

TERTIARY WASTEWATER TREATMENT IN EUROPE

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1. Introduction

The global population growth and overconsumption have led to an increase in the production of domestic wastewater. Domestic wastewater refers to wastewater from residential settlements and services that originate mainly from human metabolism and domestic activities. Wastewater originating from domestic activities is divided into: blackwater wastewater, greywater and yellow water. Blackwater wastewater corresponds to wastewater contaminated with human waste. Greywater corresponds to wastewater originating from units other than toilets (e.g. showers), without being contaminated with human feces or urine, and the latter being contaminated by urine collected from sewers [1,2]. There are various methods of treating domestic wastewater, while the countries of the Europe apply different degrees of treatment to domestic wastewater. In this paper, the extent to which the countries of the Europe apply domestic wastewater treatment is presented.

2. Domestic Wastewater Treatment

The most common wastewater treatment method is the activated sludge process. It usually starts with pretreatment. This is followed by a primary settling tank, an aerobic degradation process, and finally a secondary settling tank. Secondary wastewater is usually chlorinated and discharged into a water body. Tertiary treatment aims to improve the characteristics of secondary wastewater to facilitate its reuse [1]. Tertiary treatment is sometimes called final or advanced treatment and is applied to remove the organic load remaining after secondary treatment, and in particular to kill pathogenic bacteria. Wastewater from secondary wastewater treatment plants contains nitrogen (N) and phosphorus (P), which when discharged in excessive amounts, lead to plant growth in the receiving waters, resulting in eutrophication. This step also removes different types of pollutants, such as organic matter, suspended particles, nutrients, pathogens and heavy metals, which secondary treatment is unable to remove [3].

3. Importance of Tertiary Treatment

The purpose of tertiary treatment is to provide a final treatment stage to increase the quality of wastewater before discharge into the receiving environment, such as sea, river, lake, soil, etc., or to increase the quality of the treated water to such a level that it is suitable for its intended reuse. The wastewater is made even cleaner in this treatment process through the use of more powerful and advanced treatment systems [3].

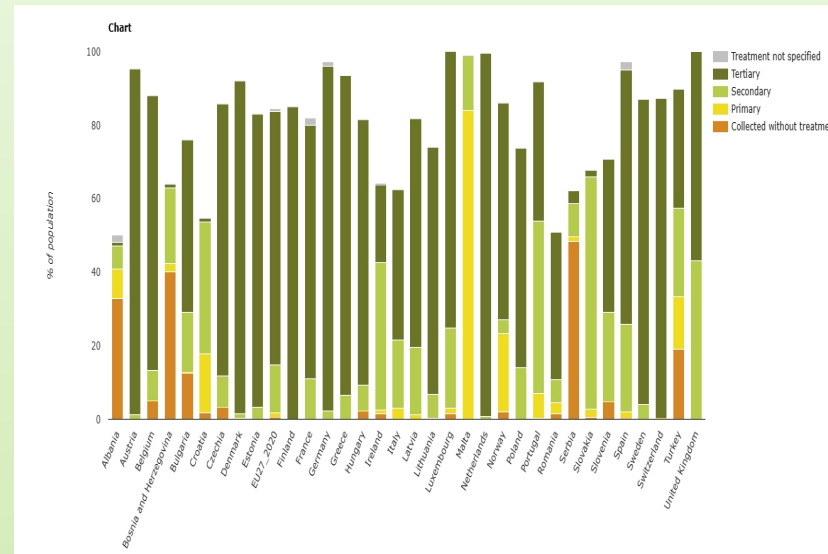


Figure 1 shows the percentage of urban wastewater collected and the level of treatment applied as a percentage of the population. The orange lines represent wastewater collected but not treated before discharge. The yellow lines represent primary treatment, such as sedimentation. The light green lines represent secondary treatment to reduce dissolved and suspended organic compounds, such as those using biological methods. The dark green lines represent more stringent "tertiary" treatment, mainly to reduce nutrients [4].

4. Tertiary wastewater treatment in Europe

The results show that several European countries apply tertiary treatment of urban wastewater, while a few countries have lagged behind in this application. Figure 1 shows that countries such as Finland, Netherlands and Switzerland apply tertiary treatment to a universal extent, while countries such as Austria, Denmark, Estonia, Germany, Greece, France, Lithuania, Poland and Sweden apply tertiary treatment to a large extent, with only a small percentage of wastewater remaining in secondary treatment. On the contrary, there are countries such as Bulgaria and Turkey that apply tertiary treatment, however a significant percentage of wastewater is collected without treatment. Of the remaining European countries, Malta is the only country that applies primarily primary treatment, with no tertiary treatment at all, while a smaller percentage of wastewater receives secondary treatment. Croatia, on the other hand, applies mainly secondary treatment, while Albania, Bosnia and Herzegovina and Serbia collect the largest percentage of their wastewater without treatment, with the characteristic fact that in Albania and Bosnia and Herzegovina, no tertiary treatment is applied at all. Finally, countries such as Spain, United Kingdom and Ireland apply tertiary treatment, with a significant percentage of wastewater, however, receiving secondary treatment, while Slovakia applies mainly secondary treatment, with a minimal percentage receiving tertiary treatment.

5. Conclusions

Overall, the majority of European countries implement tertiary treatment to a significant extent, with secondary treatment following. Only Malta and Albania have lagged behind in the implementation of tertiary treatment, while it is important to note that wastewater collected without treatment is at low levels, especially in the Balkan countries.

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