



Characterization of Wastewater in Nepal

Isha Dhakal & Pramina Nakarmi
Environment and Public Health Organization (ENPHO)
isha.dhakal@enpho.org

Introduction

Disposal of wastewater is largely an issue in developing nations like Nepal. For wastewater treatment, it is crucial to know the nature of wastewater as the quality of effluent largely depends upon the influent characteristics. Also, the capacity and efficiency of treatment systems are designed based upon influent concentrations and effluent requirements.

Objective

- To assess the characteristics of wastewater in Nepal
- To understand difference in wastewater quality based on source of generation

Methods

361 untreated or raw wastewater samples from various sources from different parts of Nepal analyzed at ENPHO laboratory from 2012 to 2017 were analyzed in terms of 10 parameters. The samples were categorized based on their sources of generation.



Lab technician collecting wastewater sample

S.N.	Parameter analyzed	No. of samples analyzed
1	pH	115
2	Electrical Conductivity (EC)	50
3	Dissolved Oxygen (DO)	58
4	Oil and Grease	73
5	Biological Oxygen Demand (BOD)	150
6	Chemical Oxygen Demand (COD)	309
8	Total Suspended Solids (TSS)	206
9	Total Kjeldahl Nitrogen (TKN)	26
9	Nitrate	63
10	Ammonia	80
11	Total Phosphorus (TP)	117

Results

Table 1: Mean values of pH, DO and Oil & Grease in different sources

Parameters	Domestic	Industrial	Hospital	Institutional	Municipal
pH	7.2 (±0.9)	7.0 (±1.7)	7.5 (±0.5)	8.3 (±0.6)	7.8 (±0.2)
DO (mg/L)	0.7 (±1.1)	-	2.9 (±2.5)	1.0 (±1.1)	0.1 (±0.3)
Oil & Grease (mg/L)	17 (±27)	37 (±55)	15 (±22)	368 (±783)	19 (±12)
EC (µS/cm)	1962 (± 1994)	-	1030 (± 324)	1373 (± 485)	2979 (± 4036)

Table 2: Correlations (p-values) among the tested parameters

Parameter	pH	EC	TSS	BOD	COD	DO	Ammonia	TKN	Nitrate	TP	Oil and grease
pH	x	.40	.70	.40	.77	.03	.00	.01	.56	.87	.09
EC	x	x	.83	.68	.16	.10	.26	.00	.00	.30	.70
TSS	x	x	x	.00	.00	.03	.00	.06	.06	.00	.16
BOD	x	x	x	x	.00	.01	.00	.01	.89	.00	.60
COD	x	x	x	x	x	.01	.00	.00	.99	.00	.52
DO	x	x	x	x	x	x	.01	.05	.19	.16	.44
Ammonia	x	x	x	x	x	x	x	.00	.00	.00	.00
TKN	x	x	x	x	x	x	x	x	.00	.57	.33
Nitrate	x	x	x	x	x	x	x	x	x	.65	.88
TP	x	x	x	x	x	x	x	x	x	x	.50

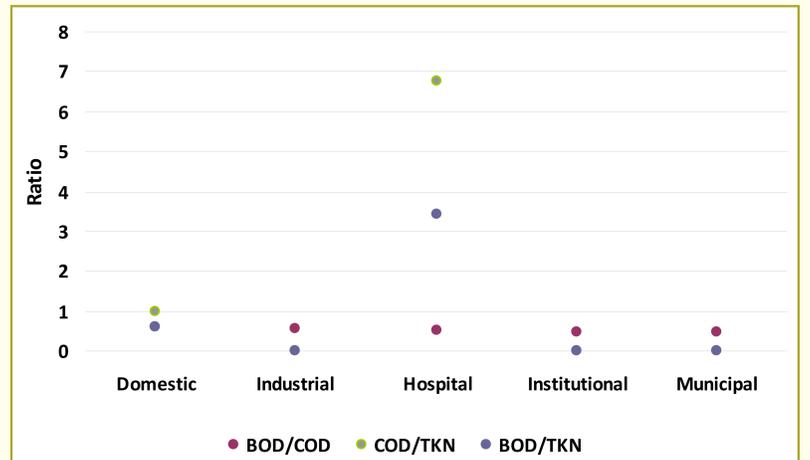


Figure 3: Ratios of different parameters for different types of wastewater

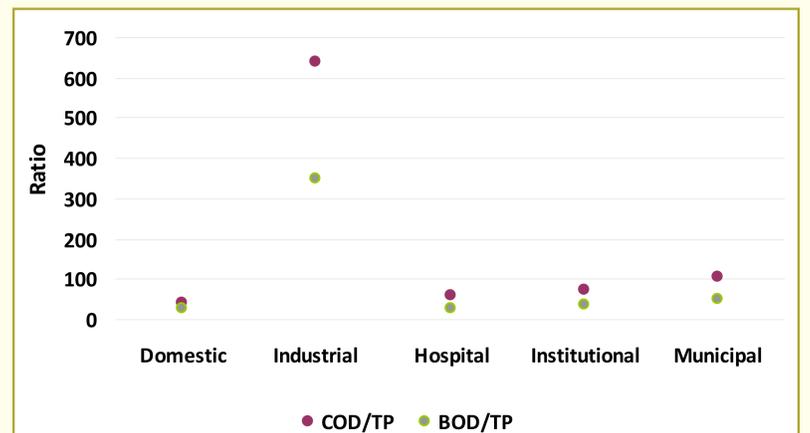


Figure 4: Ratios of COD and BOD with TP for different types of wastewater

Table 3: Tolerance Limits for Industrial Effluents to be discharged into Inland Surface Waters (GoN, 2012)

Characteristics	Tolerance Limit
pH	5.5 to 9.0
Total Suspended solids, mg/L	200
Biochemical oxygen demand, mg/L	100
Chemical Oxygen Demand, mg/L	250
Oils and grease, mg/L	10
Ammonical nitrogen, mg/L	50

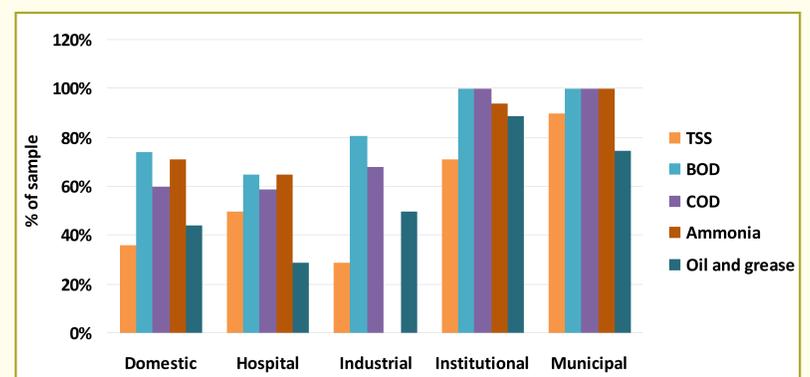


Figure 5: % of samples exceeding the national standards

- The mean BOD and COD values of tested samples were found to be 459 mg/L and 774 mg/L respectively.
- The maximum COD was found to be 13500 mg/L and BOD was found to be 6600 mg/L.

Discussion

Correlation of TSS, BOD and COD indicates that removing of suspended particles through settlement- a simple wastewater treatment component only can remove much of BOD and COD from the wastewater.

Domestic wastewater in Nepal, due to presence of high organic load i.e. BOD/COD > 0.6, can be treated by biological processes (Zaher & Hammamb, 2014).

Low COD/TKN and BOD/TKN ratio in domestic wastewater show that organic concentration in wastewater is not sufficient for nitrogen removal by biological denitrification.

Conclusion

The study clearly indicates differences in characteristics of wastewater from domestic, hospital, industrial, institutional and municipal sources in terms of studied parameters.

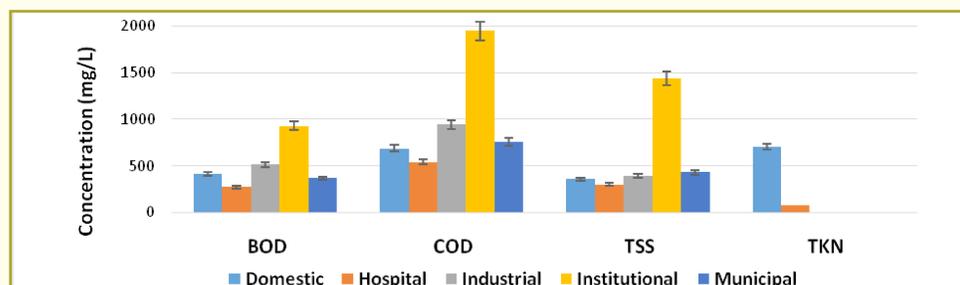


Figure 1: Mean BOD, COD, TSS and TKN values in different sources

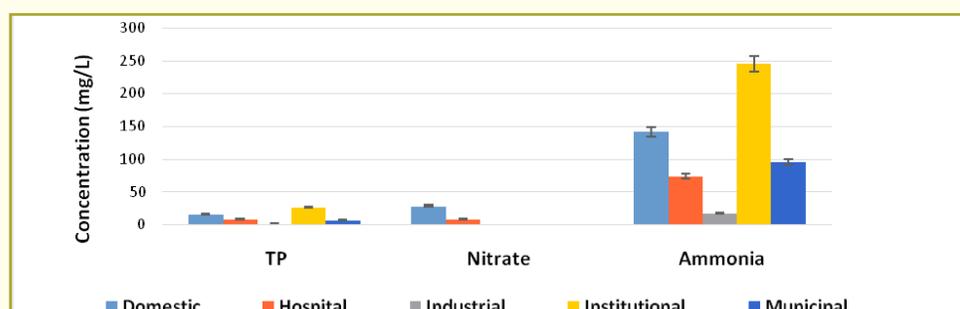


Figure 2: Mean TP, Nitrate and Ammonia values in different sources