Quality Improvement of collected rain water by elimination of micropollutants to sea site settlements with the use of new technologies

Kollias P.S.[1], Kollias V.P.[2,*], Kollias S.[3]

[1]Dr. Civil-Sanitary Engineer, 21 Naxou st., 11256 Athens
[2]Dr. Physics, Argonauton & Filellinon, 38221 Volos
[3]Dipl. Mathematics, 77 Lambraki str. Glifada, 16675
[4]Affiliation and address

*corresponding author: e-mail: vkollias@uth.gr

Abstract

The continuous increase of water needs in sea site settlements, created the need to collect rain waters in order to use them, after their treatment to achieve the necessary quality improvement. To realize that we need at first to mark the water sources in the neighboring area of the serviced district, in order to collect the necessary water quantities, for the covering of the existing necessities. One part of the sustained pollution is removed from the water treatment installations but the rest remains in the natural medium. Further treatment includes the abstraction of pollutants by natural mechanisms, like biodegradation, photolyse, votalisation, adsorption, degradation, fixation from vegetables. Further water treatment will include addition of rain water coming from roofs and other waters from country side areas, when enough water quantities are available. The water will be treated with conventional methods, in order to succeed the foreseen quality and finally get transferred to ZONES of REGECTION WITH SUITABLE VEFETATION (ZRV) for the elimination of micropollutants, as well as other pollutant traces.

Keywords: sea site settlements, rain water, ZRV

1. Introduction

The continuous increase of water demand near sea site settlements leads to rain water collection. A certain procedure has to be followed however in order to achieve the needed quality.

First we mark the water sources in the neighboring area (water coming from roofs and other water from country side areas). An initial water treatment installation reduces pollution. Further treatment includes the removal of pollutants by natural mechanisms such as biodegradation, phtolyse, votalisation, adsorption, degradation, fixation from vegetables, installed downstream from water treatment installations called ZONES OF REJECTION WITH SUITABLE VEGETATION (ZRV).

The purpose is the elimination of micropollutants in order to achieve the best water quality for human consumption.

2. Water sources in the neighboring area of the serviced district. The face of pollution.

Various water sources have to be used in order to cover the needs of sea site settlements:

- The water sources in the neighboring area

- The water coming from neighboring districts through ravine, that can be collected to storage basins and then treated to achieve the intended levels of quality.

- The collection, after treatment, of waste water, produced from the population and other water use sources, with the appropriate cleaning methodology

- The collected water from roofs through the application of the necessary design and the anticipation of measures to avoid pollution.

A water treatment installation can lead to sharp decrease in the amount of pollutants.

3. Reduction of pollutants by natural mechanisms

Various natural mechanisms can lead to further waste water treatment: biodegradation, photolysis, votalisation, adsorption, degradation, fixation from vegetables that are grown downstream from water treatment installations.

High water quality can be achieved through the use of a bioreactor with membranes. This technology could be considered as quartiary treatment.

Other water treatment can focus on the rain water coming from roofs.

According to recent references the aim is to remove micropollutants such as heavy metals and detergents. Good efficiency for disinfection and less space than the one for conventional units can be achieved.

4. Further water treatment

The improvement of water quality of treated waters can be done by the use of biostations. Bioindicator plants allow the continual following of the water quality. The water that arrives to the biostation, is renewed for a pre determined time interval. The kind of vegetables that can

be used are, Bryophyte aqutiques and others, that facilitate the improvement of water quality to the level of being suitable for water supply.

5. The creation of vegetable ecosystems

Natural ecosystems can help achieve a better ecological protection. The covering of dwellings with plants has started in France from 2011. It depends on the construction characteristics and the intended uses. The plants need to be specified in reference to the type of roof. The plumpness of the soil layer for the planting, the kind of plants, their structure and the acceptability of roofs of green areas are factors that need to be considered.

6. The use of Zones of Rejection with suitable vegetation

The improvement of water quality of treated waters can be done by the use of biostations. Natural mechanisms can abstract certain pollutants (biodegradation, volitalisation, adsorption) after fixation from plants, that are placed downstream of the treatment installation. These are named ZONES OF REJECTION WITH SUITABLE VEGETATION (ZRV) and can be placed between the treatment installation and the medium of reception.

The object of ZRVs is the wiping out of water pollutants through natural, chemical and biological mechanisms. The following need to be examined:

- The size of Treatment Installation.

- The existing natural mechanisms in the humid zones that permit the elimination of some pollutants.

- The kind of ZRV

- The time of stay

- The local climate.

There are also examined the suitable locations aiming towards a theoretical time of one day staying. After the initial investigation a protocol of sampling analysis is followed, for the quantities of contaminants, water, sediments and plants.

The evaluation of removal of micropollutants is done through the calculation of the rendering of water. The samples are usually 100 g and they are transferred in special containers maintained at a temperature of 4o C as fast as possible.

The goal is water quality similar to that of a mountain source.

7. Conclusions

ZRVs are a hopeful direction towards the suitable treatment of used rain waters from micropollutants.

References

Cupta, S.R. (2001), *Environmental engineering and science*. Ed. Governmental Institutes.

Kollias, P.S. (2008), *Sewerage and sewage disposal*, Fifth Edition, p.608.

Penru, Y. et al. (2017), L' ingénierie écologique appliquée aux zones de rejet végétalisées: élimination de micropolluants, biodiversité et intégration socio-territoriale, *TSM*, 12, 157-183.

.