

Water pollution by microscopic plastic particles

The pollution of the world's seas, rivers and lakes is an omnipresent aspect in people's minds and it represents one of the greatest challenges for our society. The environmental organization of One Earth – One Ocean (OEEO), which is committed to cleaning up the global expanses of open water by means of removing the plastic rubbish from them, analyses the plastic particles that are present in samples of water taken from the rivers and oceans. It makes the analyses with an infra-red spectrometer.

Someone who previously spoke about the contamination of open expanses of water by plastics referred to the rubbish that was visible on its surface and on the riverbanks. Current scientific estimates indicate that there are already up to 150,000,000 tons of plastic in our oceans and that 6,400,000 tons more of it are being added every year. However, the microscopic plastic is incomparably worse: this arises whenever the plastic rubbish in the water is broken down into the smallest particles by means of degradation and mechanical influences. These tiny particles are distributed everywhere and they sink downwards to areas from which they can hardly be removed any more. Current analyses of the sediment at the bottom of Lake Garda in Italy or along the Danube for example show that high values of these microscopic particles are also present in our inland expanses of open water.

Particles entering the food chain

The definitive effects that the smallest plastic particles have on human beings and animals over the medium term and long term have hardly been researched sufficiently and nobody has come up with any viable solutions for eliminating them either. However, it is certain that the marine



Figure 1 Michael Röchling (on the left) of the Röchling Foundation hands over the firm of Perkin Elmer's spectrometer to the OEEO's Günther Bonin (in the centre); Perkin Elmer's Frank Trinkl is on the right.

creatures consider the plastic to be food and they ingest it on this basis. The plastic constituents like plasticisers for example also threaten us as human beings via their insidious effect on our food chain. Therefore, the charitable environmental organization of One Earth – One Ocean e.V. is also committed to researching into the microscopic plastic and it is working on drawing up a worldwide data bank of the polluting values. The association has been cooperating with the traditional OPDR container shipping line of Hamburg since the beginning of 2003, which takes regular samples of water from the River Elbe in Hamburg, the North Sea, the Atlantic Ocean and the Mediterranean Sea on its ships that sail on fixed courses between northern Europe and Africa. Further shipping lines will also be participating soon.



Figure 2 Perkin Elmer's Spectrum Two FTIR spectrometer.

Analysis by means of IR spectrometry

The association previously depended upon the expensive services of scientific institutes in order to analyse these samples of water. However, an infra-red spectrometer that the Röchling Foundation of Mannheim has generously donated now enables One Earth – One Ocean to determine and quantify all kinds of plastic in the water.

A supplementary battery pack or alternatively a power supply of 12 V enables Perkin Elmer's Spectrum Two FTIR spectrometer to be used portably. Even the smallest particles (less than 50 microns) can be characterized and identified automatically by means of a touch application. The package is completed by a robust, industrial notebook computer that is equipped with the evaluating software. All of the equipment can be stowed away in a sturdy container.

"We are absolutely delighted with the generous support that has been given to us by the Röchling Foundation, which we were able to convince about our environmental project. Our own spectrometer from the firm of Perkin Elmer now enables us to ascertain the results from individual samples of water much more quickly and even on the spot" declared Günter Bonin, who is the founder of One Earth – One Ocean e.V. "We receive a description of the degree of pollution in the tested open expanses of water promptly in this way."

Researching and documenting the degradation of plastic and the degree of pollution

Dr. Rüdiger Stöhr, who is a microbiologist, takes care of the scientific evaluation at One Earth – One Ocean. Mr. Stöhr is a member of the association and he gives lessons in biotechnology at Elly Heuss Knapp School (EHKS) in Neumunster as a trainee teacher. Furthermore, he is researching into bacterial cultures that are intended to decompose the plastic, within the framework of a students' project there. The students have already won 3rd place in the biology category in the National Youth Competition for this purpose and they were able to present their project to an international audience for the Stockholm Junior Water Prize. "We consider that the research into the problem of microscopic plastic is crucially important" commented

Enlarged analysis of filtered particles down to the size of 6 microns by means of IR imaging.

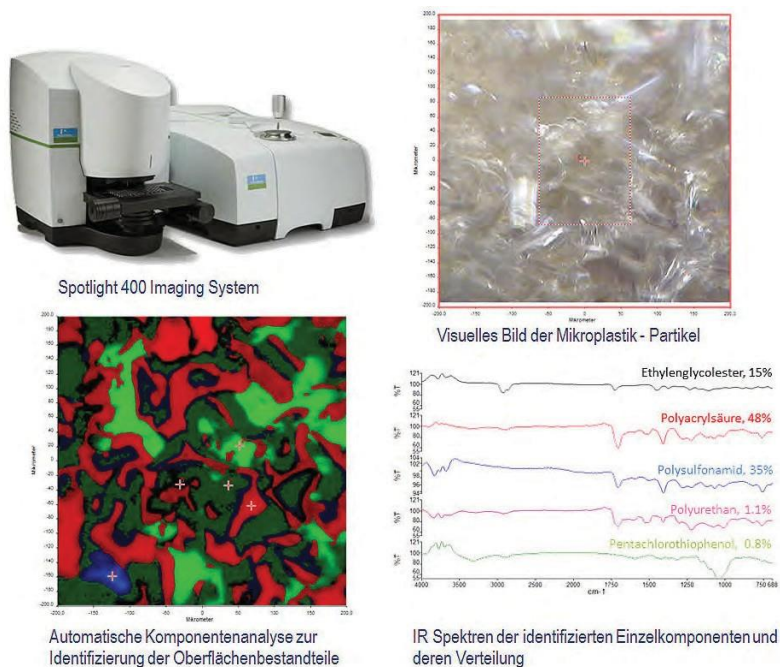


Figure 3 Even the smallest particles (less than 50 microns) can be characterized and identified automatically by means of a touch application.

Mr. Bonin. "The results are intended to contribute to estimating the problem's magnitude reliably and to demanding urgency with the means of solving it nationally and internationally in this way. We are gladly making our contribution in this case."

One Earth – One Ocean e.V. is using its idea of 'maritime refuse collection' to pursue the vision of removing the visible plastic rubbish from the seas, rivers and lakes via specially developed catamarans of various sizes. The refuse will be separated and recycled on land. The collected plastic is intended to be converted back into oil directly on board oil tankers during a later phase. About 900 litres of oil can be extracted from one ton of plastic. Günter Bonin was also presented with the Green Tec Award of 2013 last year, which is Europe's most important environmental and economic prize.