



Circular Economy Lab & Observatory

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WATER STATUS

Wastewater purification
Italy-2.2



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INTRODUCTION

Lately there is a lot of talk about wastewater but in practice what are they? Why do we care so closely? . Wastewater ¹ from a chemical and environmental engineering point of view is normal water that has been altered by domestic, industrial and agricultural use (pesticides). In European Union according to the EEA (European Environmental Agency) which have published data of 27 members of UE ²: about “90% of urban wastewater is collected and treated in accordance with the standards of directive 91/271 / CEE (UWWTD) and which is continuously improving” ².



The wastewater is divided into:

Domestic wastewater

Waste water from homes and services and deriving mainly from human metabolism and domestic activities (such as hotels, schools, barracks, public and private offices, sports and recreational facilities, retail and wholesale shops and bars); substances from human manure essentially contain cellulose, lipids, protein substances, urea, uric acid and carbohydrates.³

Industrial wastewater

Any type of waste water from buildings or installations in which commercial activities or production of goods are carried out (also subjected to preventive purification treatment), qualitatively different from domestic waste water and from leaching rainwater, meaning for such also those that have come into contact with substances or materials, including pollutants, not connected with the activities carried out in the plant; the waters of the streams contain various micro polluting substances, such as hydrocarbons, pesticides, detergents, rubber debris.

Urban wastewater

The mixture of domestic wastewater, industrial wastewater, and/or so-called runoff waste water (rainwater accumulated, road washing water, etc.) conveyed into sewerage systems, whether or not separate, and coming from agglomerations. Industrial wastewater similar to domestic wastewater Waste water from commercial or production installations that by law or for particular qualitative and quantitative requirements, can be considered as domestic waste water.

The Italian government uses only 16 € per year per citizen to create new infrastructures for the treatment of wastewater, unlike of the annual expenditure per citizen in the rest of the EU is 41 €. In Italy there are areas very sensitive to wastewater for this they need a more “complete” treatment than the secondary treatment (activated sludge plants) for the removal of nitrogen and or phosphorus.

There are 90 areas that need such treatment in Italy, where at least 75% of nitrogen and phosphorus should be eliminated, but in the Po Valley the maximum value of removal has been only 68%. ²



Wastewater treatment plant, Photo by Martine Nolte, license CC-BY 3.0



PROBLEM DESCRIPTION

Continued population growth, accelerated urbanization and economic development have meant that the amount of wastewater generated and its overall pollutant load increase worldwide.



Schematic diagram illustrating routes of pesticides into streams and groundwater By Carl E. Thodal, U.S. Geological Survey, and Jon Carpenter and Charles W. Moses, Nevada Department of Agriculture (Modified from Gilliom and others, 2006.), Public domain, via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Schematic_diagram_illustrating_routes_of_pesticides_into_streams_and_groundwater.svg

Man is making water unusable by draining and contaminating its reserves.

But this is not the only problem, there are other aspect we need to think of: ⁴

HABITAT CONTAMINATION

the main effect of wastewater on the environment is that it contributes to the contamination and destruction of natural habitats and wildlife that are exposed to harmful chemicals that should not be present naturally;

DISEASE TRANSMISSION

wastewater is the first source and carrier of diseases. More than 3 million people die each year from a waterborne disease. Leaving aside diseases, the mix of waste, solvents and paints creates fumes that are harmful to humans;



SOIL DETERIORATION

wastewater is often reused for irrigation, but water treatment processes are not completely effective. Harmful chemicals can get to the ground when wastewater is not treated properly. These substances lead the soil to produce fewer crops and at a slower pace. Considering also the fact that these crops will be eaten, the product will harm humans (i.e.: microplastics);

PRESENCE OF HARMFUL SUBSTANCES

the composition of wastewater may include heavy metals, pathogens, salts, toxic chemicals, oil and grease, acids and bases, and toxic organic compounds. This presents numerous risks to humans, animals and the environment as a whole, because it can be toxic, corrosive, reactive, acidic and flammable.

The result of these problems are the harmful effects they have more than anything else on the marine life within these waters. To dispose of the biodegradable substances that end up in water, a lot of dissolved oxygen is used, oxygen that is fundamental for marine life, and whose absence could make life underwater dangerous. As mentioned before, wastewater also contains oils and fats that settle on the surface and get entangled in the feathers of birds and suffocate fish.

Same thing for heavy metals, which are harmful to both animals and humans, which feeds on animals that have been in contact with these dirty waters full of harmful substances, and this could lead to serious health problems.



Disposal Oxygen cylinders
Photo by Tom Fisk,
<https://www.pexels.com/it-it/foto/acqua-sporco-costruzione-settore-4741971/>



What could be effective solutions that can help improve the situation?

Pollution from agriculture

Even if we might think that agriculture does not contribute to water pollution, because after all it water is not an output of the process of irrigation, it is the input, and we do not see sewage system in the fields (except from the farms where livestock are grown), it is quite the opposite:

for some type of contamination, agriculture is the main source of pollution, for instance when we think about nitrate and the problem of eutrophication. Another issue that puts the responsibility mainly on agriculture is the pollution from pesticides. There very harmful substances can reach the surface water and the groundwater as well. Their removal is quite difficult, if not impossible.

POSSIBLE SOLUTION

This problem has also moved very large cities, such as Los Angeles, to seek a solution.

Precisely with regard to the latter, a mega investment of 3.4 billion dollars was made at a plant in Carson, and a further 16 billion will be made, for the realization of the Next plan, a plan carried out by the specific Department of Los Angeles. ⁵



CONSTRUCTED WETLANDS

To solve these problems there are various possible solutions, one of these is the constructed wetland system. But what does it consist of?

The phytodepuration plant is a natural-based method, formed by an impervious basin filled with gravelly material, useful as a filter, with aquatic plants located above.



Waste Water treatment plant- Photo by Marcin Jozwiak, <https://www.pexels.com/it-it/cerca/acque%20reflue/>

The process is very simple, through chemical actions that take place between gravel, plants and microorganisms (the main work, however, is done by the plants), the water is subtracted from the nutrients and then purified.

PURIFICATION PLANTS

In purification plants, on the other hand, the process is different. Scheme of a purification plant

1. The waste water is transported to the purification plants through the various collectors;

2. Screening takes place, used to remove coarse materials (for example pieces of paper, wood, stones, paper, etc.), which are then washed, pressed and sent to landfill;

3. In de-oiling sandblasting takes place the separation of the sands by natural sedimentation, while the separation and the rising of the oils and fats on the surface is favored by the insufflation of air which, by ensuring a limited turbulence, also prevents the sedimentation of organic substances;

4. In the primary sedimentation tank, the sedimentable solids are separated by gravity. The sludge that accumulates on the bottom of the tank is transported to collection hoppers and from these it is then collected to be sent for subsequent treatment;

5. In activated sludge tanks, the elimination of suspended solids and dissolved substances takes place through a process based on the metabolic action of microorganisms and bacteria;

6. In the final sedimentation tank, the separation of the sludge flakes from the aerated mixture takes place;

7. A part of the activated sludge is recirculated in the aeration tank and the excess part is sent to the next treatment. The water leaving the final sedimentation can be defined as clean at this point and can therefore be returned to the surface water course;



<https://www.pexels.com/it-it/foto/edificio-costruzione-settore-campagna-6060196/>
photo by- tom Fisk

There are also treatments that aim to limit nutrients such as nitrogen and phosphorus in the final discharge, substances that can lead to problems of hypertrophy in rivers and lakes. From here on, the sludge treatment also takes place.

Conclusions

Finally we have ascertained what are the main problems of wastewater, their origin and the possible processes to be used for the purification of these waters in such a way as to make them reusable for both domestic, agricultural and industrial use.



Petri dish with bacterial culture - Photo by Anna Shvets <https://www.pexels.com/it-it/foto/scienziato-che-tiene-la-capsula-di-petri-3786247/>

The purpose of these processes is to give a “second life” to this water and provide it with a new life cycle using materials that are also easily available.

We hope that this article will help you for an in-depth reflection on this problem very close to us all, especially us guys who have to commit ourselves and give our best so that these problems are at the center of youth discussions to raise public awareness of these issues that can be fundamental for the future of the earth.

Also it is important to eliminate waste water to significantly reduce the probability of contracting dangerous diseases such as cancer, chronic-degenerative diseases, or infectious diseases such as hepatitis of various types (A-B-C-D).

So all this is aimed at improving the lifestyle of the population, its well-being, and In particular, to preserve the environment around man, to allow other microscopic or macroscopic life forms to take advantage of it, to make human life on planet Earth sustainable, trying to affect as little as possible that of animals today put to the test by the various consequences due to anthropological phenomena such as the now well-known global climate change, or the excess of chemicals in the waters of the seas, rivers, oceans, the excess of non-biodegradable plastics that need thousands of years to be eliminated, which have now become part of the diet of any living being from the smallest to the largest.



Our little effort now could be a good contribution for the future.

We need to be able to leave the earth in a better state than we found it.

This article must be a stimulus for the reader, we must learn to be aware of what will be tomorrow.

We are just students but who one day will grow up and become adult men or women capable of understanding the sustainability that can be achieved even with just a small gesture, the only thing we ask for is that institutions will be capable of doing something, but not in the future, right now.

We must act as soon as possible because the health of the earth and of mankind is priceless and it is now compromised.



The earth seen from space - Photo by Pixabay, <https://www.pexels.com/it-it/cerca/pianeta%20terra%20esploso/>

REFERENCES

ergowastewater, wikipedia, available at: Acque reflue – Wikipedia

`<blockquote class="wp-embedded-content" data-secret="4Z5we85ixF">Acque reflue in UE: migliora il trattamento ma persistono disomogeneità </blockquote><iframe class="wp-embedded-content" sandbox="allow-scripts" security="restricted" style="position: absolute; clip: rect(1px, 1px, 1px, 1px);" title="“Acque reflue in UE: migliora il trattamento ma persistono disomogeneità” — Regionieambiente.it" src="https://www.regionieambiente.it/acque-reflue-aea/embed/#?secret=cTYpHezfRT#?secret=4Z5we85ixF" data-secret="4Z5we85ixF" width="600" height="338" frameborder="0" marginwidth="0" marginheight="0" scrolling="no"></iframe>`

Acque Reflue: significato, strumenti per l'analisi (hanna.it)

`<blockquote class="wp-embedded-content" data-secret="nfsta3IEeB">The Effects of Wastewater and How Bad It Is For the Environment</blockquote><iframe class="wp-embedded-content" sandbox="allowscripts" security="restricted" style="position: absolute; clip: rect(1px, 1px, 1px, 1px);" title="“The Effects of Wastewater and How Bad It Is For the Environment” — Conserve Energy Future" src="https://www.conserve-energy-future.com/effects-wastewater-environment.php/embed#?secret=IDDkv2DV4z#?secret=nfsta3IEeB" data-secret="nfsta3IEeB" width="600" height="338" frameborder="0" marginwidth="0" marginheight="0" scrolling="no"></iframe>`

<https://www.unwater.org/water-facts/water-quality-and-wastewater>

GROUP

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