# CHLORINATION EFFICIENCY AND CHLORINE DECAY IN WATER DISTRIBUTION SYSTEMS IN PALESTINE: THE CASE OF KUFOR MALEK

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Abstract

Chlorine is added to the extracted groundwater from Ein Samia wells to maintain the minimum chlorine residuals in the distribution system in order to ensure safe water and protection of consumers. Chlorine disappears in the distribution systems due to reaction with organic and inorganic substances that usually exist in water (bulk decay) and due to reaction with pipe walls (wall decay). The loss of chlorine in distribution systems can affect disinfection efficiency by causing re-growth of microorganisms. On the other hand if soluble organics are present in water, the reaction of chlorine with these organics will occur, which leads to formation of trihalomethanes as a result of this reaction. The impact of various levels of chlorine addition might affect the level of trihalomethane formation.

Water quality at source was assessed by analyzing several relevant parameters including: pH, Turbidity, Temperature, SS, Ammonium, TOC, Faecal coliform, EC, Ca, Mg, Fe and Mn. The results showed that all of those parameters have values within the limits of WHO standards, meaning that water has a good quality at source. However, the probability of network exposure to contaminants needs to be monitored in order to ensure consumers' access to good drinking water, especially in terms of residual chlorine and related parameters.

The study also focused primarily on the measurement of residual chlorine in the drinking water network in Kufor Malek town as a part of the water distribution system of Ramallah district. The residual free chlorine values were monitored through the water network during 12 hours and analyzing 84 samples distributed on seven nodes. Many of the measurements have shown residual chlorine concentration lower than the required limits of WHO standards for drinking water except for some points where the concentration of free chlorine residual was within the allowable limits.

The effect of pipe diameter and pipe age on the residual chlorine was studied where the results showed that most of lower values appeared on the pipes with oldest age and smallest pipe diameters.

EPANET software was used for the computation of wall decay coefficients where the pipe wall reaction contribution is more significant than that of bulk fluid reactions which represented by bulk decay coefficient that was measured for chlorinated water samples at the source.

To increase the chlorination efficiency it is recommended to:

1) Replace the old (15-20 years) and small (1″ and 2″) pipes.
2) Step chlorination process is needed through the distribution system at the parts with low residual chlorine value, especially at the start of old pipes with 2" diameters.