Abdelhafid Bousouf University Center - Mila

2024-2025 Semester 1

Module: Sanitation

– Lesson 1 –

Chapter 01 : General Characteristics of Water

to be evacuated.

teaching staff			
Name	**Institute**	**Grade**	**E-mail address**
Amel Boumessenegh MCB	Science and Technology		a.boumessenegh@centre-univ-mila.dz

Students concerned			
Institute	**Department Year**		**Speciality**
Science and Technology	Civil engineering and hydraulic	Bachelor 3	Hydraulic

A brief history of urban sanitation

Historical

The most advanced civilizations ancient peoples invented a set of techniques, and means which allow the removal of waste from homes and human activities.

Everyone knows that we found some remarkable drainage networks in the remains of Greek buildings and Roman.

In particular; those from the Middle East which contained sanitary facilities with pipes allowing the supply and drainage of water. (Figure 00).

The first sewer systems were built in **antiquity,** such as the famous **Cloaca.**

The Maxima of ancient Rome, 600 BC (is a long canal, the main sewer collector of Rome) antique. It combines three functions: rainwater harvesting, drainage ...) (Figure 1).

After the fall of the Roman Empire, sewer systems were gradually abandoned. Dirty water, fecal matter, and other household waste were then dumped there. directly and caused foul odors, contamination of well water and numerous diseases.

Following the successive cholera epidemics that swept across the world during the 19th century, the The hygiene movement advocated for the construction of sewer systems in the 1850s. buried (Figure 2) to evacuate domestic wastewater, rainwater and wash water streets directly into rivers or the sea. The length of the sewage network of the The city of Paris thus grew from 150 km² in 1853 to nearly 900 km² in 1890 (approximately 2500 km²). Currently).

In 1894, a law required Parisian buildings to discharge their wastewater and rainwater as well as their wastewater into the newly created (so-called combined) sewer system. The concept of **all-in-**

This is how **the sewer** came about.

Figure 2. Cloaca Maxima of ancient Rome 600 BC (1st sanitation network).

It was only from the 1960s onwards that **separate networks** were developed in the new districts in cities and in new towns to collect and treat water separately Domestic wastewater and rainwater. Wastewater produced by **activities industrial** pollutants cannot be discharged directly into the sewage system and must be decontaminated by industry

Wastewater disposal shifted the problem of nuisances out of cities and generated a Increasingly unacceptable pollution of surface waters. The first purification techniques are then appeared in the 1860s with the spreading of raw wastewater on sandy soils in order to to utilize the purifying power of the soil.

Course Objective 1

This course aims to provide a thorough understanding of the fundamental principles of sanitation urban, with an emphasis on wastewater and stormwater management in urban environments.

This course will therefore provide a solid foundation for understanding the challenges and solutions related to sanitation. urban, with a view to more efficient and sustainable water management in urban areas.

1. Introduction

Water is the enemy of the road, as it poses numerous and complex problems. on the roadway, which puts the safety of the user at risk (slipping, flooding, etc.).

So the purpose of the sewage system is to collect runoff water; in order to avoid Infiltration into the layers of the road base can also occur as surface runoff. follows the direction of the transverse and longitudinal slope.

1.1 Definition

Sanitation: The purpose of urban sanitation is to ensure the removal of all rainwater and wastewater, as well as their discharge into natural outlets, in various ways compatible with public health and environmental requirements.

- **collective:** wastewater is discharged into the sewers;
- **non-collective:** wastewater is treated and disposed of autonomously on-site their production (septic tank, all-water tank).

1.2 Objective of sanitation

- Avoid erosion problems.
- Ensure the disposal and treatment of wastewater and rainwater
- Minimizing risks to health and the environment
- To ensure the protection of property and people up to a certain intensity of rain.

1.3 The origin of wastewater

Wastewater can be classified as urban wastewater consisting of water Household wastewater (personal and laundry washing, cleaning of premises, kitchen water) and wastewater loaded; all this mass of effluent is more or less diluted by the street washing water and rainwater.

Depending on the circumstances, industrial and agricultural wastewater may also be included. Water, thus collected in a sewer system, it appears as a cloudy, usually greyish liquid. containing suspended matter of mineral and organic origin at extremely high levels variables.

In addition to rainwater, urban wastewater is primarily of domestic but can contain wastewater of extremely diverse industrial origin. Therefore, urban wastewater (UWW) consists of:

- Wastewater or sewage of domestic, industrial and/or agricultural origin
- Stormwater or urban runoff. (For more details, see paragraph following).

1.4 Nature of the water to be evacuated

Wastewater consists mainly of water from domestic and industrial sources and rainwater. Their composition depends on the organization of the urban fabric. The table I.1 gives the main elements contained in the discharged water.

Table I.1. Elements contained in wastewater and rainwater

Waters worn activity industrial	Waters worn activity housewife	Waters rainwater activity urban
Depends on the type industry	Sands from washing	**Sand and gravel**
	Waste plants (vegetables)	**Dust**
	Waste animals (meats)	**Branches And fallen leaves**
	Fats and oils	**Hydrocarbons**
	Omo (bleach, detergent)	**Used motor oil**
	Paper, plastic, etc.	**Tar**
	Chemicals	**Objects of all natures**
	Subject of all nature	

1.4.1 Rainwater (runoff)

It is the waters resulting from atmospheric precipitation (rain, snow, hail) that run off the roofs, the ground and the facades.

1.4.2 Wastewater

All waters that are likely to contaminate the environment into which they are discharged are considered to be wastewater. distinguished :

1.4.2.1 Domestic Wastewater

These are everyday waters. They include:

- Household wastewater (grey water): it comes from the kitchen, the bathroom.
- Black water (sewage): this comes from toilets

1. Industrial Wastewater

As its name suggests, this water comes from industrial waste; it includes all water likely to be discharged by industries, that is to say, manufacturing wastewater, and cooling water.

They are most often polluted by chemicals. Although a special treatment must be required before any rejection.

1.5 Characteristics of the water to be evacuated

Wastewater includes household wastewater (from the kitchen, toilet, laundry, etc.); these are the only those whose characteristics we will examine below, which are those of a polluted and harmful effluent (the The characteristics of industrial waters actually vary with each type of industry.

1.5.1 Physical Characteristics

a. Suspended matter

For reasons related to wastewater treatment, a distinction is made between settleable materials and 2 hours (approximately 270 mg/l of organic matter and 130 mg/l of mineral matter) and the materials non-decantable (130 mg/l of organic matter and 70 mg/l of mineral matter).

Dissolved materials:

Approximately 330 mg/l of organic matter and 330 mg/l of mineral matter.

These values are summarized in Table 1.1

Table 1-1: Average composition of wastewater

	Materials minerals	Total organic matter	
Materials in suspension	130 mg/l	270 mg/l	400 mg/l
Decantable in 2 hours.	70 mg/l	130 mg/l	200 mg/l
Not decantable in 2 hours	200 mg/l	400 mg/l	600 mg/l
Total			
Dissolved matter	330 mg/l	330 mg/l	660 mg/l
Total	530 mg/l	730 mg/l	1260 mg/l

All these concentrations depend on the quality of water consumed daily by inhabitant.

1.5.2 Chemical Character

a. Mineral materials

This is the dry residue after heating; they are not dangerous.

b. Organic matter

We distinguish between ternary substances, composed of carbon, oxygen, and hydrogen (fats) which are easily oxidizable, and quaternary substances, which also include nitrogen, and possibly iron, sulfur, phosphorus, etc., and are generally more refractory to oxidation.

1.5.3 Bacteriological characteristics

The germs found in wastewater are primarily those that originate from Fecal matter contains pathogenic germs that can partially disappear through competition for survival. are associated with bacteria that play a vital role in purification.

1.6 Conventional treatment methods

The complete wastewater treatment line can be schematically divided into two sectors:

• The water treatment process in which water is purified of all pollutants before being discharged into the natural environment;

• The sludge treatment process, in which the residues generated by the water treatment process are treated and dewatered before their disposal. The water sector generally includes:

• A pretreatment for the removal of objects with a size between 0.1 and 50 mm (screening, sieving), grease and sand,

• A primary treatment for the removal of easily settleable suspended solids,

• A secondary treatment consisting of a biological reactor for the removal of pollution biodegradable organic (BOD5) or mineral (NH3, NO3-, P).

• Some stations are also equipped with tertiary treatment for the removal of microorganisms or residual phosphorus. Sludge from the primary settling tank (sludge primary waste) and biological treatment (biological sludge) will then be processed and conditioned on the sludge sector.

1.7 Wastewater Reuse

Water from industries (effluents) and wastewater treatment plants can be used in a closed loop. Closed, for cleaning, energy production (biomethanization) and heating. One Another **use** is irrigation. In some cases, **the treated water** can even replenish the water table. phreatic.

1.8 Impact of wastewater reuse

Wastewater reuse involves recycling water considered as unusable but which, depending on the area of reuse and following certain treatments, can suitable for the following uses:

1) Agriculture

Despite significant modifications made to wastewater treatment plants to ensure the wastewater quality means that it can be used to meet irrigation needs in agricultural activities.

This has the advantage of allowing crops to benefit from the richness of the wastewater by natural nutrients, to increase soil productivity as well as to enable the practice of certain crops in regions where environmental conditions are not favorable, as in arid regions. Wastewater recycling represents a solution to address this. to the growing demand for water resources for irrigation.

However, the use of treated wastewater in agriculture can pose some problems. problems for public health. Furthermore, an irrigation project using wastewater as a source is not always economically viable.

2) Cleaning

Cleaning public roads and vehicles does not require the use of drinking water.

3) Environment

The discharge of treated wastewater concentrates can have environmental impacts . Excessive concentrations of chloride and sodium ions in the discharged water can make the poisonous plants.

Conclusion

The aim of this chapter was to demonstrate the general characteristics of the waters at discharge into a public sewage system. Wastewater has been defined and classified according to their nature; we then considered industrial and domestic wastewater. The latter have were also classified according to their source, showing their composition.

Subsequently, we demonstrated the physical, chemical, and biological characteristics of wastewater. It was also necessary to address the indicators of wastewater pollution which can be quantified and assessed through a series of physico-chemical and biological analyses (quantification of microorganisms).

Thus, the direct discharge of wastewater into the natural environment causes serious problems on the human health and the environment. For this reason, the Algerian state has set standards for wastewater discharge. wastewater collected in urban networks and wastewater directly emitted by industries.

Conclusion

The wastewater to be evacuated, whether domestic, industrial or rainwater, presents a diversity characteristics that require special attention during their management and processing. Understanding these parameters is essential to minimizing their environmental impact and to ensure effective sanitation.

Useful links

- https://youtu.be/mhGIIRCdrVE
- https://youtu.be/UuH6S0WCi_8
- https://youtu.be/tF9UAwdRPH4
- https://youtu.be/prSAxCJJVg8
- https://youtu.be/CyryS04SIrU
- https://youtu.be/J-40uOzHuew
- https://youtu.be/94C92SmLbRo

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- https://staff.univ-batna2.dz/sites/default/files/nemili_zohra/files/cours_dassainissement.pdf
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- https://elearning.centre-univ-mila.dz/a2025/mod/resource/view.php?id=53296
- https://www.cieau.com/le-metier-de-leau/ressource-en-eau-eau-potable-eaux-usees/quest-ce-wastewater/
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