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Press Release

First “Rheines Wasser” results revealed

Rhine swimmer Andreas Fath reports on water analysis at Hansgrohe Water Symposium

First the good news: critical levels are not exceeded at any point. But the Rhine is still a veritable “chemical cocktail”. That was Dr. Andreas Fath’s announcement at the Hansgrohe Water Symposium (13 November, 2014) in Schiltach im Schwarzwald. In summer 2014 he swam the whole length of the River Rhine, from the source in Tomasee to the estuary at Hook of Holland in only 28 days for his “Rheines Wasser” research project.

The water samples, which were collected daily during the marathon swim, have now been tested for approximately 600 substances. The research team from Furtwangen University, where Professor Fath lectures and carries out research, was supported by various companies and research institutes. “With the compilation of all the results we get a detailed overview of the water quality along the complete length of the Rhine,” Dr. Fath stressed in his talk.

Search for minute amounts

With the highly-sensitive analysis equipment used, the researchers were able to detect amounts as small as one nanogram per litre of the various substances in the Rhine water. One nanogram is a millionth part of a gram. What the tests repeatedly

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indicated was that the further the Rhine flows, the higher the concentration of non-biodegradable substances. The really interesting question was – at what point on the Rhine did these substances start to appear? Blood pressure medications first made an appearance around Ilanz in the Swiss Alpine Rhine and the concentration of these increased continuously until the Rhine reached the North Sea. The antibiotic Sulfamethoxazol, used in the treatment of urinary tract and lung infections, showed up from the next swim stage in Chur. The betablocker Metoprolol, used mainly in the treatment of high blood pressure, started being found in Lake Constance around the town of Constance. The painkiller Diclofenac was not detected in the water until Laufenburg on the High Rhine.

Blockbusters – substances we all use

"You find all the blockbusters in the Rhine: from sweeteners to the remains of dishwasher tabs," says Fath. What he means by that is substances which people use in large quantities which then find their way into the rivers. Low-calorie drinks sweetened with artificial sweeteners are very popular. Sweeteners cannot be completely removed in the water filtration systems, so Acesulfam and Sucralose turn up again in the Rhine.

Benzotriazol is a chemical which is used in dishwasher tabs, among other things. In dishwashers it protects the silver and it is used in de-icers to prevent corrosion. "If we run the dishwasher every evening, the level of Benzotriazol in the waste water rises. Because it is difficult to break down, large quantities of it land in the Rhine," added Professor Fath.

The researchers also tested the Rhine for cosmetic substances. Climbazol is used in anti-dandruff shampoos as an anti-fungal agent. If it is absorbed by the human body, one of its component chemicals, Chlorphenol, a substance suspected of causing cancer, can detach itself and enter the blood stream.

Other substances found

Besides the substances which are found in many private households, Andreas Fath's team also made some more "exotic" finds. Gadolinium is one of the rare earth elements and is used as a contrast agent in MRI scans. "We found significantly higher levels of this around the area of Xanten where the river Lippe enters the Rhine," reported Andreas Fath.

PFOS, one of a group of perfluorinated tensides, was in the past often used as a wetting agent in fire extinguishers. Fire extinguisher foam containing PFOS has been banned in the EU since June 2008 and the positive effects of this ban can be seen in comparisons with past measurements. In 2006 around Düsseldorf 80 nanograms of PFOS could be detected in the water of the Rhine - in August 2014, the level had fallen to only 6 nanograms.

Good news too, with some other substances. The level of heavy metal ions - whether copper, lead, titanium or chrome - was found to be consistently lower than that allowed in drinking water. In other areas, however, the levels identified are not so comforting. Nitrates and phosphates from agricultural fertilizers and manure pollute our drinking water as a lack of retention methods means these are washed straight into the groundwater during heavy rainfall. "Nitrates find their way into our drinking water through the water table, which lies close to the earth's surface," explained Andreas Fath. Nitrates themselves are not toxic, but within the human body nitrate can transform into nitrite, which is dangerous for babies and can lead to the development of cancerous substances in adults. The significant rise in the level of nitrates indicated by the water samples from the individual swim stages is due to the increasing amount of water flowing into the Rhine either from surface water or from tributaries.

"The good news about phosphate, nitrate and oxygen levels doesn't mean we can stop worrying," stresses Dr. Fath. One look at the development of the chemical

oxygen demand (COD value) confirms this. “The further down the Rhine you go from the source, the greater the concentration of the organic oxidizing substances from industry, agriculture, hospitals and care homes, and private households”.

Goal: more effective protection of our water systems through research

“Our long-term goal is to develop systems capable of mineralizing these substances close to their source in order to prevent them from entering the water systems at all,” Andreas Fath stressed. An electrochemical process already developed by Fath has been successful with perfluorinated tensides and could render other toxic substances harmless, too. This will be the focus of Professor Fath’s future research.

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