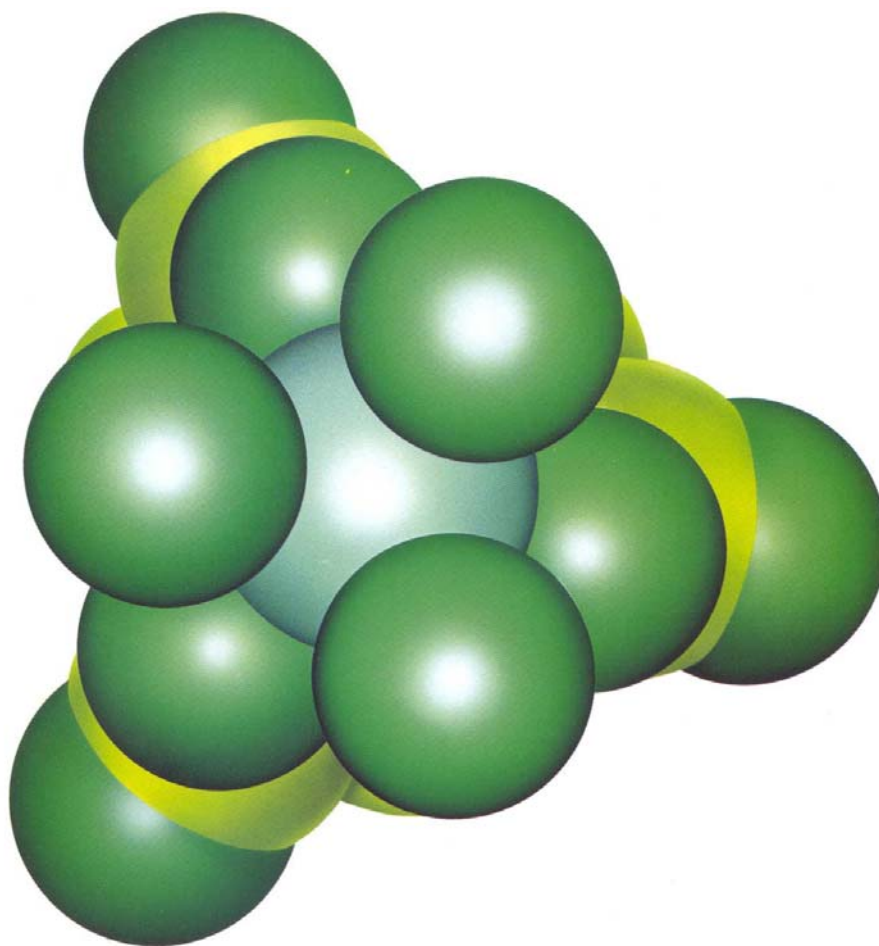


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# CHELATING AGENTS

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Update on the ecotoxicity and product safety of NTA



**NTA**

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### ***1. The results of the research programme on the environmental impact of NTA in the Federal Republic of Germany***

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A comprehensive study was made in Germany on the environmental impact of NTA in the years 1987-1990. The report, along with a summary and an evaluation of the results, was presented to the Environment Ministry, which commissioned the studies, on 16 September 1991.

A detailed account of the results and conclusions is available upon request at Cefic – EAC. The following is a brief summary of the most important findings.

- NTA is readily biodegradable. Removal rates of ca. 95 % from waste water can be achieved under practical conditions in treatment plants at all times of the year. This figure is much higher than the removal rates of 80 % in summer and 50 % in winter that were quoted in the NTA study of 1984. Variations in the concentration of NTA in the inflow, such as heavy loads on wash days, or high concentrations of other readily biodegradable substances, such as when treatment plants are temporarily overloaded, have no detrimental effects on removal rates. It can be assumed that there would be no significant increase in the concentrations of NTA in surface waters if it were to be used on a larger scale, as in Switzerland. This has been confirmed by a monitoring programme on NTA concentrations in rivers and lakes that was carried out in Switzerland after NTA had been introduced in detergents. No significant increases in NTA concentrations were detected, even when NTA consumption had increased by 400%.
  - Like many other substances that are easily broken down aerobically, NTA is only moderately biodegradable in anaerobic treatment plants, but these are in rural areas and serve only about 8 % of the population of Germany.
  - NTA does not affect the removal of heavy metals from waste water by adsorption on the activated sludge. Hardly any changes in the concentrations of lead, cadmium, chromium, iron, copper, manganese and zinc were detected in the overflow from sewage treatment plants. There was a slight increase in the nickel concentration, but the report emphasizes that no detrimental effects on water quality can be implied.
  - There is no experimental evidence for any remobilization of heavy metals from river sediment at H<sub>3</sub>NTA concentrations of less than 50µg/l. There was some evidence, albeit of doubtful significance, that some zinc might be remobilized at this concentration, but it has been calculated from modelling that zinc is only released from sediment into running water in any significant amounts at H<sub>3</sub>NTA concentrations of ca. 200µg/l. No copper or nickel is remobilized, even at higher concentrations. In view of H<sub>3</sub>NTA's biodegradability, concentrations in excess of 50µg/l cannot be expected in surface waters.
  - There has recently been some concern that NTA might have long-term effects on the growth of algae. The results of a two-year field study gave no evidence for this. Some very slight stimulation to the growth of algae and plant life was observed, but no significant effects can be expected in lakes and reservoirs at H<sub>3</sub>NTA concentrations up to 500µg/l. No toxic effects were observed in any of the many species that were studied, including fish.
  - After evaluating numerous scientific publications, the NTA Working Group came to the conclusion that NTA is bio-degradable in the sea, but the rate at which it breaks down decreases with increasing salinity. Because of the low concentrations of NTA involved, it is extremely improbable that the growth of algae will be affected in any way.
  - Bank filtration is an important process in the treatment of drinking water. NTA is at least 90 % biodegradable under aerobic conditions. It is also broken down quickly under anaerobic conditions, provided that nitrate is present. The biodegradability of NTA is restricted if oxygen and nitrate are absent.
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- Apart from bank filtration, ozone treatment is an especially effective means of removing small amounts of NTA from drinking water. Up to 50µg/l H<sub>3</sub>NTA can be completely removed from drinking water.
  - These studies have shown that NTA deserves a much more favourable assessment than it was given on the basis of the 1984 study. Nevertheless phosphate-free detergents in Germany are still formulated with zeolite and poly-carboxylates, but NTA is expressly recommended as a substitute for substances that are not easily biodegradable under practical conditions. NTA is especially recommended for use in countries in which phosphate-free detergents have not yet been introduced. This is reinforced by the positive experience that has been made in Canada and Switzerland.
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### ***2. The toxicological properties of NTA with particular reference to the results of carcinogenicity tests***

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The toxicological properties of NTA have been investigated very thoroughly, and a great deal of detailed information is available on its toxic potential. It has been shown that the levels of exposure that can be expected in the manufacture, handling and use of NTA are several powers of ten smaller than the toxic threshold, even under the most unfavourable conditions. The same also applies to the formation of tumours observed in animal experiments. No carcinogenic effects can be expected when handling this substance under normal conditions if the usual precautions when handling chemicals are observed.

There is no contradiction in the fact that an IARC Working Group has recently classified NTA as a possible carcinogen to humans (Group 2B) on the basis of animal experiments, the results of which have long been available. This classification merely indicates that the experiment on which the classification is based were carried out correctly and according to scientific principles, and that the results were very positive. A positive result does not imply that the handling and use of NTA poses a hazard.

Reference has to be made to other toxicological data in order to make an assessment of the hazards posed by NTA. The following are the most important points to consider.

- NTA has been tested for mutagenicity in a great many different species, and it has not been shown to be genotoxic.
- NTA is not metabolized by mammals, and it is quickly excreted via the kidneys. NTA collects in the kidneys, and it is there that highest concentrations in the tissues are found.
- Sub-chronic and chronic studies have shown that the kidneys and the ureters are the focus of NTA's toxic effects. The no adverse effect level is 15 mg per kg body weight per day.
- The high doses of NTA conventionally employed in toxicological testing cause a disturbance in the electrolyte metabolism, which leads to damage to the tissues in the bladder, kidneys and urinary tract.
- All the experimental data that have been obtained to date indicate that toxic lesions caused by the high dosage levels are a precondition for the formation of tumours in the bladder, kidneys and ureters of the test animals.
- No tumours typically caused by NTA have been observed at dosages that have no toxic effects on the kidneys. There is no reason to expect tumour formation at low levels of dosage.

The studies show that with NTA - as opposed to genotoxic carcinogens - there is a threshold concentration below which no toxic effects, and thus no tumours, appear.

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Comprehensive accounts of the toxicological properties of NTA can be found in the following publications.

- R.L. Anderson, W.E. Bishop and R.L. Campbell, A Review of the Environmental and Mammalian Toxicology of Nitrilo-triacetic Acid, *CRC Critical Reviews in Toxicology*, 15 (1985), 1-101.
  - Beratergremium für umweltrelevante Altstoffe (BUA) der Gesellschaft Deutscher Chemiker, Nitriloessigsäure, BUA-Stoffbericht 5 (1986), VCH Verlagsgesellschaft, Weinheim.
  - IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, 48 (1990), 181-212.
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