MONITORING AND TREATMENT OF VOCs IN DRINKING WATER

(COMPARATIVE STUDY)

Submitted By

Ehab Zaki Abdel-Hady Ahmed

B.Sc. of Science (Chemistry), Faculty of Science, Ain Shams University, 1994

A thesis submitted in Partial Fulfillment

Of

The Requirement for the Master Degree

In

Environmental Sciences

Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
Ain Shams University

2018

APPROVAL SHEET

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Ehab Zaki

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ABSTRACT

VOCs present in drinking water because of industrial and agricultural discharges onto water streams or chlorination step in the treatment process, which form a disinfection by-products (DBPs). These compounds have negative impact on the human health and environment. Disinfection by-products of Volatile Organic Compounds (DBPs-VOCs) {Chloroform ($CHCl_3$), Bromodichloromethane ($CHBrCl_2$), Dibromochloromethane ($CHBr_2Cl$) and Bromoform ($CHBr_3$)} were classified as possible human carcinogens, if they exceeded the permissible limits of Egyptian guidelines (100 μg/l) **(Decree 458, 2007)**. The identification and quantification of VOCs performed by purge & trap GC/MS instrument, using a reference analytical method (EPA 524.2, 1995). A monthly monitoring comparative study established during 2016 in both input and output of **Shubra El-Kheima** (Water Treatment Plants WTP) (1 km Far from Nile River on Al-Sharqawia canal at the northern border of capital Cairo) and **South Alamein** WTP (270 km downstream far from the Nile River on Alhamam canal at North Coast of Egypt).

Our study revealed the absence of VOCs in raw water but (DBPs-VOCs) detected in final treated water of both investigated plants. Values of (DBPs-VOCs) obtained from Shubra El-Kheima WTP were comply the Egyptian guidelines, and recorded the highest level in October 2016 (90 μg/l), while the values obtained from South Alamein WTP were near or greater than the permissible limits. The highest level was recorded in August 2016 (193 μg/l), as well as most values recorded from the boosters output (6 boosters) next to South Alamein WTP were higher than the permissible limits. The values gradually increase as the booster moves away from the production plant due to increasing the contact time of final treated water with residual chlorine.

As regards the negative effect on health of these (DBPs-VOCs) which are carcinogenic, the study concerned to find an appropriate way for reducing their values in South Alamein WTP to be comply with the Egyptian guidelines using Granular Activated Carbon **(GAC)**. Lowering of (DBPs-VOCs) precursor concentrations has the additional advantage of reducing overall disinfectant demand, thereby reducing the possibility of the formation of all disinfection byproducts.

Finally the study succeeded in estimating the amount of GAC required and its duration time to reduce the total concentration of produced (DBPs-VOCs) from the maximum recorded concentration (178 µg/l) in the final treated water of South Alamein WTP to (94 µg/l) which is lower enough than the permissible limit (100 µg/l). About 581-ton GAC consumed every 17 day where the plant works at maximum production capacity (172000 m^3/day).

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