Original Article

Investigate the presence of plastic particles in bottled and reused water bottles for several times and medical feeder bottles

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Abstract

The research results revealed the presence of microplastics in bottled water exposed to the sun. The effect of direct sunlight on standard plastic bottle samples was studied and reused to estimate microplastic particles. Samples of standard plastic bottles made of water-packed polyethylene terephthalate (bottled water) were collected and compared with plastic bottle samples packed with wastewater. The number of microplastics was estimated through the sample filtration process, and then the number of particles was calculated using a microscope. The average number of microplastics measured in standard samples of bottled bottles exposed to sunlight was 180.7 microplastics/L. While the average number of particles for water-packed plastic bottles that have been reused several times and exposed under direct sunlight and the effect of the same conditions for standard samples was 326.2 microplastics/liter, and the results proved that there were obvious differences in the number of plastic particles as the research results showed that there were clear differences in the number of plastic particles between the water bottled in the standard polyethylene terephthalate bottles exposed to sunlight and the bottles reused several times. After their laboratory observation, the results of verifying the presence of plastic particles revealed the degradation of those particles in the nutrient liquid. This may be due, among other things, to the manufacture and packaging of these canals and the bottle from which they may be produced.

Keywords: plastic particles. Polyathylene bottles. My medical feeder bottle. Bottled water.

INTRODUCTION

The accelerated growth in the spread and production of plastics requires research and studies on the risks that microplastics can pose, for the purpose of understanding and avoiding any health concerns that may affect humans or other organisms in the near or long term. The international workshop was held on 9-11 September 2008 at the University of Tacoma, United States of America, on the topic of microplastic particles and agreed that microplastics are plastic fragments of 330 micrometers,1.

They are also found in human consumables where microplastics are found in foods such as seafood2,3,4 food salt5,6.

As well as in honey, sugar, beer7 and most worrying in tap water and bottled water in plastic bottles8,9,10,11,12,13,14 .

Plastic particle contamination in bottled water can be through the production and packaging phase and the rate of continuous transition from plastic bottles to water. Thus, we should conduct extensive studies on microplastics in bottled water and the impact of different storage conditions on them due to increased demand and consumption in these recent years.

Microplastics can be transported to humans through several pathways, such as consuming food and beverages contaminated with microplastics. The smaller the gross plastic, the easier it is to penetrate the organs of humanity and its transfer. According to their size, microplastics are also divided into "large microplastics (1-5 mm) and" small plastic particles "(20 micrometers - 1mm)15 and nano-plastic16,17, resulting from exposure to oxidation mechanisms by solar radiation as a result of differences in size. Microplastics are divided into two types: primary microplastics and nods. Primary microplastics are plastics that are produced to be small particles. Secondary microplastics are plastic particles from a larger pieces. Then degrade and become

small particles18,19. The degradation rate of plastics depends on the surrounding environment and temperature. However, solar radiation appears to be the most influential factor in plastics degradation processes20,21, depending on the conditions, where UV radiation affects plastic materials differently22. The World Health Organization (WHO) has called on scientists from all countries to promote research on the impact of microplastic particles on human health23,24, so as microplastic inputs into the environment increase, microplastic pollution has become a global problem and concern25,26,27,28. This study aimed to count microplastic particles in standard bottled water and reused plastic bottles several times and the impact of direct exposure of plastic bottles to sunlight for various periods, and determine whether there was a difference in the number of microplastic particles in samples.

MATERIALS AND METHODS

Samples of bottled water were collected from November 2021 until March 2022 at random from Mosul's local markets within the shelf life to avoid the possibility of altering some water properties with the expiration date of water-packed plastic bottles. The most traded bottles were selected as 0.5 liters. The effect of direct sunlight on standard plastic bottle samples was studied and reused to estimate microplastic particles. The study included testing 11 samples, 10 of which were standard (control group) and one which was reused several times down to the tenth reuse. During different scheduled periods (1), the samples to be examined were placed under direct sunlight, and the plastic bottles were reused 10 times and compared with the standard samples (control group) in terms of estimating the number of microplastics for each period of reuse of the bottle shown in table (1). All work steps and sample preparation were conducted in laboratory conditions to avoid air contamination. Early studies identified micro-particle concentrations by optical examination/microscopic counting29 filtered a certain size for both standard and reused samples by micro-fiber filter using filtration sheets of a type (Grid Membrane, Diameter 47 mm, size (0.45) µm The filtration sheets were placed in sterile glass Petri dishes after the filtration process to dry at room temperature taking into account their closing provisions to avoid laboratory contamination and then conducting visual analysis using an eye-lens microscope with magnification strength (10X) and an objective lens with

magnification strength (40X)30,31 hot needle test was used as a way to distinguish between salt parts and other non-plastic materials in the presence of a very hot needle.

In addition, the study included the analysis of a sample of nutrient-liquid bottles and a sample of plastic antibiotic bottles in the same way as the analysis of bottled water bottles.

RESULTS AND DISCUSSION

3.1Effect of sunlight on plastic particles

The results of the research, Table No. (1) figure (1) and figure (2) showed the presence of microplastic particles for all standard samples and reused for several times exposed to direct sunlight. The highest number of plastic particles for standard plastic bottles was exposed, urging the effect of sunlight 340 plastic particles/liter for the tenth reading for 30 days. While the highest number of microplastic particles in reused plastic bottles was obtained at the tenth time that they were reused was at a limit of 1,100 plastic particles/liters. While the lowest number of plastic particles for standard samples was 60 plastic/liter particles within five days under the influence of sunlight, the lowest number of reused samples with 33 plastic/liter particles was obtained within three days under the same conditions.

Table (1) Number of plastic particles for standard samples and reused samples placed under direct sunlight

Microplastic for reuse sample/L	Microplastic/L	Daily value
33	80	3
45	60	5
84	70	7
80	100	10

100	97	12
250	220	15
450	250	18
520	290	20
600	300	25
1100	340	30

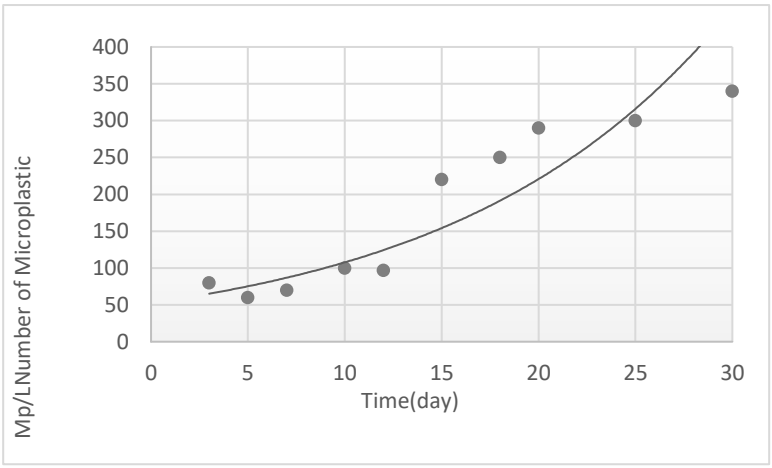

Fig (1) Number of plastic particles in water for standard samples in different conditions under the influence of sunlight

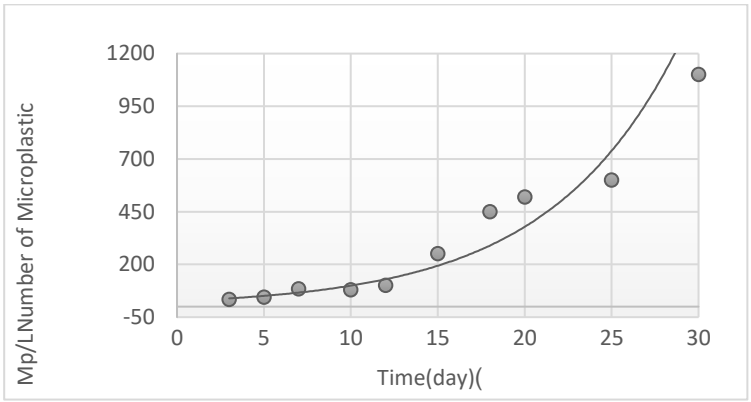

Fig (2) microplastic particles of reused bottles for several times under direct sunlight

This rise in the number of particles can be attributed to the effect of sunlight, as most plastics tend to absorb high-energy rays into the ultraviolet radiation part of the spectrum, which increases the electron reaction and leads to oxidizing and thus makes plastics degradable by breaking the molecular chain on the surface of the surface Polymer32, the solar rays make the plastic material fragile enough to disintegrate into fragments and small pieces (clear plastics) during a certain period of exposure33. The results obtained correspond with the researcher34 through his study to expose the samples to direct sunlight. The manufacturing cycle of the plastic bottle also includes certain factors, including transport, temperature exposure, and pressure applied to it 35. The study also showed that the sources of plastic pollution are at least a result of the industrial process of packaging as well as of packaging materials, especially when particles detected in water samples were verified as polyethylene terephthalate and (PET) polypropylene (PP) is a material used in the packing itself and this corresponds to the high number of plastic particles for standard samples during the study period36,9. The high number of plastic particles for reused samples can also be due to the frequent reuse of plastic bottles, which increases the carrying of microplastic particles8. It was observed that whenever plastic bottles were reused, microplastic particles were released in larger forms and sizes than in single-use bottles; during the experiment, soft plastic particles were observed on the surface of the filter blue color in the reused samples with a greater proportion of standard samples and likely from the cap material of the bottles as a result of the corrosion caused by the frequent opening and closing of the spine cover. In addition to that, microplastic can be affected by chemical species in water, such as ions and salts17; how mechanical pressure can affect plastic bottles by releasing microplastic particles into bottled water

where it has been determined that mechanical properties and manufacturing process can affect the fragmentation and distribution of plastic particles. The low number of plastic particles for samples.

Standard in the second reading compared with the number of particles for the first reading can be the result of weather conditions that prevented exposure to solar radiation of samples and a marked drop in temperatures which in turn led to a decrease in the number of plastic particles in addition to the manufactured packing of standard bottles that in turn add microplastic particles to bottled bottles. From this, we conclude that microplastics can be the product of bottled water, so that repeated reuse more than once increases the loading of microplastic particles into reused bottles by more than if the bottle were used for a single time, and can affect human health in a long term. And recommend many studies and research on water contamination with other types of plastics and proposing modern ways to treat contaminated water.

3.2 Detect microplastic particles in feeder bottles and plastic antibiotic bottles.

A sample of salt medical nutrient liquid preserved in a plastic case was analyzed (500) milliliters, and another sample of antibiotic preserved in plastic packaging of the size (100) ml as in figure (3), which is given to patients intravenously by a giving device as in figure (4) s head, which is tightly sealed by rubber repayment, putting considerable pressure on the front of the bottle's hacked plastic tender, leading to its fragmentation that this particle was generated after the second use of the tender device Plastic particles figure (5). Results revealed the presence of microplastic particles, as in figure (6), which may have entered the bottles during the manufacturing and packaging stages as well as the decomposition of the bottle itself as a result of shipping and transportation36 and the pressure applied to the bottles when stored at cold storage conditions, this can pose a significant risk to patients who are given these medical fluids by moving those particles directly to the blood.

Figure (3) Nourishing Liquid Bottle

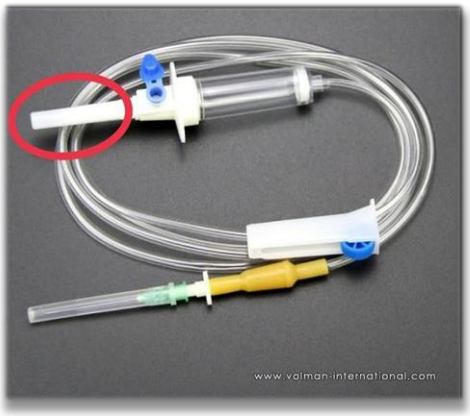

Figure (4) Intravenous tender device

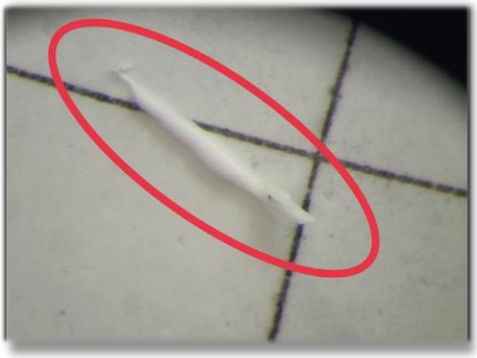

Fig (5) microplastic particle

Fig (6) Microplastic particles on the surface of the filter sheet

CONCLUSION

Sunlight obviously affects the increased release of microplastic particles into plastic bottles. Therefore, we recommend that researchers conduct further studies and research to demonstrate the impact of plastics on water properties and develop modern methods to treat such pollutants.

Microplastics for the medical feeder and antibiotic samples preserved in plastic packaging were also found.

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Conflicts of Interest: The authors declare that there is no conflict of interest regarding the publication of this work.

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