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Removal of N-Containing Inorganic Pollutants from Waste and Drinking Water

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The nitrogen cycle has unfortunately already disrupted the safe operating limits posed by planet boundaries. It has fallen well beyond other very alarming environmental issues such as climate change or biodiversity loss. Initial estimates suggest the ecosystem impacts of nitrogen pollution cost the EU-27 between €25 billion and €115 billion per year, and total costs (including those from N-related health and climate change impacts) could amount to €320 billion a year.

“A Blueprint to Safeguard Europe's Water Resources” has been published in November 2012, highlighting that diffuse and point-source pollution are still significant problems for the water environment in about 38% and 22% of EU water bodies, respectively. Eutrophication due to excessive nutrient load remains a major threat to the good status of waters as nutrient enrichment is found in about 30% of water bodies in 17 Member States. The World Health Organisation (WHO) proposes recommended levels as 50 ppm for nitrate, 3 ppm for nitrite and 0.5 ppm for ammonium in drinking water.

One of the major N-based pollutants in wastewater is ammonia. Besides toxicity it negatively affects the environment through eutrophication [1]. Indeed it acts as a nutrient for aqueous plants that grow out of control and deplete oxygen from the environment. Different methods for the abatement of NH_4^+/NH_3 are used and consist of biological oxidation (nitrification), stripping, breakpoint chlorination and ion exchange. These are usually performed as tertiary treatments in waste water and bring about additional costs and specific disadvantages, for instance for the final disposal of concentrated wastes [2].

In addition, nitrates can cause cyanosis in infants and children (blue baby syndrome), affecting the oxygen transport. Carcinogenic effects are also reported [3,4]. Many foetal problems can be also caused by exposure to nitrates in drinking water [5-8]. Nitrites can form nitrosamines, which are carcinogenic too.

Catalytic, electro catalytic and photocatalytic processes were investigated for the reduction of NO_3^- and NO_2^- . However, the still unresolved issue is the insufficient selectivity of the process because the unselective reduction to NH_3/NH_4^+ is usually observed instead of the formation of the desired and innocuous N_2. The catalytic hydrogenation over Pd-based catalysts has been proposed, for instance, but the selectivity to the undesired nitrite and ammonium ions is still excessive.

The attention has been also turned towards the possibility to use solar light and photo catalysis for the abatement of these pollutants with significant selectivity to N_2. The most interesting results have been reviewed recently [9].

Therefore, one of the future issues for industrial chemistry could be the development of new or revised processes for the abatement of nitrogen containing pollutants from waste water and drinking water, which must be characterised by high selectivity to N_2.

References

1. Lee J, Park H, Choi W (2002) Selective photocatalytic oxidation of NH_3 to N_2 on platinized TiO_2 in water. Environ Sci Technol 36: 5462-5468.
2. Christensen MH, Harremoes P (1978) Nitrification and denitrification in wastewater treatment. Wat Pollut Microbiol 2: 391-414.
3. Volkmer BG, Ernst B, Simon J, Kuefer R, Bartsch GJ, et al. (2005) Influence of nitrate levels in drinking water on urological malignancies: a community-based cohort study. BJU Int 95: 972-976.
4. US Environmental Protection Agency (1991) Nitrate: CASRN 14797-55-8: Integrated Risk Information System (IRIS). National Center for Environmental Assessment, USA.
5. Bukowski J, Somers G, Bryanton J (2001) Agricultural Contamination of Groundwater as a Possible Risk Factor for Growth Restriction or Prematurity. J Occup Environ Med 43: 377-383.
6. George L, Wiklund M, Aastrup M, Pousette J, Thunholm B, et al. (2001) Incidence and geographical distribution of sudden infant death syndrome in relation to content of nitrate in drinking water and groundwater levels. Eur J Clin Invest 31: 1083-1094.
7. Cedergren MI, Selbing AJ, Kallen BA (2002) Chlorination byproducts and nitrate in drinking water and risk for congenital cardiac defects. Environ Res 89: 124-130.
8. Brender JD, Olive JM, Felkner M, Suarez L, Marckwardt W, et al. (2004) Dietary Nitrites and 2 Nitrates, Nitrosatable Drugs, and Neural Tube Defects. Epidemiology 15: 330-336.
9. Compagnoni M, Ramis G, Freyria FS, Armandi M, Bonelli B, et al. (2017) Photocatalytic processes for the abatement of N-containing pollutants from waste water. Part 1: Inorganic pollutants. J Nanosci Nanotechnol 17: 1-22.

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