-the-art methods.

Consortium
8 Partners (5 Countries)

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Project number	**731465**
Project website	**www.aquarius-project.eu**
Project start	**1st January, 2017**
Project duration	**3 years**
Total costs	**EUR 3,891,263.75**
EC contribution	**EUR 3,891,263.75**

The project leading to this application has received funding from the European Union under grant agreement No 731465. This project is an initiative of the Photonics Public Private Partnership.

OIL-IN-WATER MEASUREMENT
A COMPARISON OF STATE-OF-THE ART METHODS

Oil-in-water measurement: In general

Contrary to popular belief, oil is, in fact, soluble in water (up to a certain degree). This amount, together with the undissolved part, constitutes the total hydrocarbon content that needs to be quantified accurately when dealing with discharge to surface water or when trying to implement process monitoring.

While phase separation ensures the removal of most of the oil, a potentially hazardous amount is still left behind and requires specialised methods for quantification to determine the total hydrocarbon content in question.

Comparison of available methods:

The two most common methods seen in oil in water analysis instruments are: **UV fluorescence** and **MIR absorption**. UV fluorescence uses rays within the UV region (200 - 400 nm) to excite certain molecules into a state in which they possess excess energy. Upon relaxation, part of this excess energy is converted to rays with slightly less energy which is subsequently picked up by a detector (see schematic below). Due to the nature of these energy states, only certain types of molecules exhibit fluorescence behaviour. Most notably, it is primarily sensitive to the aromatic fraction in oil. Saturated carbons (the largest composition in crude oil) do not fluoresce, greatly limiting the applicability of this method. Furthermore, quantification of oil in water is not possible with this method, as only a specific fraction of the oil is measured. Even though calibration would allow quantification by accounting for the invisible fraction in case the oil is of constant composition, the fluorescence signal is highly dependent on environmental conditions (temperature, concentration, solvent effects). Fluorescence therefore is only suitable as a warning signal, which provides notification in case hydrocarbons with an aromatic fraction are present in the water.

MIR absorption on the other hand has the great advantage of being capable to detect all the total hydrocarbon content by exploiting the vibrational characteristics of molecules. Rays with wavelengths between 3-15 µm are directed at the sample to be measured. Depending on how much light is picked up at the detector one can calculate the concentration of analyte in the sample due to absorption. To minimize the influence of water during measurements, an extraction solvent is added. This solvent is immiscible with water and readily extracts any oils within the sample. The advantages are twofold: firstly, the water no longer interferes with the measurement and secondly, a higher concentration of the analyte is achieved, thereby improving the sensitivity of the measurement.

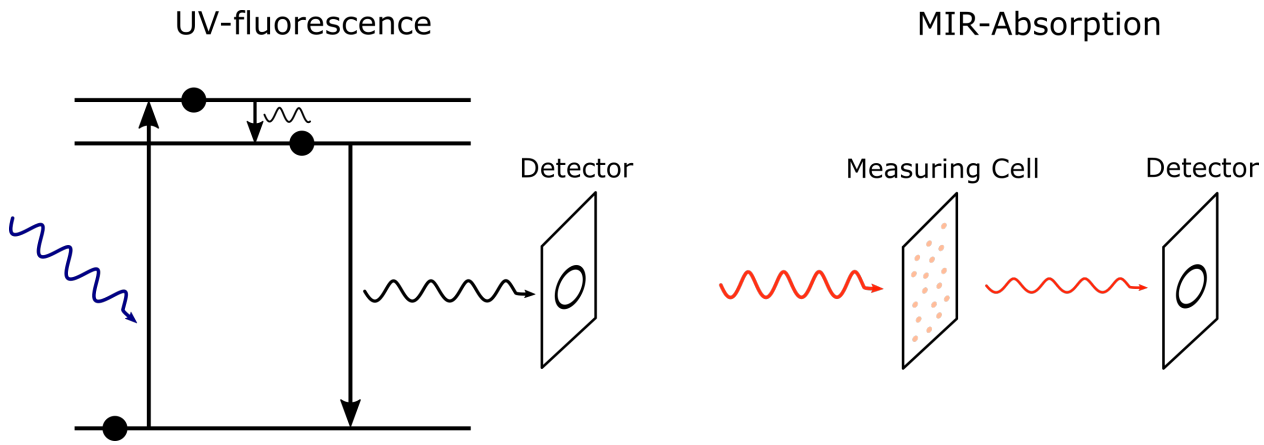

Figure 1: Comparison between UV-fluorescence (left) and MIR-Absorption (right) for quantification of oil in water.

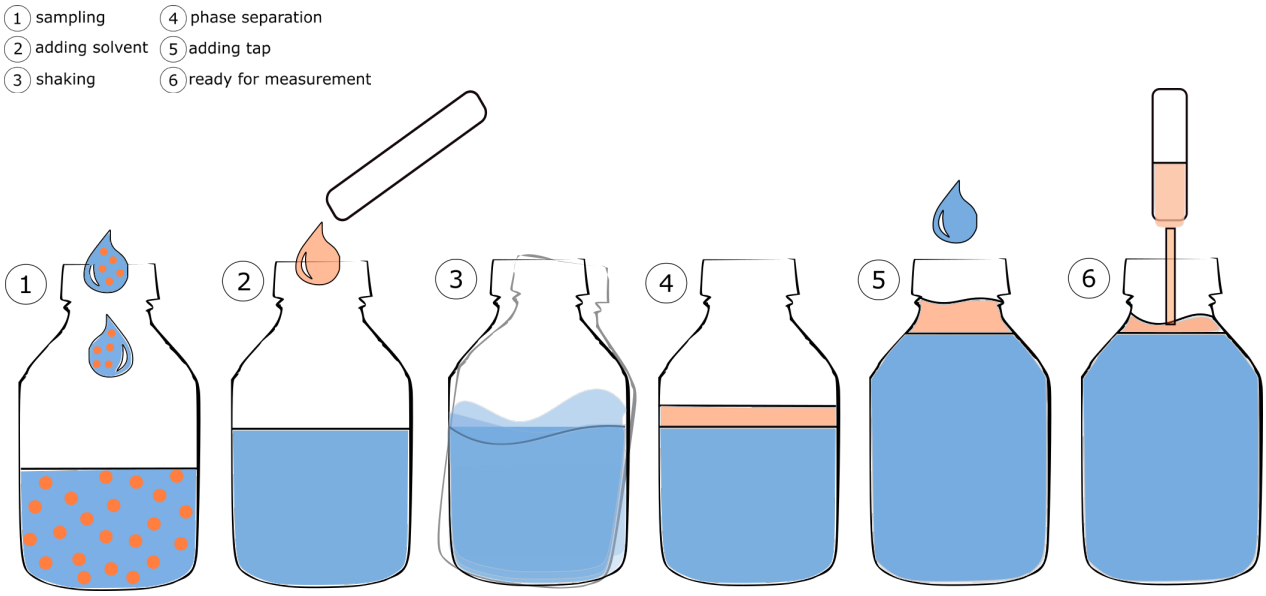

Figure 2: Extraction procedure according to ASTM D7678

Infrared-measurement (analysis of different oil types)

As a result of the specificity towards hydrocarbons, MIR absorption has become the favoured method when it comes to measuring oil concentrations in the field.

The method is based on a specialized spectrometer setup that allows us to scan over several wavelengths, thereby picking up signals that can be assigned to specific hydrocarbons. Exactly which oils can be detected depends on the scanned wavelengths and the power of the laser however, it is safe to say that most oil compositions can be identified this way.

Online (continuous) measurement application

The ASTM D7678 method as described above is an excellent approach to quickly and reliably determine the oil in water concentration and shows considerable potential for automatization.

Considering that several application cases would benefit from a continuous measurement system, there exists a high demand for online oil in water analysers. In the future this will enable seamless process- and surface water monitoring with minimal effort.

TECHNICAL MEETING

On the 3rd to the 4th of April, the consortium came together for a technical meeting in Katschberg, Austria. A revised project plan was established and the consortium collaborated to set common goals and objectives for the next months.

The technical meeting was highly successful mainly thanks to opportunities for group, individual and consortium-wide discussions about the pertinent topics that push the project forward.

OPTICS & PHOTONICS DAYS

Optics & Photonics Days is an annual event hosted by Photonics Finland. This year's event was held at **Aalto University Dipoli**, in **Espoo, Finland**.

The goal of the event is to showcase cutting-edge research and technology from both academic and industrial partners. The event spanned three days (**May 27th to 29th**) and included an exhibition with booths from 30+ companies, two full days of talks organised in parallel academic and industrial sessions, as well as a job fair. More than 250 personal members attended the conference.

Snorre Buganski-Olsen, from VIGO) gave a talk, „Photonics applications of VIGO products", in the industrial session, focusing on VIGO's involvement in R&D projects and in particular H2020 project AQUARIUS and related project WATERSPY.

The event also included a kick-off meeting for the PREIN Flagship, a new started collaboration between Finnish photonics partners aiming to accelerate innovation in the field and connect Finnish research groups with industrial partners, both local and from abroad.

Upcoming Events

IWA aspire
31st October - 2nd November 2019
@Hong Kong, China

11th Micropol & Ecohazard Conference 2019
20th - 23rd October 2019
@Seoul, South Korea

Aquatech Amsterdam
5th - 8th November 2019
@Amsterdam, The Netherlands

Follow AQUARIUS on:

Past Events

SPIE Photonics West 2019
2nd – 7th February 2019
@San Francisco, USA

IMEC and Fraunhofer represented the AQUARIUS project at this event.

PITTCON
17th - 21st March 2019
@Philadelphia, USA

TuWien attended the conference

SPIE defense and commerical Sensing
14th - 18th April 2019
@Boltimore, USA

Fraunhofer attended the event

ASTM D19 Meeting
11th - 12th December
@Phoenix, USA

Wasser 2019
27th - 29th May 2019
@Erfurt, Germany

Laser world of photonics
24th - 27th June 2019
@Munich, Germany

TWS Ground Water Monitoring advanced
29th May 2019
@Vienna, Austria

This workshop focused on the exploration and detection methods used when dealing with contaminated land and groundwater. QuantaRed's presence was important to obtain a better overview of the potential application areas of an online oil in water analyzer.

Produced Water Workshop
11th - 12th June 2019
@Aberdeen, United Kingdom

Over 90% of the produced water from offshore production activities is currently being discharged into the ocean, posing a significant risk to the environment. Regulations are becoming more stringent over time and new online detection methods are required to comply with the new laws. An Online Oil in Water analyzer based on infrared absorption (as developed in AQUARIUS), would meet such specifications and received a very positive response from several partners that attended.