Volume : 2 | Issue : 9 | Sept 2013 • ISSN No 2277 - 8160

Research Paper | Environment

Comparative Analysis on the Legislative Requirements of Wastewater Disposal in Water Bodies for Asia and Europe

Mircea-Vlad Muresan — Ph.D. Student, Technical University of Cluj-Napoca, Romania

Elena Maria Pica — Ph.D. Professor, Technical University of Cluj-Napoca, Romania

ABSTRACT

Water is the planet's common good, every country has thus the responsibility to protect it from pollution, for the entire human race's sake. The importance of the water for the environment has become a major component of every country's legislation. This article makes a comparative analysis of the water protection standards from a legislative point of view, concerning the disposal of wastewater into the water bodies. In consequence, we compare the current legislations regarding the discharging standards of wastewater from five countries, on two continents: Jordan, China and India from the Asian continent, respectively Germany and Romania from the European continent.

KEYWORDS: discharging standards, wastewater, water bodies

Introduction

The legislative objectives for the treatment of wastewater are the environmental protection against deterioration, the enforcement of general clauses of purification and evacuation and establishing the limit values of the main indicators of quality from the effluents.

A comprehensive legal framework and its efficient constraints applied nationally and internationally are essential for the wastewater treatment and the environmental protection to succeed.

Methodology of research

For the purpose of a wide perspective upon the jurisprudences on minimum quality levels of the effluents, we will study the legal standards concerning the wastewater treatment in different countries of some continents, emphasizing on the disposal clauses based on BOD_5, COD, N and P values. As the laws in some countries establish the pollution standards depending on the human agglomerations they serve, for the study to be relevant, the authors will compare the pollution marks for treatment facilities with a 10,000 LE capacity (LE - the biodegradable organic charging, with a 5 days biochemical oxygen demand - BOD_5 - 60g O_2/day).

Study in the Asian area

Jordan

Jordan is one of the fourth driest countries in the World, its existing water resources being seriously over exploited. The demand for water exceeds Jordan's available water resources (Ahmed et al., 2012; MWI, 2009). In 2008, 62% of Jordan's population was served by the sewerage systems, most of the cleaned water being mixed with the surface water and reused later on, for irrigation (MWI, 2009).

The very high BOD_5 rates in the wastewater, present on the account of insufficient quantities of water, must be controlled (MWI, 2009).

In order to surmount these difficulties, the "Water Strategy 2008-2022" proposes water treatment plants for every inhabited place. The treated effluents will abide by the national standards, their quality making them fit for agricultural or other non-domestic usage (MWI, 2009).

Jordan's National Standard JS 893/2006 stipulates specific discharging conditions for treated wastewater into the water bodies, as shown in Table 1.

Table 1. Discharging conditions for treated wastewater in Jordan (Ahmed et al., 2012)

Marker [mg/l]	Discharge to water bodies
BOD_5	60
COD	150
N	70
P	15

China

In the last decade, China has made remarkable progress in expanding its urban water supply and wastewater infrastructure (ESDDWAPR, 2006). The share of the urban population served by municipal water supply utilities increased from 50% in 1990 to 88% by 2005. Over the same period, wastewater treatment capacity has tripled (Browder et al., 2007).

The applicable legislation for the wastewater treatment divides China's towns in two categories, based on the number of inhabitants and their income; therefore, each category has different standards (Browder et al., 2007).

The specific discharging conditions for IB degree treated wastewater into the water courses are shown in Table 2.

Table 2. Discharging conditions for treated wastewater in China (Browder et al., 2007)

Marker [mg/l]	Discharge to water bodies
BOD_5	20
COD	60
N	20
P	1

India

India accounts for 2.45% of Earth's land area and 4% of water resources of the world, but represents 16% of the world population (Kaur et al., 2012). Being an economy in transition from a developing to a developed nation, India faces two problems. On the one hand, there is a lack of infrastructure and on the other, an ever-increasing urban population. Water supply sources, sanitation measures and management of wastewater cover only a fraction of the total urban population (Kamyotra et al., 2011).

It is estimated that the urban gatherings - class I cities (over 1 billion population) and class II towns (from 0.5 to 1 billion population) - represent 72% of urban population in India and generate about 38.254 million litters per day (mld) of wastewater (Kaur et al., 2012; Amerasinghe et al., 2013; Gutter et al., 2009).

The municipal wastewater treatment capacity developed by 2011 was about 11.787 mld, representing 31% of wastewater generated in these two classes of urban centres (Kamyotra et al., 2011).

The water sector is governed by the following environmental legislations, pollution control acts and rules: The Water Act (Prevention and Control of Pollution), from 1974, amended in 1988 (EBTC, 2011), synthesized from the water courses protection point of view in Table 3.

Table 3. Discharging conditions for treated wastewater in

India (The Environment Rules, 1986)

Marker [mg/l]	Discharge to water bodies
BOD_5	30
COD	250
N	100
P	5

Study in Europe Area

The highest rate pollutants admitted in water bodies [mg/l] vary from country to country. For instance, the rates allowed in Germany (table 4) and in Romania (table 5) are different from the rates of other European states, members of EU (91/271/ECC Directive, 1991).

The Urban Wastewater Treatment Directive was adopted May 21st 1991, known as the 91/271/CEE Directive, its main objective being the environment protection from the effects of industrial and household wastewater disposal. This Directive sets the highest rates allowed for the discharging of wastewater in effluents, mandatory for every country member of the GR, 2004).

Germany

Nowadays, Germany is one of the most advanced countries of Europe and worldwide, in the area of water technology and water management, with an over 90% rate of treatment of collected wastewater (GFMENCNS).

Table 4 presents the minimum standards for the disposal of urban wastewater, as stipulated in the German Ordinance for Wastewater (GFMENCNS, 2004).

Table 4. Discharging conditions for treated wastewater in Germany (GFMENCNS, 2004)

Marker [mg/l]	Discharge to water bodies
BOD_5	20
COD	90
N	18
P	2

Romania

Romania's cohesion to the European Union, in January 1st 2007, made a series of special dispositions to be adopted in order to respect the 91/271/CEE Directive.

In 2012, the rates of collecting and treatment of wastewater was 58.95 % (for collecting) respectively 48.32% (for treating it). It is a 12% increase from 2007 for the collection, respectively 11% for the treatment of the wastewater (ANAR, 2013).

The minimum rates of the wastewater, before being disposed into water bodies are presented in Table 5.

Table 5. Discharging conditions for treated wastewater in Romania (The Governmental Disposition 325/2005)

Marker [mg/l]	Discharge to water bodies
BOD_5	25
COD	125
N	15
P	2

Results and discussion

Analyzing the technical standards of the five countries for establishing the maximum rates of pollutants admitted in the wastewater disposal in natural waters, we observe major differences of the enforced standards.

From the BOD_5 perspective, Jordan is the most permissive country, with a 60 mg/l BOD_5 concentration at the discharging, compared to the other countries, which embody rates close to the average 25mg/l BOD_5, as presented in Figure 1.

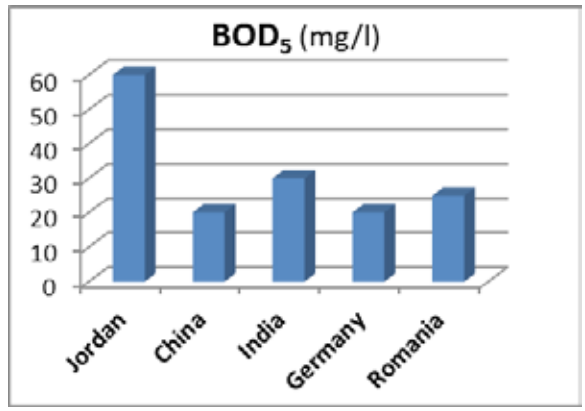


Figure 1. The disparity of BOD_5 maximum rates at the disposal in water bodies

Comparing the COD maximum concentrations allowed at the discharging, as shown in Figure 2, we notice India tolerates the highest rate - 250 mg/l COD. The lowest rate and the strictest legislation is the Chinese one, with the maximum concentration of 60 mg/l COD.

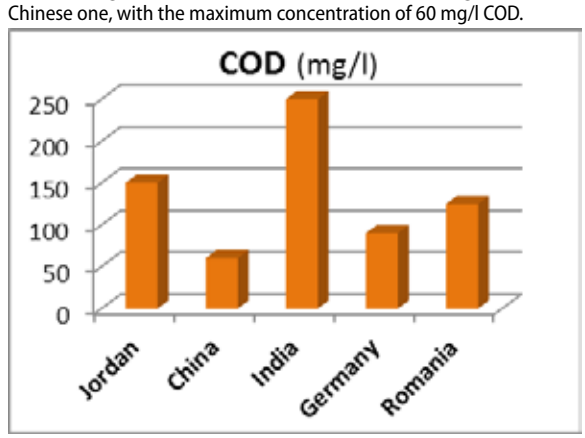


Figure 2. The disparity of COD maximum rates at the disposal in water bodies

Observing the highest values of N inflicted at the discharging of wastewater in natural waters, we see India and Jordan admit 100 mg/l, respectively 70 mg/l, values much higher than the other three countries in this survey, with a 18 mg/l admitted average, as seen in Figure 3.

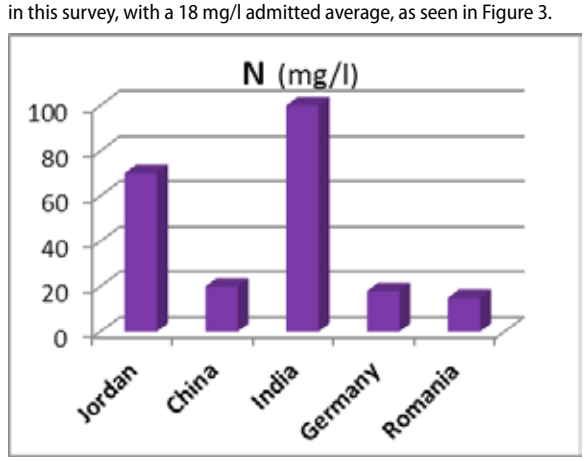


Figure 3. The disparity of N maximum rates at the disposal in water bodies

After analyzing the P highest admitted rates of the wastewater at the discharging, as in Figure 4, we identify high values of 15 mg/l in Jordan, whereas countries like China and Romania admit 1 mg/l as the uppermost value.

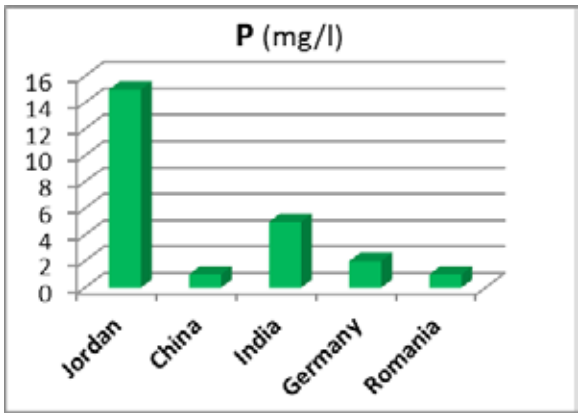


Figure 4. The disparity of P maximum rates at the disposal in water bodies

Conclusions and personal considerations

The study of the main polluting markers from the countries surveyed shows that it is compulsory for Jordan and India to use secondary technologies of wastewater treatment, while for China, Germany and Romania the implementation of advanced treatment technologies is required.

Taking into consideration the massive discrepancies between the highest values of the pollutants at the discharging for different countries, the formulation of a worldwide legislation becomes essential. It should contain minimum compulsory stipulations on the discharging of wastewater in the natural environment, in order to produce a balance in the efforts all countries should make for the environmental protection.

The discharging of insufficiently treated wastewater in water courses affects water quality in the countries and continents around. A worldwide legal standard and efficient legal constraints applied internationally are compulsory for the water and environmental protection strategies already implemented in some countries to be a real success.

Acknowledgment

This paper has been completed due to the support of the Doctoral School within the Technical University of Cluj-Napoca.

REFERENCES

Ahmed, A.A., (2012). Wastewater Production, Treatment and Use in Jordan, Water Authority of Jordan, India. Retrieved from: http://www.ais.unwater.org/ais/pluginfile.php/356/mod_page/content/111/Jordan_ULIMAT_ICID_AHMA_2012-1.pdf. | Minister of Water and Irrigation [MWI], Royal Commission for Water [RCW], (2009). Jordan's Water Strategy 2008-2022, Water for Life, India. Retrieved from: http://www.joriew.eu/uploads/private/joriew_org_jordan_national_water_strategy.pdf. | Environment and Social Development Department East Asia and Pacific Region [ESDDWAPR], (2006). China Water Quality Management, Policy and Institutional Considerations, Washington D.C., Publisher The World Bank, Retrieved from: http://www.circleofblue.org/waternews/wp-content/uploads/2010/11/World-Bank_China-Water-Quality-Management.pdf . | Browder, G.J., Xie, S., Kim, Y., Gu, L., Fan, M. & Ehrhardt, D., (2007). Improving the performance of China's urban water utilities, Washington D.C., Publisher The World Bank. doi:10.1596/978-0-8213-7331-6. | Kaur, R., Wani, S.P., Singh, A.K. & Lal, K., (2012). Wastewater production, treatment and use in India, Country report India, India. Retrieved from: http://www.ais.unwater.org/ais/pluginfile.php/356/mod_page/content/111/CountryReport_India.pdf . | Kamyotra, J.S. & Bhardwaj, R.M., (2011). Municipal Wastewater Management in India, India Infrastructure Report 2011, pp. 299-311. Retrieved from: http://www.idfc.com/pdf/report/2011/Chp-20-Municipal-Wastewater-Management-In-India.pdf. | Amerasinghe, P., Bhardwaj, R.M., Scott, C., Jella, K. & Marshall, F., (2013). Urban wastewater and agricultural reuse challenges in India, Colombo, Publisher International Water Management Institute, (Research Report 147). doi:10.5337/2013.200. Retrieved from: http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/PUB147/RR147.pdf . | Gutterer, B., Sasse, L., Panzerbieter, T. & Reckerzügel, T., (2009). Descentralised Wastewater Treatment Systems and Sanitation in Developing Contries, A practical guide , ISBN: 978-84380 128 3, Published by the Water, Engineering and Development Centre (WEDC), Loughborough University, UK in association with Borda Germany. Retrieved from: http://www2.gtz.de/Dokumente/oe44/ecosan/en-sample-only-borda-dewats-2009.pdf. | European Business and Technology Centre [EBTC], (2011). Water and Wastewater in India, New Delhi. Retrieved from: http://www.ebtc.eu/pdf/111031_SNA_Snapshot_Water-and-waste-water-in-India.pdf. | Indian Ministry of Environment and Forests, (1986), The Environment (Protection) Rules, New Delhi, pp. 124-128. Retrieved from: http://tripura.nic.in/tspcb/envrules1986.doc | European Council, (1991). Directive 91/271/ECC concerning urban waste-water treatment. Retrieved from: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:en:NOT . | Romanian Government, (2004). Plan of completion of the 91/271/CEE Directive on the treatment of urban wastewater, Bucureşti. Retrieved from: http://www.rowater.ro/Legislatia%20internationala/Directiva%20Cadru%20Apa/Plan_implementare_Directiva_ape_uzate%20oraseneti.PDF. | German Federal Minister for the Environment, Nature Conservation and Nuclear Safety [GFMENCNS], The German Water Sector Policies and Experiences. Retrieved from: http://www.umweltbundesamt.de/wasser/wsektor/wasserdoku/english/doku_e.pdf | German Federal Minister for the Environment, Nature Conservation and Nuclear Safety [GFMENCNS], (2004). Promulgation of the New Version of the Ordinance on Requirements for the Discharge of Waste Water into Waters, Germany, Retrieved from: http://www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/wastewater_ordinance.pdf. | Romanian Government, (2005). H.G. 352/11.05.2005, Standards on the circumstances of wastewater disposal in the aquatic environment, Bucureşti. Retrieved from: http://aquamax.ro/fileadmin/content/Download/Diverse/hg-188-2002_si_hg-352-2005.pdf . | The National Administration "Romania's Waters", (2013). Romania's Water Quality Synthesis of 2012 (excerpt), Bucureşti, Retrieved from: http://www.rowater.ro/Lists/Sinteza%20de%20calitate%20a%20apelor/Attachments/10/Sinteza%20calitatii%20apelor%20din%20Romania%202012.pdf.