Chapter N 007

**Closing the cycle by reusing treated wastewater: the role of Prato in the European debate on Circular Economy**

**Abstract.** Circular economy policies in the management of water, especially at urban level is relevant in order to overcome water scarcity issues and to faster the transition to more sustainable practices. In order to stimulate the transition to circular economy, in 2015, the European Commission has adopted a “Circular Economy Package”, which includes priorities for legislative revision. More recently, by launching the European Green Deal, European Commission aimed to boost the efficient use of resources by moving to a circular economy and stop climate change. Water issues were included in the European debate, involving cities in processes of legislative revision. At European level, the Urban Agenda for the EU was established with the aim to favour the discussion on circular economy at the city level. The Municipality of Prato represented Italy in the EU partnership on circular economy. Prato is one of the largest Italian industrial districts and one of the most important textile production centers in the world. The local centralized water treatment plant also plays one role as best circular practice within the textile district. This paper describe the role of the Municipality of Prato at European level in the process of legislative revision in terms of wastewater reuse.

**Keywords.** circular economy, cities, water, wastewater, urban agriculture

**1. Introduction**

Circular economy enables the development of a brand new paradigm, where the model overcomes the concept of an economy that close the loop with waste (Ellen Macartur Foundation, 2015). Today, both the reasons for the sustainability and the environmental impact suggest a radical switch to the circular paradigm, with positive conditions leading to a full exploitation of the big potential of this new approach (Ghisellini et al., 2016). In order to stimulate the transition to circular economy, in 2015, the European Commission has adopted a “Circular Economy Package” (CEP), which includes revised legislative proposals. CEP consists of an action plan with concrete actions and measures covering from production and consumption to waste management and the potential market and reuse of secondary raw materials (European Commission, 2015). These actions aimed at both promoting to close the loop in products’ life cycle and bringing benefits for both the environment and the economy. During the Dutch presidency of the European Union in 2016, EU Ministers responsible for Territorial Cohesion and/or Urban Matters adopted the so-called Pact of Amsterdam (PA). PA strived to involve urban authorities in achieving better regulation, better funding and better knowledge, considering the cities as drivers of innovation. In order to ensure that these facts are acknowledged and reflected by EU legislation, funding and knowledge sharing, it was established the so-called Urban Agenda for the EU (UAEU). Among the UAEU, the EU Partnership on Circular Economy (UEPCE) operated from 2016 and 2020. In facts, cities play an essential role in the development of a circular economy; acting as enablers of potential measures by which they can influence both the consumers and the businesses (Kirchherr et al., 2017). Moreover, overall governance, enabling businesses, public procurement, consumption and resource management are the themes that would all have a bearing upon the development of circular economy concepts within cities. UEPCE consisted of six urban authorities, namely the City of Oslo, The Hague, Prato (as Italian representative), Porto, Kaunas and Flanders region. Also members states (i.e. Finland, Poland, Slovenia and Greece.) and the European Commission (in particular DG Regio, DG ENV, DG Clima, DG RTD, DG Grow), was involved. Within the partnership, the Municipality of Prato (MoP) led the debates regarding wastewater reuse.

Prato is one of the largest Italian industrial districts and one of the most important textile and clothing production centers in the world. Since the post-war period, textile waste management has represented one among the main drivers for textile district development: recovery and recycling of natural fibers from rags and used clothes were the basis for the Prato’s yarn and textile industry. Prato has been always a model of innovation in this sector having historically based its industrial fortune on the reuse of waste from the textile process and on the reuse of second-hand clothing from all over the world. The local centralized water treatment plant also plays one role within the textile district. Created in 1981, GIDA was founded in order to manage wastewater and sewage treatment plants, as well as the industrial aqueduct network. The core of the centralised treatment system is the Baciacavallo treatment plant. Weekdays the plant can treat up to 130,000 m³/d, breaking down up to 100,000 kg of COD per day and 4,500 kg of surfactants per day. It consists of stages for equalization, primary sedimentation, biological oxidation, sedimentation, flocculation and a final refinement with ozone to remove colour and surface residues. The sludge line consists of gravity thickening, mechanical dewatering by centrifugation and sludge incineration. The MoP, together with GIDA, and the scientific partner ARCO took a step forward in order to outline a future vision of sustainable city where water management is circular.

This study aims to describe the role of Prato (as member of the Urban Agenda partnership on Circular Economy) in addressing the recent EU legislation revision process on reuse of treated wastewater. In particular, regarding the proposal for Regulation of the European Parliament and of the Council on minimum requirements for water reuse, discussed in 2018 and approved in 2019.

**2. Materials and methods**

The paper is the result of the involvement of the authors within the EUPCE. Among the methods used for the results achieved: a) Desk-based analysis of reports and publications on CE and about main European legislation on water; b) Conduction of semi-structured interviews with local representative stakeholders; c) Participation at all debates and meeting within the EUPCE. These methods has allowed diversifying the sources of information, in order to obtain a comprehensive and consistent picture of existent and potential water reuse issues. Furthermore, this paper focuses on the legislative revision called “Regulation of the European Parliament and of the Council on minimum requirements for water reuse”, finally the minimum requirements proposed have been compared with the current results of the analysis on the treated water exiting the GIDA treatment plant.

**3. Results and Discussion**

Despite legislative restrictions, reclaimed water could be potentially used, under specific safety procedures, for several purposes (i.e. street cleaning, irrigation of parks and gardens, etc.). It should be noted that with term ‘urban wastewater’ European legislation defined domestic wastewater or the mixture of domestic wastewater with industrial wastewater and/or run-off rain water. Although, water reuse encounters numerous barriers in the EU, this practice is commonly used in extra European countries (i.e. Israel, Australia, and Singapore). In Europe, wastewater from industrial production activities has more regulatory limitations than urban wastewater. More, as awareness constraint, reused water is considered less attractive than freshwater (EU Commission, 2018). Both southern member states such as Spain, Italy, Greece, Malta and Cyprus and northern member states like Belgium, Germany and the UK already have in place initiatives regarding water reuse for irrigation, industrial uses and aquifer recharge (Alcalde-Sanz et al., 2017). Cyprus and Malta already reuse more than 90% and 60% of their wastewater respectively, while Greece, Italy and Spain reuse between 5 and 12% of their effluents, clearly indicating a huge potential for further uptake (EU Commission, 2018). In Italy, the level of stringency of the existing water reuse standards has been reported to be an obstacle to the further uptake solutions, due to administrative burden and associated costs for local authorities.

The need to address the problem at EU level (also to overcome differences at member states level) has been acknowledged in the 2012, in the Commission Communication named "A Blueprint to Safeguard Europe's Water Resources". The European Parliament, in 2016, encouraged the Commission to draw up a legislative framework on water reuse (EU Commission, 2018).

Within the EUPCE, MoP (leading the action on water reuse) proposed the use of treated industrial and civil waters (e.g. urban wastewater) at urban level for irrigation purposes (e.g. urban green-gardens, green areas, peri urban-agriculture). That action idea has come along the announcement of EU Commission about the issue of a proposal for “Regulation of the European Parliament and of the Council on minimum requirements for water reuse”. For this reason, together of other municipalities involved in the EUPCE, MoP decided to start a debate over the new proposal, contributing at the general discussion about requirements and future applications.

According the Commission’s proposal, reclamation plant operators should ensure that reclaimed water destined to a specific use (e.g. crops irrigation) comply with specific quality requirement. The proposed limits distinguished among i) food crops consumed raw (so-called Class A); ii) food crops where the edible part is not in direct contact with water or processed food (Class B); iii) food crops where the edible part is not in direct contact with water or processed food and drip irrigation only (Class C); iv) use of reclaimed water in crops for industrial or energy purposes.(Class D). To avoid unequal barriers, the proposal went in the direction that no member state could ban imports of food products irrigated with reclaimed water in another member state. Member states competent authorities was set to be responsible for enforcing the permit and carrying out inspections as necessary.

In order to evaluate if the minimum requirement expressed in the EU proposal were realistic, within the EUPCE, MoP, GIDA and ARCO compared the requirements with the results of treated wastewater exiting from GIDA plant. It should be noted that GIDA treats urban wastewater as a mix of domestic wastewater with industrial wastewater (coming from textile industries of Prato district), meeting the requirements of Italian legislation. The considered analyses are the official ones carried out by GIDA (through the internal accredited laboratory as well as by an external accredited laboratory) from 2014 to 2017 considering E.coli, BOD5, Total Suspended Solids (TSS) and Turbidity. Table 1 shows the average of the results of the analyses, in correspondence with the minimum requirements established by the proposal as well the limits required by the Italian DM 185/2003 on “Legislation about use of reclaimed water” .

Table 1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Quality class A(limits) | Quality class B(limits) | Quality class C(limits) | Quality class D(limits) | Italian law DM 185/2003 (limits) | GIDA(average of analyses) |
| E. coli (cfu/100 ml)  | ≤ 10 | ≤ 100 | ≤ 1000 | ≤ 10000 | 100 | 2.48 |
| BOD5 (mg/l) | ≤ 10 | According Council Directive 91/271/EEC | 20 | < 5 |
| TSS (mg/l) | ≤ 10 | According Council Directive 91/271/EEC | 10 | 1.14 |
| Turbidity (NTU) | ≤ 5 | - | - | - | - | 0.8 |

Sources: Authors

According these comparisons, both with the average and with absolute values, water exiting from GIDA meets the limits indicated in the proposal.

More, the proposal, along with laying down minimum requirements for water quality, provided indication about the conduction of a specific risk management tasks for the safe use of reclaimed water. In fact, the reclamation plant operator could set the risk management plan.

UEPEC issued a position paper in order to address about the proposal and its feasibility. After having validated the proposed quality limits, some remarks were issued about the responsibility of food business operator that use reclaimed water within his productions (i.e. crops irrigation or water as food ingredient). Further indications for food operators in fact are considered crucial to push them to take into specific account the hazards linked to the use of reclaimed water (in order to further add eventually control points and analyses in the HACCP plan). It should be noted that, if the reclamation plant operator knows the destination of treated water could be easier for him to set the treatments according the requirements. In fact, a collaboration among reclaimed plant operator and food operators could create positive industrial symbiosis. At city level, this kind of collaboration can advance social relationships among the involved local actors, including surrounding neighborhoods.

**4. Conclusions**

This paper aims to outline the role of the MoP within the EUPCE, as well describing the recent evolution on EU legislation about reuse of treated wastewater. The European Parliament voted the new Regulation in 2019 and it is expected to be effective at member states level from June 2023. Along the harmonised minimum water quality requirements for the safe reuse of treated urban wastewaters in agricultural irrigation, the Regulation took into account suggestions came from public consultation and position papers (included the one proposed by EUPEC). In the Regulation, risk management is considered relevant to assess and address potential additional health risks and possible environmental risks. The new rules are to be situated in the context of the new Circular Economy Action Plan adopted in 2020, which includes the implementation of the new Regulation amongst Europe’s priorities for the circular economy.

Further development of this work will be to understand, at the city level and among agricultural operators, the degree of acceptance of this regulation, together with the perception of citizens and consumers. Indeed, at the light of the recent critical water scarcity in Italy, due to the unusual high temperatures, the application of this regulation could represent a valid solution.

**References**

Chertow M. R., 2000. Industrial symbiosis: literature and taxonomy. Annual review of energy and the environment, 25(1), pp. 313-337.

Directive 2000/60/EC. Water Framework Directive.

Directive 1998/83/EC. Drinking Water Directive.

Directive 2006/7/EC. Bathing water quality.

Directive 2006/118/EC. Groundwater.

Directive 91/271/EC. Urban Waste Water Treatment.

Ellen MacArthur Foundation, 2015. Growth within: a circular economy vision for a competitive Europe.

European Commission, 2018. Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse.

European Commission, 2018. Working document Impact Assessment accompanying the document Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse.

European Commission, 2015.

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop - An EU action plan for the Circular Economy.

European Commission, 2012. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Blueprint to Safeguard Europe's Water Resources.

European Commission – DG ENV, 2015. Optimising water reuse in the EU.

European Commission - DG Internal Policies of the Union, 2006. Economic and Scientific Policy Status of Implementation of EU Environmental Laws in Italy.

Ghisellini P., Cialani C., Ulgiati S., 2016. A Review on Circular Economy: the Expected Transition to a Balanced Interplay of Environmental and Economic Systems, Journal of Cleaner Production, 114, 11-32.

<https://ec.europa.eu/environment/water/reuse.htm> (last visited 14.06.2022)

Kirchherr J., Reike D., Hekkert M., 2017. Conceptualizing the circular economy: An analysis of 114 definitions Resources, Conservation & Recycling 127, 221–232.

Italian Legislative Decree 152/2006 “Norms Concerning the Environment”.

Italian Ministerial Decree n. 185/2003. Regolamento recante norme tecniche per il riutilizzo delle acque reflue.

**Disclaimer**

The views expressed herein are those of the authors and therefore not necessarily reflect the official opinion of the European Commission.