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Review Paper

Rainwater Collection of Forms and Areas of Environmental Use

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Abstract: Water is the basic right of the living thing, and it is an indispensable element for living things. The amount of water consumption is increased by the effect of the industrial activities that are developed due to the increase of the population. Water resources must be conserved, water pollution must be reduced, and wastewater reuse should be maximized to release adequate and healthy water resources for future generations. It is aimed to use the rain water in the water consumption without mixing with the sewage water by the technology developed in the waste water treatment. For this reason, it is important that rainwater is recycled due to decreased water resources in our country. Rainwater analysis is of great importance in the recovery of rainwater so in this study, the advantages and disadvantages of the rainwater collection will be compared and it will be evaluated in which areas in the environment can be used.

Keywords: *Rainwater, Health, Environment, Water resources,*

Introduction

Water is the basic right of the living thing, and it is an indispensable element for living things. The amount of water consumption is increased by the effect of the industrial activities that are developed due to the increase of the population. The total amount of water in the world is 1.4 billion km^3. 97.5% of these waters are in the oceans and in the seas are salt water and 2.5% are fresh water in rivers and lakes. It is understood that the amount of available fresh water that the human can easily benefit from is small. The average annual precipitation in Turkey is approximately 643 mm per year, which corresponds to an average of 501 billion m^3 of water (Figure 1).

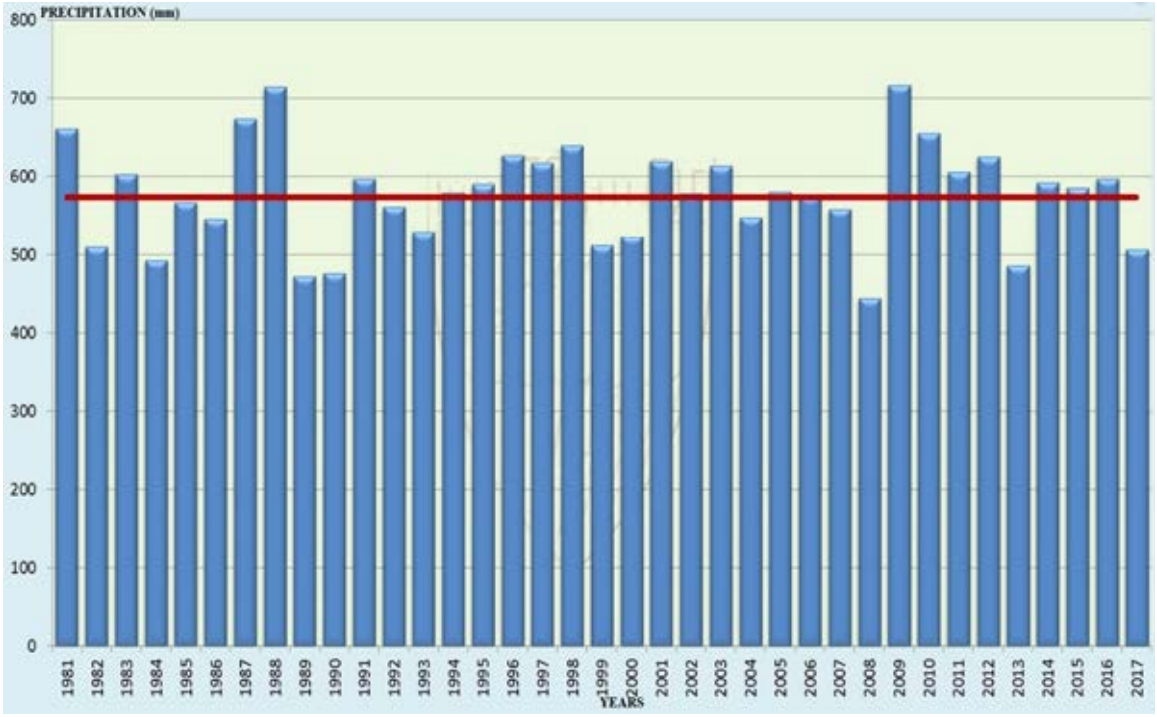

Figure1: Turkey's General Annual Areal precipitations (General Directorate of Meteorology, 2017)

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Our country received an average of 597.6 mm of precipitation in 2016 (01 January - 31 December). Precipitation was about 24 mm higher than normal and 12 mm higher than last year's rainfall. The use of alternative water resources technologies is becoming increasingly widespread throughout the world in the recent period when the effects of water stress are beginning to be felt more and more. It is known that in traditional practices, solutions such as the use of rainfall waters in appropriate seasons and use them when needed are widely used. There are water wells around historical buildings. The use of cisterns for collecting rainwater is very common in traditional houses near water wells. (Figure 2)

Figure 2. Yerebatan Cisterns (URL 1)

Rainwater Management

- In-building rainwater management: The collection of rainwater from the roofs of buildings can reduce network water usage. (Figure 3)
- Regional rainwater management: Water use can be reduced with agricultural irrigation and water harvesting techniques on a wider scale.

In particular, the use of potable drinking water for irrigation water needs to reach significant quantities today is a significant environmental and economic loss. For this reason, some public housing areas are trying to reuse wastewater, but these are still inadequate. However, along with other water-efficient practices, it is clear that the use of rainwater harvesting systems in areas suitable for precipitation will provide multi-dimensional benefits. (Karakaya & Gönenç, 2005). The strengths and weaknesses of the rainwater harvest are summarized Table 1(Karakaya & Gönenç, 2005).

Table 1. Advantages and Weaknesses of the Rainwater

Advantages of the Rainwater	**Weaknesses of Rainwater**
• Investment and operating costs are generally low.	•Uncertainties in the rain reduce the reliability of the system.
• Construction and operating is easy.	• A selfish solution, kills feelings of sympathy and sharing.
• Responsibility belongs to the property owner in individual/individual systems.	• Responsibility belongs to the owner of the system in individual systems; this may not be attractive.
• Integrate with existing water supply system.	• The widespread use of individual collection systems can lead to a drop in the income of municipal or private companies that supply water to settlements.
• Adaptation to the system is easy.	• Governments do not develop policy on the assessment of rainwater as an alternative water source. People generally do not have to ask for it.
• Compared to other water supply schemes, the adverse environmental impacts are less.	• Tanks may create danger for children.
• The water obtained is free of charge.	• Tanks can take up a lot of space.
• The water obtained is close to the point of use.	
• The water obtained is much more qualified than other water supplies and can be reused without purification.	
• Helps to protect existing water resources.	
• Can be used in emergency situations (earthquake, sudden thirst, etc.).	
• Reduces the risk of fouling and reduces the pollution load carried to the receiving environment.	

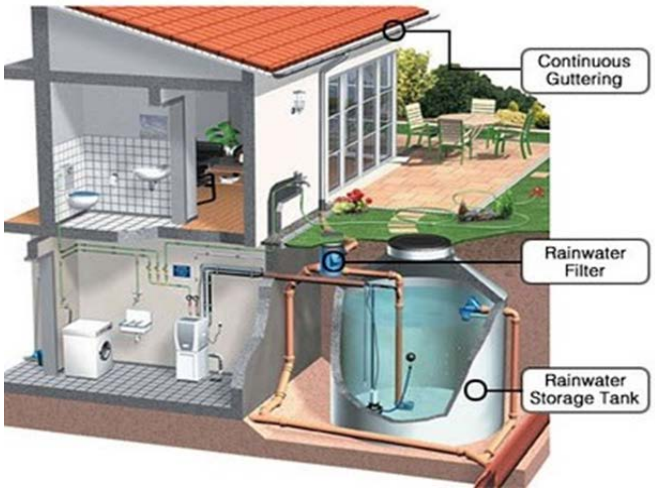

Figure 3: Roof rainwater collection systems

Rain water areas of environmental use

Especially in airports, military areas, stadiums, touristic facilities, and in buildings where the roof area is big enough, gathering rain water, passing through simple treatment processes and using it is an important measure that can be taken for water conservation in the buildings. In general, half of the rainwater is evaporated while the other half is either confused with groundwater or mixed with rivers. These waters can be used for many purposes such as watering green areas, toilets, car washing. Şahin (2011) the collection of rainwater in 2011, cistern system and advanced rainwater collection systems are mentioned. The regulation of rainwater system which is rainwater harvesting different systems have been legally regulated in Turkey, Germany, England, Japan, India, Australia, U.S. Dündar *et al.* (2015) demonstrates that rainwater can be used economically in the health campus of Bülent Ecevit University in meeting the irrigation water demand in their study.

Bayrakçı *at al*. (2016) were collected from the city centre of Eskişehir city and its surroundings and characterization of the rainwater was included in the sewage system. Measuring high levels of heavy metals, especially zinc and lead, in roof flows has been determined to pose a major threat to natural waters according to the water quality standard. It has become clear how important it is to detect a significant pollution in the city centre when the rain water is being worked on and also to see that the roofs, which are not considered pollution, are actually important.

Results and Discussion

It is important to promote the use of rainwater in the premises in terms of sustainable use of water resources and water conservation. The development and support of technologies for collection and use of rainwater in buildings may enable an important step to be taken to protect ecological balance, to ensure the sustainable development of human communities and to use water resources more efficiently.

Rather than trying to adapt the evaluation systems of other countries to ourselves while creating green building evaluation systems, which are becoming increasingly widespread throughout the world, a local certificate system is required. (Şahin & Manioğlu 2011).

Rainwater harvesting is important tool sustainable city. The many benefits of on-site maintenance, infiltration and the use of rainwater have been demonstrated by a series of successful pilot projects in industrialized cities around the world. Little attention has been paid, however, to the urban dimensions of rainwater harvesting. In literature has many case studies about rainwater harvesting in cities, there are a few knowledge about how the 'urban' shapes, and is shaped by, rainwater management policies and practices. Soler et al. (2018) draws on recent contributions to transitions research from human geography and urban studies in order to explicate the dynamic interactions between rainwater harvesting and the city (Soler et al., 2018).

Water is scarce in the Middle East and population growth is causing urban centres to rise rapidly. The use of rainwater harvesting as an alternative to traditional water sources has garnered growing interest among water resource planners as many towns of the Palestinian Authority suffer from water

stress. Lang et all (2012) investigated the expected real volumes of urban RWH from highly variable Mediterranean precipitation A one-parameter model uses potential evaporation and high-resolution rainfall data to calculate the RWH volumes from rooftops in Ramallah, a traditional Arab city. (Lange et al, 2012).

There are Water Sensitive Urban Design approach getting the rainwater harvesting in the literature. The urban drainage infrastructure is generally designed to expedite the rainwater from the urban environment in order to reduce the most torrential rain generated by the dense waterproof surface covering. The combination of urban development, low water availability and the effects of future climate change overheating can put human health and comfort at risk for urban dwellers. Coutts et al. (2013) draws on existing literature to demonstrate the potential of Water Sensitive Urban Design to help improve outdoor human thermal comfort in urban areas and support Climate Sensitive Urban Design objectives within the Australian context. Water-Sensitive Urban Design provides protection of water in the urban landscape by collecting and reusing storm water, while at the same time reducing urban temperatures through improved evapotranspiration and surface cooling. Coutts et. al. (2013) recommend that Water-Sensitive Urban Design can provide a water source in Australian urban environments for landscaping irrigation and soil supply to maximize the urban climatic benefits of existing vegetation and green spaces.

Water resources must be conserved, water pollution must be reduced, and wastewater reuse should be maximized to release adequate and healthy water resources for future generations. It is aimed to use the rain water in the water consumption without mixing with the sewage water by the technology developed in the waste water treatment. For this reason, it is important that rainwater is recycled due to decreased water resources in our country.

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