

Meta-Table 1: Characteristics of Different Sanitation Flows

Parameter	Units	Urine (Fresh)	Urine (Stored)	Urine (Fresh)	Faeces	Faeces	Domestic Wastewater	Municipal Wastewater	Septic sludge	Effluent from septic tanks and aqua privies	WWTP sludge	Primary sludge	Secondary sludge	Untreated activated sludge
1.Total solids	mg/L			82	140,000-370,000 (14-37%)		390-1,230			46-820		60,000 (6%)	40,000 (4%)	10,000 (1%)
2. Volatile solids	% TS				84-93							65	40	59-88
3. Chemical Oxygen Demand	mg/L O ₂	10,000	10,000	6,270–17,500	46,230–78,310		250-800	500-1,200	6,000-90,000	360-452	500-2,500			
4. Biochemical Oxygen Demand	mg/L O ₂				1,792-4,288		110-350	230-560	2,000-30,000	90-295	20-250			
Nitrogen (as N)	5.Organic	mg/L					20-70	10-15						
	6. Free ammonia	mg/L	480	8,100	125-600		8-25	20-75	50-150	12-131	2-168			
	7. Nitrates	mg/L					0	0.1-0.5		<1				
	8. Nitrites	mg/L					0			<1				
9. Total Nitrogen (as N)	mg/L	9,200	9,200	4,000–13,900			20-70	30-100	200-1,500		32-250	1,500	1,200	320
Phosphorous (as P)	10.Organic	mg/L			250-1,800		1-10	2-10						
	11.Inorganic	mg/L					3-10	4-15		8-17 (form?)				
12.Total Phosphorous (as P)	mg/L	740	540	350-2,500	1,770-9,860		4-12	6-25	40-300	8-20	9-63	960	1,000	690
13. Total coliforms	CFU/100 ml						10 ⁶ -10 ¹⁰	10 ¹¹ -10 ¹³		10 ⁶				
14.Faecal coliforms	CFU/100 ml					10 ¹⁰	10 ³ -10 ⁸		10 ⁶ -10 ⁸	10 ⁶	10 ⁴ -10 ⁵			
15.E. coli	CFU/100 ml							10 ⁶ -10 ⁸						
Source		<i>Udert et al., 2003</i>	<i>Udert et al., 2003</i>	<i>Rose et al, 2015</i>	<i>Rose et al, 2015</i>	<i>Ashbolt et al., 2001</i>	<i>Metcalf & Eddy, 2003</i>	<i>Henze et al.,2008</i>	<i>Henze et al.,2008</i>	<i>Watt,2003</i>	<i>Strande et al., 2014</i>	<i>Metcalf & Eddy, 2003</i>	<i>Metcalf & Eddy, 2003</i>	<i>Metcalf & Eddy, 2003</i>

Key: FS = faecal sludge

Sources:

N. J. Ashbolt, W.O.K. Grabow & M. Snozzi (2001) Water Quality: Guidelines, Standards and Health. London: World Health Organization/IWA Publishing. Indicators of microbial water quality; pp. 289–314.

M. Henze, M.C.M. van Loosdrecht, G.A. Ekama & D. Brdjanovic (2008) Biological Wastewater Treatment: Principles, Modelling and Design

Metcalf & Eddy, Inc. (1991). Wastewater Engineering: Treatment, Disposal, and Reuse. New York :McGraw-Hill,

C. Rose, A. Parker, B. Jefferson & E. Cartmell (2015) The Characterization of Feces and Urine: A Review of the Literature to Inform Advanced Treatment Technology.Critical Reviews in Environmental Science and Technology, 45:17, 1827-1879.

L. Strande., M. Roteltap & Bradjanovic (2014) Faecal Sludge Management. IWA Publishing, UK.

K.M. Udert, T.A. Larsen, M. Biebow , W. Gujer (2003). Urea hydrolysis and precipitation dynamics in a urine-collecting system. Water research 37, 2571–2582.

S. B.,Watt (2003) Septic Tanks and Aqua privies from Ferrocement. ITDG Publishing, UK.

Meta-Table 2: Characteristics of Different Sanitation Flows (Faecal Sludge)

Parameter	Units	FS: Pit Latrine	FS: Public Septic Tanks	FS: Private Septic Tanks	FS: (dry) VIP Latrines	FS: Pit Latrines	FS: Pit Latrines	FS: Private Septic Tanks	FS: Public Septic Tanks	FS: Septic Tanks	FS: Septic Tanks	FS: Septic Tanks	FS: Vacuum Tankers	FS: Septic Tanks & Pit Latrine	FS: Public toilet	FS: Septic tank	Septic sludge
		Kumasi, Ghana			Durban, SA	Nakuru, Kenya	Mzuzu, Malawi	Accra, Ghana		Bangkok, Ghana	Manila, Philippines	USA	Hanoi, Vietnam	Kampala, Uganda	Not stated		Not stated
Number of samples		30	30	30	10	132	20	60		15	15	EPA data	Not stated	76	Not stated		Not stated
1.Total solids	mg/L	46,800 (4.68%)	19,000 (1.90%)	9,800 (0.98%)	190,000 (19%)		50,000-90,000 (5-9%)	11,900	52,500	16,000	72,000	38,800	5,020-71,007	833-121,601	30,000-52,000	12,000-35,000	
2. Volatile solids	% TS				90			60	69	69	76	65	66-73	45-99	65	45	
3. Chemical Oxygen Demand	mg/L	45,611	26,765	9,495		72,000-176,000	20,180-22,310	7,800	49,000	14,000	37,000	43,000	4,233-83,000	742-100,017	20,000-50,000	1,200-10,000	6,000-90,000
4. Biochemical Oxygen Demand						11,000-39,500	2,820-3,110	600-1,500	7,600		3,800	5,000			7,600	840-2,600	2,000-30,000
Nitrogen (as N)	5.Organic	mg/L															
	6. Free ammonia	mg/L				1,300-5,100	255-331							2,000-5,000	150->1,000	50-150	
	7. Nitrates	mg/L													0.2-21		
	8. Nitrites	mg/L															
9. Total Nitrogen (as N)	mg/L	4,479	1,396	649		1,717-5,497								131- 4,880			200-1,500
Phosphorous (as P)	10.Organic	mg/L															
	11.Inorganic	mg/L															
12.Total Phosphorous (as P)	mg/L	521	228	137		613-4,927	249-359							6-2,040	450	150	40-300
13. Total coliforms	CFU/100 ml																
14.Faecal coliforms	CFU/100 ml														10 ⁵		10 ⁶ -10 ⁸
15.E. coli	CFU/100 ml						10 ⁴										
Source		Franyin-Martin et al., 2017			Zuma et al,2015	Gudda et al., 2017	Kalula et al., ND	Heinss et al., 1999					Schoebitz., et al., 2014	Schoebitz., et al., 2014	Strande et al., 2014	Henze et al.,2008	

Key: FS = faecal sludge

Sources:Franyin-Martin A., Tamakloe W., Antwi E., Ami J., Awarikabey E., Apatti J., Mensah M., Chandran K. (2017) Chemical characterization of faecal sludge in the Kumasi metropolis, Ghana. *Gates Open Res* 2017, 1:12Gudda, F. O., Moturi, W. N., Omondi, S. O., & Muchiri, E. W. (2017). Analysis of physiochemical characteristics influencing disposal of pit latrine sludge in Nakuru Municipality, Kenya. *African Journal of Environmental Science and Technology*, 11(3), 139-145.

Heinss u., Larmie S. A., Stauss M (1999). Characterisation of Faecal Sludges and their Solid Liquid Separation. Report EAWAG/SANDEC.

https://www.sswm.info/sites/default/files/reference_attachments/HEINSS%20et%20al%201994%20Characteristics%20of%20Faecal%20Sludges%20and%20their%20Solids-Liquid%20Seperation.pdf last accessed 07/05/2018Kalulua K., Thole B.,Thengolose A., Chikhwenda E., Kululanga G., (ND)Characterisation Of Pit Latrine Sludge From Informal Settlements In Mzuzu City In Malawi. www.ywp-za.org/uploads/4/3/7/7/43773355/characterisation_of_pit_latrine_sludge_from_informal_settlements_in_mzuzu_city_in_malawi.pdf last accessed 07/05/2017Henze M., van Loosdrecht M.C.M., Ekama G.A., & Brdjanovic D. (2008) *Biological Wastewater Treatment: Principles, Modelling and Design*Schoebitz L., Bassan M., Farre A., Vu T.H. A., Nguyen V. A., Strande L. (2014) FAQ: Faecal Sludge Quantification and Characterisation – field trails of methodology in Hanoi, Vietnam. 37th WEDC International Conference, Hanoi, Vietnam.

Schoebitz L., Bischoff T., Ddiba D., Okello F., Nakazibew R., Niwagaba C, B., Lohri C. R., Strande L. (2014) Results of Faecal Sludge Analysis in Kampala, Uganda: Pictures, Characteristics & Qualitative Observations for 76 Samples. EAWAG/SANDEC.

www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/EWM/Laboratory_Methods/results_analyses_kampala.pdf last accessed 04/05/2018Strande L., M. Roteltap M., Bradjanovic D., (2014) *Faecal Sludge Management*. IWA Publishing, UK.Zuma L., Velkushanova K., Buckley C. (2015) Chemical and Thermal Properties of VIP Latrine Sludge. *Water SA*. Vol. 41. Pp. 534-540.