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Review of the water resources, pollution sources and wastewaters of the Moroccan textile industry

Mohamed Berradi* and Ahmed El Harfi

Team of Organic Chemistry & Polymers (TOCP)/Laboratory of Agro Resources and Process Engineering Polymers (LARPEP), Department of Chemistry, Faculty of Science, University Ibn Tofail, PB 14000 Kenitra, Morocco.

* Corresponding Author: Phone: (+212) 0677030641; e-mail: mberradi24@gmail.com

During the present review, we tried to set out the different types of water resources, including surface water are included water dams, lakes, rivers, wade's, seas and oceans, and groundwater including type of water aquifers, wells and springs. The different sources of groundwater pollution were also mentioned, namely pollution from physical, chemical and biological, and pollution of nature accidental, domestic, urban, agricultural and industrial one hand, and wastewaters from industries textile finishing at the Morocco on the other, and the status of their treatment.

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Introduction

For a long time the world has experienced a remarkable development in the scale demographic, technology, tourism, agriculture and industry in relation of the exploitation of raw water whatever surface or underground. This development has contributed in one way or the other in environmental pollution including water especially through human activities and sometimes by natural disasters (volcanoes, earthquakes and floods). This has depleted natural water resources and even makes their quality over time more deteriorated due to various urban liquid effluents, domestic and industrial [1-4] direct and indirect evacuated in different receiving environments (well, groundwater, lakes, wadis, rivers and seas) without any treatment.

Industrial units are generally generating effluent whose characteristics are extremely varied and sometimes toxic, including known pollutants, namely the food, pharmaceutical, chemical, paper, paints, galvanizing, slaughterhouses, ceramics, plasturgies, tanneries, leather, textiles, etc.

These industries account for a significant share of industrially polluted water [5, 6], as they generate among

other very large volumes of wastewater loaded with organic matter such as solvents, additives, derivatives phenolic, fats, oils, dyes [7, 8, 13], inorganic materials namely heavy metals like copper, nickel, chromium, zinc, cobalt, manganese, arsenic and those most toxic such as mercury, cadmium and lead [9-13], and organometallic compounds [13-15], including adverse effects on aquatic flora and fauna, therefore on the environment and humans in particular [16]. That regulation imposes reduction by requiring disposal by the standards of treatment of industrial wastewater before discharge into receiving waters [16, 17].

The aim of the present work is to present a bibliographic review on the different water resources and pollution sources by looking through wastewater of textile industries in Morocco.

1. Natural waters

1.1. Groundwater

Is all water which is below the surface in the saturation zone and in direct contact with the floor or basement. Hydrogeological standpoint, aquifers are divided into [18]:

- ✓ **Groundwater:** shallow and are supplied directly by rainfall and water flows underneath, they traditionally supply wells and drinking water resources. This type of sheets is little used because of its low productivity and its adverse chemical quality of his presentation to the resulting pollution of their direct contact with the soil surface [19].
- ✓ **Free cloths:** are all perched permanent or temporary tables and formed in an unsaturated zone that overcomes a water table of greater extension.
- ✓ **Captive cloths:** are deeper than groundwater and free. They are separated from the surface by an impermeable layer, such that their power supply is provided by the infiltration on their edges.

The terrain in which the groundwater is located a key determinant of their chemical composition [20, 21], however, they are called as clean water because they generally meet the drinking water standards. Yet, this type of water is less susceptible to accidental pollution and in the case of contamination by micropollutants [22-24], it completely loses its original purity.

Where groundwater contains concentrations of certain minerals exceeding those indicated in drinking water standards, they represent therapeutic properties [25, 26]. This requires a well-defined treatment for this type of water, and they are sometimes distributed bottled and sold as mineral water.

1.2. Surface water

They are also called surface water and consist of all the circulating water, standing or stored, fresh and brackish, which are in contact with the atmosphere. The water surface is mainly river water, wadis, lakes, ponds, dams, runoff, seas and oceans.

The chemical composition of surface waters mainly depends on the nature of the land crossed by them during their journey across the watershed [27]. Most often, these waters are the seat of development of microbial life because of the waste dumped in and the large contact area with the external environment [27-29], which makes them more deteriorated quality.

1.3. Waters of seas and oceans

They cover more than 70% of surface of planet earth by building huge water tanks and representing about 97% of the total water volume currently existing on our planet [30-33], the rest is the share of inland waters (ground and surface water).

The waters of seas and oceans are characterized by high salinity and acidity [30, 34], also known as brackish water, which makes them difficult to use in most cases, because of their high cost for their desalination by distillation techniques and reverse osmosis membranes [30, 31]. In addition to marine pollution from natural disasters, sinking boats of accidents and oil leaks, a very

large amount of waste and polluted water is discharged into the marine environment [35].

2. Water consumption

These are water consumption for industrial, administrative and domestic. They have experienced tremendous growth due to the demographic development and the improvement of living conditions of the population. Tap water, packaged water (spring water, natural mineral and drinking made by processing) and private well water used for drinking are all water intended for public consumption [36].

Domestic water consumption varies from a few liters per day in countries without public supply and low domestic comfort to the several hundred liters in developed countries. Even if only a small amount that will be drunk, never these waters are not distributed after proper treatment. They must undergo treatment according to the regulatory requirements of the quality of drinking water in all points of the network, to be consumed with a man without danger. The treatment of water for public consumption is linked to three important factors:

- ✓ The amount: as the water source must meet demand at all times.
- ✓ The quality: it must be compatible with existing legislation.
- ✓ The economy: the cost of investment and operation of the treatment processes relative to available resources is an important determinant.

3. Wastewater

They are very complex and altered environments either by human activity as a result of agricultural, industrial, craft, domestic and others, or by natural causes namely volcanoes, storms, earthquakes, floods, tremors ground ...Wastewater is also called polluted waters should be so treated before reuse or discharge into the natural receiving environments [37, 38].

Based on some references, the term pollution has taken a number of definitions, among which we quote the following definitions as the:

3.1. Larousse dictionary

Pollution is an environmental degradation by substances (natural, chemical or radioactive) waste (household and industrial) or various nuisances (noise, light, thermal, biological, etc.) [39].

3.2. World Health Organization (WHO)

Pollution of aquatic environments as any modification of the physical, chemical or biological, through the discharge of liquid, gaseous or solid in water to create a nuisance or render this dangerous or harmful water perspective, or the health, safety and welfare of the public, or its uses for domestic, commercial, industrial,

agricultural, recreational and other, either the wild and aquatic life [40-42].

3.3. Report on the Environmental Quality Board of the White House in 1965

The pollution is an adverse change in the natural environment that appears in whole or in part as a by-product of human action, through direct or indirect effects altering the criteria for the distribution of energy flows, radiation levels, and the physico-chemical constitution of the natural environment and abundance of living species. These changes can affect humans directly or through agricultural water resources and other biological products. They can also affect altering physical objects it owns, recreational opportunities of the environment or disfiguring nature [43-45].

3.4. Moroccan water law N° 10-95

The polluted water is water that has suffered due to human activity, directly or indirectly or under the action of a biological or geological effect, a change in its composition or condition which results to make unsuitable for the use for which it is intended [46].

Note that multiple identifiable substances and contaminants in urban discharges, craft, industrial and agricultural succeed in the aquatic environment causing pollution of various types according to their nature and origin. These substances can be suspended solids, organic, inorganic and organometallic, pathogenic micro-pollutants, bacteria, viruses ... having multiple effects affecting both public health and aquatic organisms.

4. Classification of wastewaters

There are several ways used for the classification of wastewaters, based on either the origin or nature of the pollutants or the nature of the nuisance created or on other criteria. To classify wastewater during this present work, we will be satisfied only by the nature of pollutants and their origin.

4.1. Classification according to the nature of the pollutant

Based on the nature of the pollutant, the term pollution can be classified into three categories namely pollution physical, chemical and biological [47].

4.1.1. Physical pollution

We speak of this type of pollution when the polluted environment is changed in its physical structure by various factors. It includes mechanical pollution (solid waste), thermal pollution (water heating by plants) and atomic pollution (radionuclides from fallout from nuclear weapons explosions, nuclear plants and nuclear accidents residues) [47].

4.1.2. Chemical pollution

It results from the discharge of various domestic discharges, agricultural and industrial, loaded with large quantities of chemicals namely polycyclic aromatic hydrocarbons (PAHs), pesticides, insecticides, humid acid, ammonium nitrate, etc. some of which are non-degradable and can affect many aquatic animals and amphibians [53, 54].

4.1.3. Biological pollution

This is pollution from pathogens associated with human activities, such as bacteria, viruses, parasites, fungi, plankton blooms, etc. The presence of these microorganisms in aquatic environments can cause risk of impairment of water and therefore the impact on human health [27, 47, 55].

4.2. Classification according to the origin of the pollutant

Depending on the source of the pollutant, there are five categories of polluted water due to accidental pollution, agricultural, urban, domestic and industrial [47-50]. Except that the domestic, industrial and storm sewage are the largest categories of wastewater [48, 49].

4.2.1. Accidental pollution

It is a major concern for users of water resources, including drinking water producers. Increased traffic in sea, road and transportation of hazardous materials, expose them to water pollution risk and therefore the appearance of polluted water through oil spills from accidents and other dangerous recognized products in the marine environment, constituting serious ecological and environmental damage to the marine environment and human health [51, 85], and by disrupting the conditions of life of fish and other aquatic living beings [52].

4.2.2. Agricultural pollution

She comes to agricultural activities such as agriculture, livestock, aquaculture and poultry, which are responsible for the release of many organic and inorganic pollutants in surface water and groundwater. The problem of diffuse pollution mainly arises in irrigated agricultural areas where a combination of several factors (climate, soil type, depth of groundwater, quality of irrigation water and intensity of fertilizer use and pesticides), contributes to the degradation of the quality of various types of water, and the intensification of eutrophication at some reservoirs dam used for the production of drinking water. [56].

The pollutants may be sediment from erosion of farmland, phosphate and nitrogen compounds from animal waste, fertilizers and commercial pesticides [57]. Note that in Morocco, agricultural pollution is more concern because of over-fertilization of soil and overuse of pesticides in agriculture, and lack of biodegradability [57].

4.2.3. Urban pollution

It is generated by large urban concentrations, through the disposal of domestic and industrial waste [58]. Urban discharges are summed up in all the products outflow the inhabitants of a town, including household waste, sewer, drain oils, expired medications, feces, packaging products, etc. [58, 59]. As the stream is spilled on the importance of the town, its business and its standard of living. Knowing that, the volume of industrial waste is predominantly by the washing water and solid waste, as they vary according to the nature and industrial activity.

4.2.4. Domestic pollution

It is generated to domestic wastes that are biodegradable waste, pharmaceutical products, hazardous chemicals and toxic pollutants namely detergents, dyes, paints, pesticides, solvents, etc. and personal care products that people release into the sewage waters [60, 61, 65]. All of these products is a form of substantial pollution and dangerous as installation of sewage are unable to eliminate [62].

Domestic waters are divided into household or gray water (bathrooms and kitchens) generally loaded with detergents, fats, solvents and organic debris, and valves waters (discharges from toilets) characterized by a significant burden in various nitrogenous organic matter and fecal pathogens [48, 63].

The increase in pollutant loads generated by domestic pollution flow has negative impacts on the quality of water resources, human health, wildlife and aquatic flora [62-65].

4.2.5. Industrial pollution

The rapid development of modern industrial techniques has spawned a massive and intensive load of different waste and industrial effluents from various industrial units [66], which are mainly installed at the shore to both get rid of waste and to save transport [70]. These industrial units use a very large amount of water while remaining necessary for their proper functioning, is not actually consumed in very small part and the rest is discarded.

The main industrial activities, the impact of the degradation of surface water including the food, olive oil mills, sugar mills, refineries, paint, galvanizing, physical, chemical, petrochemical, paper mills, tanneries, leather, textiles, etc. [37, 66-69, 84, 85]. Before the extreme diversity of these industries, it is clear that dumped waste and effluent discharged without proper treatment lead to undesirable changes in the receiving environment and therefore adverse effects on aquatic living beings [67].

In Morocco, if action to reduce flow of pollutants is performed, it is estimated that in 2020, the pollution carried by the industrial liquid waste will be about 220 000 tons of oxidized material, 9 000 tons of nitrogen, 600 tons of phosphorus and 1 200 tons of chromium [47, 71].

Incidentally, among the major polluting industries, textile industries occupy a large enough place to be taken into account, the diverse releases namely organic, inorganic and organometallic, fats, hydrocarbons, dyes, acids, bases and various chemicals [47, 84, 85].

4.2.5.1. Wastewater Moroccan textile industries

Moroccan textile industries are among the most polluting industries in terms of the volume and complexity of its effluent discharge [85]. Dyeing, printing and finishing in the textile industries by contribute significantly to the production of wastewater. In Morocco and according to data from the Moroccan Association of Textile and Clothing Industry (AMITH) and the Moroccan Center for Cleaner Production (CMPP) of 2000, the dyeing industry and the textile finishing are major consumers of water, such as water supply is from the public distribution network, with a total of 5.68 million m³/year and wells and private wells with a total of 4.42 million m³/year [75, 76].

In parallel, the operations of dyeing, printing and finishing consume a significant share of dyes and pigments (2 250 - 2 500 t/year), auxiliary chemicals such as humectants and surfactants (2 300 t/year), inorganic salts (20 000 t/year), halogenated solvents (very small amount) [76], as well as various chemicals operated in such industries [77-79]. This contributes vis-a-vis the production of a large volume of wastewater characterized by a strong color, a high temperature, a very fluctuating pH, high chemical oxygen demand (COD), high biological application oxygen (BOD), high bio toxicity and high concentrations of suspended solids (TSS) [80-82].

4.2.5.2. Purification of textile wastewaters

The report CMPP on the textile sector for the period June 2000-September 2001, the annual generation of wastewater of textile industries are included dyeing, finishing and printing, indicates that it is about 5% of textile companies of interest sub-sectors have their own wastewater treatment plant wastewater, treating about a total of 825 000 m³/year, 35% have some kind of pre-treatment plant that allows settling a volume of 2 340 000 m³/year of water before the latter are discharged and 60% of companies with estimated volume of 5.5 million m³/year of wastewater without the latter are treated [76].

Conclusions

In light of the present review, it shows us that despite the diversity of resources in mainland and groundwater, strong industrial and domestic use of these resources, and lack of treatment causes the proliferation and aggravation of states water deficiency. This can make a world first order dimension, as it is not therefore excluded that water is set to become an international strategic issue that could cause regional conflicts.

In scale Moroccan, given the large volume of wastewater of textile industries and a modest volume

that is purified and decanted (40% of total volume), a very large volume (60% of total volume) of these wastewaters are not treated and discharged directly into receiving waters. What happens vis-à-vis the pollution of these areas by infecting wildlife and aquatic flora and human health [85].

Recognizing this, the situation is alarming and therefore it is urgent and even vital to define a clear strategy for management, inventory, storage, processing, use, and reuse and water resources research which is essential to any economic development.

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