gálta több hazai folyó mikroműanyag-tartalmát, a Dunában Budapestnél köbméterenként ötven részecskét detektáltak. A *„Mikroműanyagok édesvízi mintavételi módszertanának és mintaelőkészítésének fejlesztése”* címet viselő állami támogatású projekt keretében nemrég hazánk legnagyobb állóvizét, a Balatont és annak fő táplálóját, a Zala folyót is vizsgálat alá vették.

Az eredmények azt mutatják, hogy ezekben a vizekben jellemzően **5-10 mikroműanyag részecske található egy köbméter vízben.** A korábbi eredményekhez hasonlóan a legtöbb azonosított részecske polietilén anyagú, de emellett polipropilén, polisztirol és poli(vinil-klorid, PVC) is kimutatható volt.

Napjainkra már megkérdőjelezhetetlen, hogy a műanyaghulladékok jelentős része bekerül a természetes ökoszisztémánkba, vizeinkbe, ahol azonban biológiai lebomlásuk nem történik meg. Ezzel szemben fizikai-kémiai hatások – elsősorban UV-sugárzás – következtében láncszerkezetük aprózódik, így 5 mm-nél kisebb, úgynevezett mikroműanyagok jönnek létre.

Édesvizeink minősége a tápláléklánc szempontjából alapvető fontosságú, ennek ellenére mikroműanyag-terhelésük kutatása még messze elmarad a tengeri vizsgálatokétól.

A különböző mintavételi és vizsgálati módszerek nem szolgáltatnak egységesen értelmezhető eredményeket, pedig a tényleges ökológiai és humán-egészségügyi kockázat megállapításához ez elengedhetetlen a jövőben. További probléma, hogy a különböző kutatócsoportok más-más módszereket alkalmaznak a mintavételre és a minták előkészítésére, így az előálló adatok nem összehasonlíthatók.

Mi volt a kutatás legfőbb célja?

A most zárult kutatás során a szakemberek édesvízi rendszerek felméréséhez **fejlesztettek olyan egységesített módszereket**, amelyek a jövőben szabványosítási törekvések alapjául szolgálhatnak. A módszerek a projekt során fejlesztett prototípusokra épülnek. Kiemelkedően fontos, hogy a mintavételi és mintaelőkészítési eljárásokat modellrendszerben is validálták, tehát pontosabb információkkal rendelkeznek azok hatásfokáról. Ez értékes információt szolgáltat a minták kezelése során elkerülhetetlenül fellépő veszteségek mértékéről, így részletesebb képet alkothatunk a tényleges környezeti körülmények között uralkodó mikroműanyag-terhelés nagyságáról. A kapott eredmények értelmében a mért adatoknál akár háromszor-ötször nagyobb lehet a vizekben jelen lévő tényleges mikroműanyag-koncentráció.

A fejlesztett módszereket terepi körülmények között is tesztelték különböző környezeti elemek mintázása során, így mérték fel a Balaton és a Zala folyó műanyag szennyezettségét, ezekből a vizekből idáig nem volt információnk a parányi plasztikokról.

Mit kell még tudni a mikroműanyagokról?

A széles körben elterjedt műanyagtípusok ellenállóak a különböző környezeti hatásokkal szemben, ennek a perzisztenciának a következtében halmozódott fel nagy mennyiségű műanyaghulladék mind a szárazföldi, mind a tengeri környezetben. Vizekben, üledékekben és vízi ökoszisztémák élőlényeiben változó mértékű műanyagszennyezésről számolnak be a kutatások. Veszélyességük pontos felmérése kezdeti stádiumban van, azonban már több esetben bizonyítást nyert, hogy egyrészt káros élettani hatásokkal rendelkeznek (például tápcsatorna-eltömítés, gyulladásos folyamatok indukálása), illetve a gyártás során használt lágyítószerek szivároghatnak belőlük, de apoláros felületükön a vizekben jelen lévő perzisztens szerves szennyezőket is koncentrálni képesek.

A mikroműanyagok által hordozott környezeti, humánegészségügyi kockázatok felméréséhez meg kell ismernünk a pontos elterjedésüket (anyagtípusok, alakok, mérettartományok), majd fel kell mérnünk az általuk okozott káros (ökotoxikológiai, egészségügyi, víz- és élelmiszerbiztonsági) hatásokat.

A pályázati főösszeg nettó 269 538 633 forint, ebből vissza nem térítendő támogatás nettó 138 586 808 forint. A Vállalatok K+F+I tevékenységének támogatása (Vállalati KFI_16) pályázatot a Nemzeti Kutatási, Fejlesztési és Innovációs Hivatal írta ki, a vissza nem térítendő támogatást a Magyar Állam nyújtja. Ez a pénzügyi keret jelentősen hozzájárulhat az ágazat versenyképességének növekedéséhez, illetve nemzetközi szinten tudományosan is elismert eredmények megalkotásához.

How to produce better quality food?

More specifically: what substances are released from packaging materials into food? Why do we need to regularly test for pesticides and the toxins produced by tiny fungi? How can we arrest – within a day even – a microbiological contamination? The questions above were answered by the experts of a food-testing laboratory at a conference organised on the sideline of the “Sirha Budapest 2020 Exhibition”.

Dr. Tamás János Szigeti representing WESSLING Hungary Kft. - the organiser of the conference - said that with technological advancement on our side, it is by now generally understood that from the food contacting materials several compounds transfer into the food. The thermodynamic reason for this is that all systems seek thermodynamic equilibrium, and this is reflected even in food safety-related processes. Material transfer, i.e. diffusion, takes place on the boundary surface between the packaging material and the food it contains. As temperatures rise, diffusion becomes stronger; just remember the soft drinks left in the car in the sun.

Laboratories measure the amount of every component that may be dissolved into a solution: the monomers of plastics, photo-stabilisers, lubricants, plasticisers, antioxidants, printing inks and metals – yes, these materials can all dissolve into food, and during an average human lifetime we consume almost half a kilogram of these materials.

Of course, the impact on our health is not positive. Fluorine containing hydrocarbons diluted from plastics are especially toxic: they may damage our kidneys, liver, thyroid, testicles and prostate, may cause hypertension during pregnancy, and may have immune-toxic effects in children.

Another observation we heard at the conference - important for producers, distributors and consumers - is that products sold in smaller presentations may contain a higher concentration of dissolved compounds than products sold in larger presentations. This is why requirements imposed on caps are different, too.

In the case of packaging materials stored in rolls, with printed patterns on their external surface, contact between the internal and external surfaces may result in pollution if the product is rolled up before the print fully dries.

Year to year, ever newer pests emerge and keep migrating towards the Poles – explained Mrs. Köteles Dr. Gabriella Suszter, also a colleague representing WESSLING Hungary Kft. Agriculture uses a broad range of pesticides to combat them. Eating just one piece of fruit may introduce several different compounds into our body, and it is not fortunate if the impacts of the different compounds are aggregated (cocktail-effect). In addition, the presence of pesticides above approved limits in food may cause substantial losses to producers and distributors alike.

This is why regular food testing - for pesticides as well - is so important. By screening, the most frequently used components (as many as 500-600 different compounds) may all be tested for at the same time. This comprehensive test can be supplemented by a special test targeting specific compounds.

Speed is of utmost importance in testing, as fruits and vegetables are perishable food items with a short shelf life. At the same time, it is important to remember that pests may become resistant to the substances used against them. Such resistance is more likely to develop if a farm applies the same pesticide for several years. This means that pesticides must also be used in a sustainable way, i.e. they must be used in full consideration of biosystems and in observance of the requirements of food safety.

It is good news for everyone that only a few percent of the samples analysed in laboratories so far were found to contain pesticides above approved limits.

The Hungarian diet contains a lot of food made of cereals. Myco-toxins (the toxins of microscopic fungi) are pollutants in human food and animal feed exerting a negative impact on health, detectable only by special instruments.

These compounds are resistant to heat, to the procedures most frequently applied in the processing industry, but even to gastric acid. These toxins cannot be removed from food; therefore controlling efforts focus on prevention, authority measures and continuous monitoring - we heard at the conference. It was also mentioned that in modern laboratories, certain microbiological tests can be completed in 24 hours, - a great help to the actors of the food processing industry. The modern diagnostic processes available are methods of molecular biology (PCR) and immunology (VIDAS, SOLUS), or the identification of microbes using the MALDI-TOF method.

Modern genomic instruments allow us to analyse entire bacterial genomes fast and efficiently, and the genetic markers identified within the genomes can be used to make comparisons between microbes – explained Adrienn Micsinai, Executive Director of BIOMI Kft, a company involved in molecular biology and GMO testing, among other things. The comparative assessments (full genome MLST, nuclear genome MLST, SNP analysis) may help us to identify the source of the contamination and expose the root cause, thus contributing to the production of safer food.

One of the world's most significant gastronomy contests, the the Sirha Budapest premium international food processing and HoReCa fair welcomed experts at the HUNGEXPO Budapest Congress and Fair Centre between February 4th and 6th, 2020. This is where the Hungarian final of the Hungarian Bocused'Or Academy chef contest was also organised. WESSLING Hungary Kft. is Hungary's leading testing laboratory, having conducted almost two million tests over the past decades in a large number of areas: they tested for the presence of GMOs, pesticides, myco-toxins and harmful materials dissolving from packaging into food, and conducted microbiology tests.

The conference organised at the SIRHA Exhibition was intended to be a source of useful advice to the actors of the food processing industry.

The QualcoDuna programme now offers even more

The annual closing conference of the QualcoDuna proficiency - exam assessing the results of the last year - took place amid great interest in Hotel Aquaworld in Budapest in January. The more than 50 year old programme opens up new opportunities to its participants in 2020 as well.

Examination rounds are a great service to client centricity, as they verify that partners may trust the laboratory concerned. The organisation conducting the proficiency exam helps the lab prove to its partners that it is competent in the domain analysed – explained Tamás Rikker, executive director of WESSLING Nonprofit Kft. implementing the QualcoDuna programme as he quoted from the Introduction to Standard 17 043.

He added that successful examination rounds require support and regulation by the accrediting organisations, i.e. such organisations should identify and determine in exactly what they require compliance. An examination round, however, may resolve several professional problems as well, new methods and new colleagues can be tested, and reference tasks can also be solved.

Assessing the year 2019, head of the QualcoDuna programme Zsigmond Szegény concluded that the examination round of 2019 was implemented with a stable number of participants, i.e. with 146 partners (laboratory proficiency exams were announced in 11, while sample taking exams were announced in 6 topics). Sewage, surface water and bathing water were the most popular topics. The sample taking proficiency exams were evaluated with the help of the "Forrás" management system. The central default webpage is Qualcopt.eu, from where the QualcoDuna, QualcoDanube and Qualco-MAE pages can be accessed by a single click, directly as well.

In 2020, due to extraordinarily low interest, the COD_k and TOC exams were removed from the sewage sludge/bottom sediment matrix, the elements Ti, V and Al were removed from waste exams and were replaced by As, Cd and Mo. Zsigmond Szegény directed attention to the fact that from now on, the Daphnia exam will take place in the second section, instead of the third which was its former place.

It is an important change that – from next year according to plans – the certificate of participation will also be valid in electronic format. The organisers will continue to do their best to prevent collusion among participants, for which purpose they will also conduct interim checks, while the sample taking and waste chemical proficiency exams are planned to get accrediation in a wider range of fields.

Results (final reports) become available in a month, but a preliminary assessment can be expected in two weeks.

Tamás Rikker delivered a presentation on validation, Adrienn Micsinai spoke of the Happy Fish project, László Nagy, Executive Director of Aktiv-Instrument Kft. presented state-of-the-art laboratory instruments, and also spoke of the diverse opportunities offered by TOC-tests. Gábor Széles recommended Aktivit's, while Péter Jakab recommended Unicam's instruments to the audience's attention.

The venerable event also featured - in addition to the above presentations - a microbiology section.

Laboratory adventures in the Knowledge Centre

It is now for the sevenths year that a Hungarian testing laboratory opens its gates to young generations. So far, the lab - strictly closed to the general public - welcomed the winners of Hungary's first online chemistry competition. For a year, laboratory adventurers have been able to pay visits to the lab as a result of an application procedure. Chromatography, food-tests, tiny plastics are just some of the topics discussed over the last months.

Over the last years, the chemistry competition entitled "Laboratory Adventure Online" tried to direct attention to everyday uses of chemistry by countless interesting tasks: we learned what happens to a water melon if cooled in saltwater, how to use kitchen vegetables as indicators, how to cook the best pasta, why cheese has holes and how to make ice-cream without a freezer. The contestants also participated in a time travel, conducted an investigation alongside with Sherlock Holmes, visited the great scholars of history in their homes, and the most dedicated even had the chance to learn the secret of gold-making.

The winners of the contest were treated to a day of chemical adventures in Hungary's market leading testing laboratory at WESSLING Hungary Kft.'s Knowledge Centre and in the Palace of Miracles (Csodák Palotája). The Laboratory Adventure is intended to direct attention to the beauties of chemistry and to all the great things somebody choosing this still not very popular subject can do in a professional career.

The "Laboratory Adventure" continues this year as well – this time secondary schools meeting the conditions published on the webpage can submit their applications. The secondary school "Teleki Blanka Gimnázium" took advantage of the opportunity, and the school's graduate students were welcomed in the laboratory as the winners of the national student contest announced by the Ministry of Agriculture.

The young visitors were taken on a tour in the labyrinth of the Knowledge Centre's laboratories and in the chemistry of everyday life by Dr. Tamás Szigeti. The students wore protective eye-glasses and protective gowns. Following a tour to the chromatographs, the group proceeded to the microbiology lab where they watched how experts apply validated methods. This was followed by a

visit to the analytical testing section where visitors watched the way environmental samples are analysed.

The tour of the laboratory was followed by a presentation of one and a half hours on Wessling's corporate social responsibility and its important role in the protection of the environment and human health. Tamás Szigeti pointed out how – with just a little bit of attention and conscious care – each one of us can help protect and sustain our planet.

In January, the Wessling Knowledge Centre was visited by graduate students from Pesti Barnabás **Élelmiszeripari** Szakközépiskola és Szakgimnázium (Food Processing Secondary School). The goal of the visit was primarily to have a hands-on experience of what a modern testing laboratory - meeting 21 century conditions - is like, and have a close view of how the instruments and machines indispensable for certain food tests - of which the students have so far only heard at school - operate in practice.

A thematic presentation by Gábor Balázs - head of Wessling Hungary Kft.'s food testing laboratory - explained what it means if a laboratory is independent and accredited; what methods experts apply to inspect and measure the product and material samples arriving in the laboratory; how the company's internal management system is set up and why it is indispensable for a company to dispose over standards corresponding to its profile.

Following the presentation, the Head of the laboratory presented the Food Safety Division and a number of different tests he conducts every day in his professional life, including chemical, microbiological, organoleptic and molecular biological tests; searching for pesticides in food, animal feed and waters; conducting toxic metal and myco-toxin tests; food supplement and packaging material tests, etc.

Of course he also spoke of the multitude of technical instruments - including chromatographs and spectroscopes - that are so helpful in the work of laboratory engineers.

In February, the Wessling Knowledge Centre was visited by another group of secondary school students: the students of Sent II. János Pál Iskolaközpont (Saint Pope John Paul II School Centre) were introduced into the world of micro-plastics.

They were also reached by the news about our company's highly successful project entitled "Tiny Plastic Riddle". In this project, our colleagues measured the micro-plastic content of several Hungarian rivers. The school's science manager launched a talent management project accompanied by several related external programmes, focusing on topics like sustainability, environmental consciousness and the protection of the environment. The visit to the Knowledge Centre's laboratories and the related professional presentation focused on these topics.

The teacher organising the visit asked the Knowledge Centre to make sure that the students may thoroughly immerse themselves in the operating circumstances and conditions in environmental test laboratories, the equipment they use, as well as the working methods, results and significance of the Tiny Plastic Riddle project. Upon their return to school again, they are expected to share the information with the rest of the students in the Eco Corner.

Áron Mári, project coordinator of the Environmental Analytics Division said: a major advantage of the attractive plastics used in several domains of everyday human life is that they are easy to shape and are affordable. He warned, however, that by today, the use of various plastic objects is so widespread that this now exposes the surrounding natural environment and wildlife to danger. The scary fact is that 60% of plastic waste ends up in incinerators even in the best case, and in landfills in a bad one; only 8% of the plastic used by humans during their consumption activities is recycled.

The number of micro-plastics surrounding us has also multiplied by now. According to the definition, micro-plastics are less than 5 cm synthetic polymers resisting decomposition. They can be split into two groups. Primary micro-plastics are used in the cosmetic and health-care industry to increase the efficacy of these products. Secondary micro-plastics are pieces stemming from the aging process of plastics deposited in the natural environment. Their size allows them to enter into the food chain easily, causing unpredictable consequences to wildlife as a result.

The students visiting the Wessling Knowledge Centre were enriched by a lot of information by the programme, learnt a great deal about plastics and about how we can protect ourselves and the natural environment against them.

There may be more micro-plastics in nature than what we thought

In a Research and Development project now closing, an independent laboratory worked out a method resulting in significantly more accurate and reliable indicators to be used in micro-plastic projects than before: the actual micro-plastic concentrations in our waters might be 3-5 times higher than we had previously thought. Following similar findings in the River Tisza and the River Danube, the experts of WESSLING Hungary Kft. – heading the research project – managed to identify micro-plastics in Lake Balaton and in the River Zala as well.

WESSLING Hungary Kft. has been in the vanguard of environmental analytics for several years, measuring the micro-plastic content of Hungarian waters. In the River Danube in Budapest, experts detected fifty particles per cubic meter. The project entitled „Freshwater Sample-taking and Sample Preparation of Micro-plastics – a Methodology Development" is a recently implemented state-funded project which also analysed Hungary's largest lake, Lake Balaton and its main tributary, the River Zala.

Project results indicate that typically, **one cubic meter of water** in these rivers **contains 5-10 micro-plastic particles**. Similarly to earlier results, most identified particles are made of polyethylene, but polypropylene, polystirole and poly (vinil-chlorid) (PVC) particles were also detected.

It is by today unquestionable that a significant part of plastic waste finds its way into the natural ecosystem, into waters, where their biodegradation, however, does not take place. Instead – due to a number of physical and chemical effects, primarily ultraviolet radiation – their chain structure is broken up into fragments, resulting in particles smaller than 5 mm in size, i.e. micro-plastics.

The quality of our freshwater reserves is of decisive significance from the food chain perspective, but the analysis of their micro-plastic pollution lags far behind that of marine environments.

The various sample taking and analytical methods applied today fail to produce standardisable results, while this will be indispensible to identify actual ecological and human health risks in the future. The fact that the different research groups apply different sample taking and preparation methodologies is another source of concern, as the results produced in this way are not comparable.

The primary goal of the research project

In the course of the project now ending, the experts **developed standardised methodologies** for the analysis of freshwater systems. These methods can form the foundations on which later standardisation efforts may rely. The methods take advantage of the prototypes developed by the project. It is of outstanding importance that the sample taking and preparation procedures have also been validated in a model system, i.e. the experts have more accurate information about their efficacy. This is the source of valuable information about the amount of loss – an unavoidable consequence of handling samples – enabling researchers to gain a more detailed insight into the actual dimension of micro-plastic pollution under the circumstances of the natural environment. As the results received indicate, actual micro-plastic concentration in waters may be 3-5 times higher than the levels measured.

When the samples to be used in various environmental component tests were taken, the methods developed were tested under the circumstances of the natural environment as well. This is how we now know the micro-plastic content of Lake Balaton and the River Zala – waters in the case of which we have so far lacked information about the presence of tiny plastics.

What else should we know of micro-plastics?

Generally used plastics are very resistant to a number of environmental factors, and it is due to this persistency that so much plastic waste has accumulated in both land and marine environments. Research reveals various amounts of plastic pollution in waters, sediments and in wildlife living in aquatic ecosystems. The accurate analysis of the danger they represent is still in its infancy, but it has been proven on several occasions already that their physiological impact is harmful (e.g. they choke up the alimentary canal and induce inflammatory processes), that they may leak plasticisers used during the production process, and that their apolar surface may concentrate persistent organic pollutants present in waters.

The assessment of environmental and human health risks carried by micro-plastics would require the mapping up of their prevalence (material categories, shapes, size ranges), followed by an analysis of their harmful (eco-toxicological, health, water and food safety) effects.

The grand total available under the invitation for applications is HUF 269 538 633 in net terms, of which HUF 138 586 808 is non-refundable subsidy. The application procedure entitled „Supporting corporate R&D activities" (Vállalati KFI_16) was issued by the National Research, Development and Innovation Office, while the non-refundable subsidy is provided by the Hungarian state. The funding available may make a significant contribution to increasing the sector's competitiveness, and may also result in internationally recognised scientific achievements.