The general purpose of task 5.3.8 of the Techneau project is to study the impact of chlorination on the formation of chlorophenols such as 2,4,6- chlorophenol and haloanisols such as 2,4,6-trichloroanisol generated by methylation at water treatment plants or in water distribution networks.

In fact, the organoleptic qualities of water are dependent on multiple physico-chemical and biological parameters, but the main characteristics to which water consumers are sensitive are colour, taste and odour. Research has revealed that chlorophenols and chloroanisoles are important to this problem but the traceability of their precursors in drinking water treatment is still not well known. This will be the subject of our experimental work.

Little information on the elimination of these precursors can be found in the data. Nevertheless, information on treatability collected during the present work show that both THM and haloacetic acid precursors can be partially eliminated by water treatment plants. Treatability of chlorophenol precursors would thus seem to be of interest.

The present bibliographical work has aimed to present the issue of chlorination by-products leading to bad taste and odours. The following main points were made:

- Chlorination is an effective way of eliminating micro-organisms in water distribution networks as its action is remanent. However the drawbacks of this type of disinfection are the generation of unwanted water taste and/or odour as well as the formation of sapid chlorinated by-products by reaction of the chlorine with organic matter.

- As chlorination is the last treatment stage before distribution, by-product precursors must be eliminated upstream in the water treatment process. However, here are a number of inherent difficulties in doing so including: the low olfactory detection threshold of certain compounds as well as the great variability of the organic matter and the multiplicity of possible reactions (detection). In addition, different reactants– chlorine, chlorine dioxide and chloramine may be used and they use may generate more or fewer by-products. Finally, if certain chlorinated compounds occurred in the resource, they would also be treated by the water plant.

- THM and AHA present in the resource may be eliminated by GAC filtration in adsorption mode for THM or biological mode for AHA or by nano-filtration.

Chlorophenols are not eliminated by this clarification stage. However, adsorption on powdered or granulated activated carbon, ozonation and nano-filtration are effective steps in treating these compounds. This point is important because these compounds eliminated will not add to the compounds generated during chlorination. As no given drinking water treatment process absolutely eliminates these chlorinated compounds and their precursors, a multi-barrier approach is called for.

- In terms of perspectives, it would seem appropriate to conduct laboratory tests on the possibilities of eliminating precursors of 2,4,6- chlorophenol and 2,4,6-trichloroanisol, which are emerging compounds. This would involve implementing different reactants– sodium hypochlorite, chlorine dioxide and / or monochloramine with lake water exhibiting the referenced taste and odour problems. In principle, this water would be treated by clarification, ozonation, adsorption and nano-filtration. Chlorination before and after treatment should allow us to evaluate the chlorophenol formation potential of this water, which is essential to optimisation of treatment.

More information

The first results will be presented on the report 5.3.9 as Intermediate report on T&O control trials and improvements

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