Policy Brief

# Monitoring and Evaluation of Drinking Water from Rooftop Plastic Storage Tanks


## Executive Summary

The majority of people in Palestine store water in roof-top storage tanks due to scarce and irregular water supply as a result of occupation constrains and limitations. The tanks are mostly made of plastics. Various types of chemicals, monomers, additives, plasticizers, catalysts, compatibilizers, and pigments are added to the polymer resins to enhance the mechanical (structural), thermal and optical properties of the tanks. Some of these chemicals (as raw materials) are toxic and carcinogenic (e.g. Bisphenol A), with a potential residual toxicity in the final product. This issue demanded investigating the current status of plastics roof-tanks in terms of raw materials, age, water storage period, frequency of cleaning and characteristics of stored drinking water were evaluated. Research methods included descriptive approach, field survey and laboratory testing.


## Introduction

The drinking water supply in Palestine is rather insufficient and irregular due to "Israeli" constrains and limitations. Local people, therefore, suffer from shortage of drinking water, especially during long months of summer. To partially overcome this problem, most of the people store the water in storage tanks placed at the roofs of their houses. The tanks are mostly made of plastics by local plastic manufacturing companies. The storage tanks are manufactured through molding of polymer resin that is mostly composed of one main building block polymer such as polyethylene, polypropylene or polyethylene terephthalate. In addition, various types of chemicals, monomers, additives, plasticizers, catalysis, compatiblizers, and pigments are added to the polymer resins to enhance the mechanical, thermal and optical properties of the tanks. Some of these chemicals (i.e. bisphenol A (BPA), phthalates, Diethylhydroxylamine, heavy metals, etc…) as raw materials can be hazardous to human health i.e. toxic and carcinogenic, and may have estrogenic activity which

can result in sever health effects. For instance, bisphenol A (BPA), a common polymer additive presents in many plastic products, is reported to cause cancer, asthma, infertility, hyperactivity and reproductive system irregularities, especially in infants and children. The risk that these chemicals remain active in the final product and their potential leak out from the storage tank to the water is hypothetically possible and can be highly increased by the exposure to sunlight, UV rays, and temperature and aging. This issue motivated this research project for evaluating the level of contamination of drinking water in plastic tanks, using descriptive approach, field survey and laboratory testing.

## Findings

- The majority of the households (>75%) do not perform regular cleaning of their tanks and more than 50% of them store the water in the plastic tanks for a period longer than three days.
- Physicochemical characteristics of the water samples obtained from roof-tanks included total dissolved solids, pH, heavy metal content and turbidity were within the standard permission limits set by the World Health Organization (WHO) for drinking water.
- the overall chemical migration from two selected brands of the plastic tanks was measured and the values were less than 4 mg/dm$^2$. These measured overall chemical migration are lower than the Palestinian and the similar international allowable limit of 10 mg/dm$^2$.
- The leaching of specific chemical compounds including Bisphenol-A, Bis(2-ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP), Diisononyl phthalate (DINP), Diisodecyl phthalate (DIDP) and Di-n-octyl phthalate (DNOP) from the plastic tanks to the water were measured. Their values were less than allowable standard limits.
- The concentration of hazardous chemical compounds such Bisphenol-A and phthalates in the sored drinking water is well below the local and international allowable limits.
- The current legislatives concerning restricted substance in food contacting materials, as adopted by Palestine Standards Institution is well-matched with other regional and international legislatives, and hence it is supported by the findings of this research projects without recommending a need for development at the current stage.

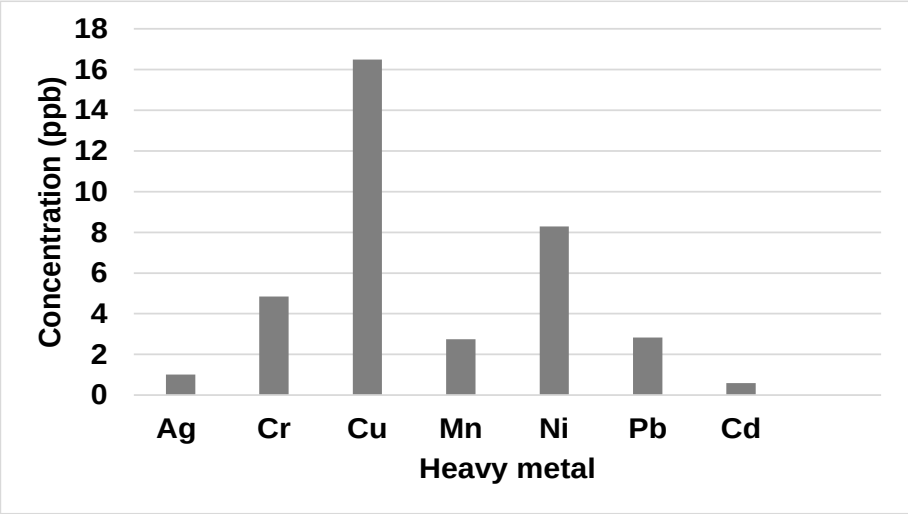


**Figure 1**: average concentration of various heavy metals in water samples collected from various roof-top plastic water storage tanks and wells.

## Conclusions

- No significant concentrations of harmful pollutants are observable in the drinking water stored in the plastic roof tanks. Hence, storing drinking water in plastic roof tanks in Palestine seems to be safe.
- The overall chemical migration from the storage tanks is below the Palestinian and international allowable limit (10 mg/dm$^2$).

## Recommendations

- Continuing the process of monitoring of the used raw materials and testing the produced plastic roof tanks and drinking bottles, for all commercially available roof tanks with reinforcing the capacity of testing facilities.
- Developing and implementing a testing program for the quality of plastic storage tanks obtained from regional and international suppliers.
- Developing and implementing a program of regular periodic monitoring and evaluation of the characteristics of drinking water stored in plastic tanks
- Implementing an awareness public campaigns for the importance of regular cleaning for plastic storage tanks.

This project has been financially supported by the Netherlands Representative Office in Ramallah. The project has been implemented during the period 2019-2020 through a collaboration of the following Palestinian and Dutch partners:

- Palestine Polytechnic University- Hebron, Palestine (Maher Al Jabari and Hassan Sawalha)
- IHE Delft Institute for Water Education, Delft, The Netherlands (Eldon Raj Rene**)**