

Physico-chemical characterization of effluents from wastewater treatment plants with different treatments and anthropogenic pressures



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Introduction

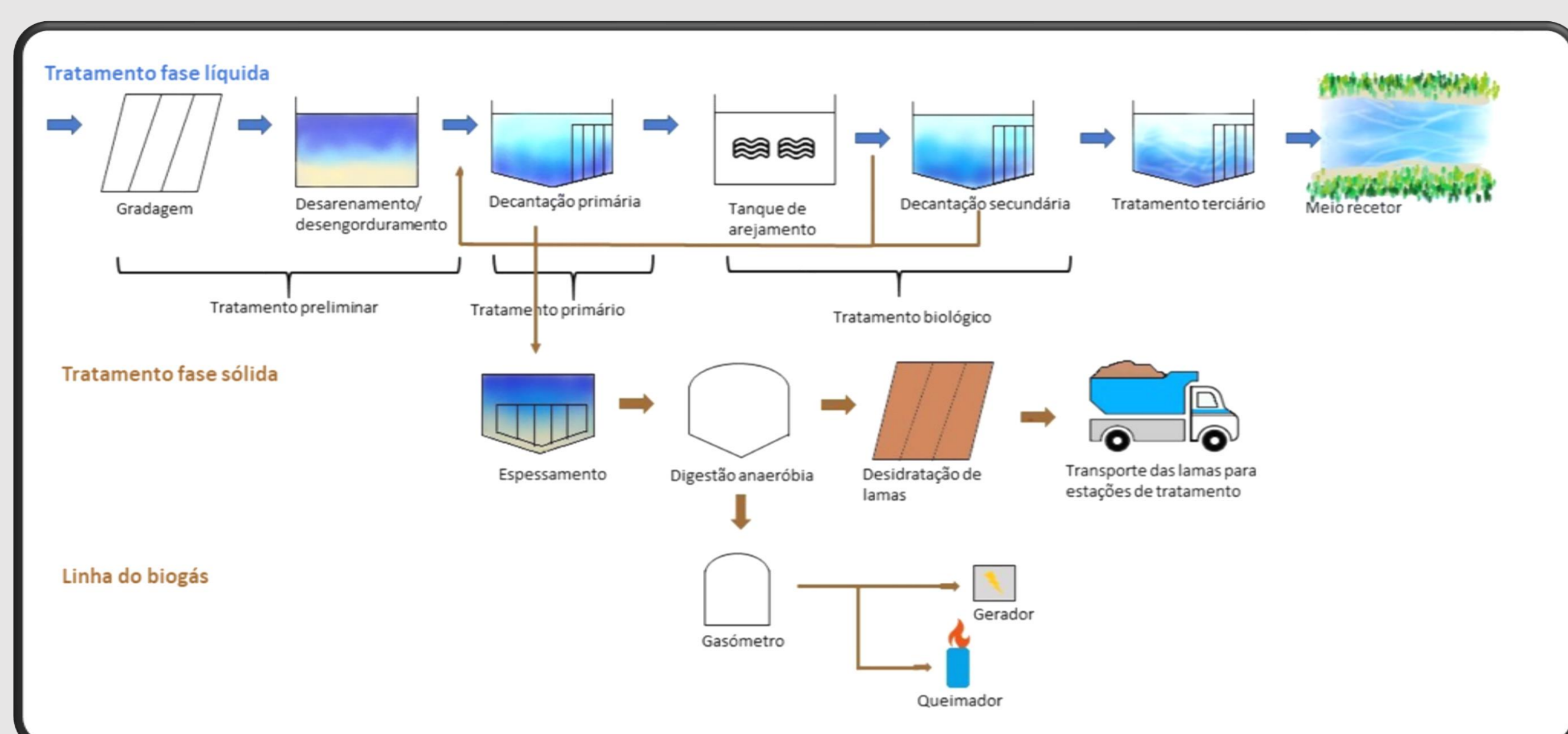


Figure 1 – Scheme of wastewater treatment at a wastewater treatment plant (WWTP). In some WWTPs, a third treatment is applied, which consists of disinfecting the effluent to remove pathogenic organisms [3].

Wastewater treatment plants (WWTPs) aim to protect human health and prevent environmental degradation by the safety disposal of industrial and urban wastewaters. Main purpose of WWTPs is to reduce the amounts of nutrients, organic content and eliminate pathogenic microorganisms. Currently, WWTP should be able to ensure effluent discharge limits of chemical oxygen demand (COD), total suspended solid (TSS), nitrogen (N) and phosphorus loads set by legal regulation established by each country and the recommended limits for human and environmental protection. The aim of this study is to evaluate physico-chemical parameters of effluents from three WWTPs with different wastewater treatment technologies and possible seasonal variations.

Material and Methods

Composite effluent samples were collected in three WWTPs in winter, spring and summer. WWTP A and B receives namely urban sewage while WWTP C also receives industrial sewage. WWTP A does not perform tertiary treatment while WWTP B and C perform tertiary treatment with UV light and ozonation, respectively.

Results

WWTP A				
Parameters	Winter	Spring	Summer	Emission Limit Value
Chemical oxygen demand (mg/L)	35	55	45	150
Phosphorus (mg/L)	3.4	1.61	3.7	10
Nitrogen (mg/L)	22.3	5.4	32.5	15
Ammonia nitrogen (mg/L)	2.89	17	24.5	10
Nitrates (mg/L)	16.1	0.47	2.57	50
Total suspended solids (mg/L)	6	15	8	60
pH	7.5	7.6	7.6	
Conductivity	289	297	292	
Turbidimetry(NTU)	1.06	5.41	0.5	
Dissolved oxygen (mg/L)	8.2	7.49	4.54	
Nitrites (mg/L)	0.444	0.234	0.125	

Table 1 – Physico-chemical parameters of the WWTP A and Emission Limit Value in annex XVIII of Decree-Law No. 236/98.

WWTP B				
Parameters	Winter	Spring	Summer	Emission Limit Value
Chemical oxygen demand (mg/L)	29.1	21	29.3	150
Phosphorus (mg/L)	1.96	1	1.3	10
Nitrogen (mg/L)	14.8	9.2	13.8	15
Ammonia nitrogen (mg/L)	0.581	2.78	9.4	10
Nitrates (mg/L)	10.5	3.62	1.19	50
Total suspended solids (mg/L)	6	6	2	60
pH	7.6	7.48	7.27	
Conductivity	186	199	382	
Turbidimetry(NTU)	3.21	4.99	0.48	
Dissolved oxygen (mg/L)	8.86	8.08	8.91	
Nitrites (mg/L)	0.363	0.722	0.638	

Table 2 – Physico-chemical parameters of the WWTP B and Emission Limit Value in annex XVIII of Decree-Law No. 236/98.

WWTP C				
Parameters	Winter	Spring	Summer	Emission Limit Value
Chemical oxygen demand (mg/L)	46.5	58.4	38.9	150
Phosphorus (mg/L)	1.3	1.61	2.21	10
Nitrogen (mg/L)	10.7	5.4	6.21	15
Ammonia nitrogen (mg/L)	0.28	0.753	0.98	10
Nitrates (mg/L)	3.09	0.456	0.94	50
Total suspended solids (mg/L)	8	15	11	60
pH	7.3	7.27	7.27	
Conductivity	284	346	382	
Turbidimetry(NTU)	1.93	4.41	0.34	
Dissolved oxygen (mg/L)	9.17	9.23	8.19	
Nitrites (mg/L)	0.294	0.216	0.136	

Table 3 – Physico-chemical parameters of the WWTP C and Emission Limit Value in annex XVIII of Decree-Law No. 236/98.

	Winter	Spring	Summer
Precipitation (mm)	254.1	105.8	0.2
T max (°C)	14.6	14.4	26.7
T min (°C)	7.5	22.4	16.6

Table 4 –Temperature and precipitation for the harvest months in each season. (Source IPMA).

All WWTPs showed physico-chemical parameters within the recommended by the Portuguese regulation except WWTP A where nitrogen and ammonia nitrogen levels were higher than the established limits. Nevertheless, this WWTP does not have to comply with these limits. However, high levels of nitrogen and ammonium may cause eutrophication of the receiving waters and the highest values were found in summer. It is important to stress that effluents discharges from these WWTPs occurs in rivers with little flow which can negative influence population close to the discharge sites.

Conclusion

Portuguese legislation should include other physical-chemical parameters and the WWTPs have a stricter discharge license. These results show that effluents might be sources of pollution to their respective receiving water systems and may threat public and environmental health.

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