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PILOT - PLANT EXPERIMENTS FOR THE REMOVAL OF THMs, HAAs AND DOC FROM DRINKING WATER BY GAC ADSORPTION - GALATSI WATER TREATMENT PLANT, ATHENS

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EXTENDED ABSTRACT

A pilot-plant study was carried out with the water supply to Athens water works filtered through a granular activated carbon (GAC) filter- adsorber. The objective of this study was to evaluate the performance of GAC for the removal from drinking water of the two main groups of disinfection by -products (DBPs), trihalomethanes (THMs) and haloacetic acids (HAAs), as well as of dissolved organic matter. The removal of HAAs by GAC adsorption has not been adequately studied internationally, while the removal of THMs and DOC (Dissolved Organic Carbon) from the drinking water of Athens by GAC adsorption was studied for the first time on a pilot-plant scale.
The pilot treatment facility is located at the Water Treatment Plant of EYDAP in Galatsi, Athens, and was operated as a rapid gravity filter- adsorber. Chlorinated water, which came from the overflow of the sedimentation tanks, was passed by gravity through the GAC bed continuously at an almost constant filtration rate. The GAC filter was in parallel operation with a full-scale sand filter. At regular time intervals water samples were taken from the inlet, outlet and different depths in the GAC column and also from the sand filter operating in parallel. The samples were analysed for THMs, HAAs and DOC. Other parameters were measured too. The operation of the GAC filter-adsorber continued until the GAC adsorption capacity for THMs and HAAs was almost exhausted.
The results of the analyses showed that the efficiency of GAC for the removal of THMs, HAAs and DOC is significant. The number of bed volumes of treated water at breakthrough for DOC was higher than that for HAAs and even higher than that for THMs (40602, 37648 and 33843 bed volumes respectively). The same was observed concerning the GAC breakthrough capacity, while the carbon usage rate (CUR) followed the opposite order, as expected.
The fact that GAC was proved much more effective in removing the dissolved organic matter (mainly humic substances) than the smaller molecules of THMs and HAAs is in accordance with the international research data. Also, the removal of THMs and the most part of the removal of HAAs and DOC must be attributed to adsorption by GAC, while that of a small part of DOC and a smaller part of HAAs may be caused by microbial degradation in the filter bed, where chlorine has been totally removed by the catalytic action of the activated carbon surface.

Key words: THMs, HAAs, DOC, GAC, adsorption, GAC filter-adsorber, drinking water treatment, drinking water quality.