



Slaughterhouse Water Use and Wastewater Characteristics

EXTENSION

September 2021

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Water use and wastewater characteristics are important factors to consider when designing a slaughterhouse and included operations. This fact sheet collects some of the data reported on slaughterhouse water use and wastewater characteristics for cattle, sheep and poultry. Engineers, planners and designers may use this information to help guide their important decisions on water supply, distribution, management and treatment involving slaughterhouses.

Contents of slaughterhouse wastewater vary widely from plant to plant, depending on many factors, including

manufacturing and cleaning practices. The organic content of wastewater can be significantly reduced by incorporating good manufacturing processes (GMPs). For example, separation of blood, grease, solid particles and paunch contents from the wastewater stream will help significantly (Stover, 1974).

Table 1 gives approximate potable water use in slaughterhouse operations for cattle, swine and poultry. Tables 2, 3 and 4 list wastewater characteristics measured from slaughterhouses processing cattle, swine and poultry, respectively. Information in all tables is arranged alphabetically by source.

Table 1. Potable water use in slaughter operations.

Source	Cattle	Swine	Poultry
5m, 2009		45 gal/animal	
Gil & Allende, 2018	150 to 450 gal/animal		3.5 to 10 gal/animal
Matsumura & Mierzwa, 2008			3.0 to 4.5 gal/animal
Park et al., 2012		15.3 to 320 gal/cwt	
Salminen, 2002	317 to 343 gal/animal	44 to 186 gal/animal	4.7 to 4.9 gal/animal
Ziara, 2015	355 gal/1,000 lbs. body weight		

Table 2. Cattle slaughterhouse wastewater characteristics reported by researchers.

Source	Animals slaughtered	BOD mg/l	COD mg/l	TSS mg/l	Oils mg/l	pH
Cassidy & Belia, 2005	Cattle, Canada		7,685 ± 646	1,742 ± 116		7.3 ± .4
Husam & Nassar, 2019	Cattle, Gaza	2,350	4,502			7.1
Maroneze et al., 2014	Cattle, Brazil		7,693 ± 5,193	540 ± 212		7.0 ± 0.2
McCabe et al., 2013	Cattle, Queensland	163 to 7,020	1,040 to 12,100		5-2,110	
Musa et al., 2019	Cattle	17,158 ± 95	32,000 ± 1 12	22,300 ± 212	1,024 ± 212	6.9 ± 0.8
Salminen, 2002	Cattle, Finland	3,100 to 4,100				
Um et al., 2016	Cattle, France	2,570 ± 11	1,860 ± 72	5,800 ± 14		7.6
United States Environmental Protection Agency, 2004	Cattle, first processing, rendering, U.S.	7,237		1,153		
United States Environmental Protection Agency, 2004	Cattle, first processing, rendering, hides, U.S.	3,673 to 6,404		1,510 to 3,332		
Wu & Mittal, 2012	Cattle, Canada	14,545 ± 5,802	50,665 ± 83,866		2,427 ± 3,386	7.0 ± 0.4
Wu & Mittal, 2012	Swine, Canada	4,711 ± 2,356	10,010 ± 6,188		1,521 ± 4,160	7.0 ± 0.6
Ziara et al., 2018	Cattle, U.S. mid-size	1,486 ± 831	4,185 ± 2,141	4,973 ± 2,526	269 ± 196	7.9 ± 0.9
Ziara et al., 2018	Cattle, U.S. large-size	1,090 ± 314	2,758 ± 856	2,767 ± 510	106 ± 153	7.4 ± 1.1

Table 3. Swine slaughterhouse wastewater characteristics reported by researchers.

Source	Animals slaughtered	BOD mg/l	COD mg/l	TSS mg/l	Oils mg/l	pH
Bui, 2018	Swine, Vietnam		4,150 ± 30	176 ± 23		6.53 ± .15
Ha & Huong, 2017	Swine, Vietnam		3,200 to 5,100			6.1 to 7.0
João et al., 2020	Swine, Brazil	3,018	4,380	1,000	100	
Masse & Masse, 2001	Swine, Canada		2,333 to 8,627			4.9 to 7.2
Oliveira et al., 2017	Swine, Brazil	2,429 ± 2,180	7,176 ± 4,631			7.8 ± 0.3
Park et al., 2012	Swine, USA (Iowa)	5,732 ± 1,522	7,864 ± 4,294	2,355 ± 1,321		5.64 ± 0.26
Salminen, 2002	Swine, Finland	340 to 980				
Villarroel Hipp & Silva Rodriguez, 2018	Swine, Chile		9,610		18,625	
Wu & Mittal, 2012	Swine, Canada	4,711 ± 2,356	10,010 ± 6,188		1,521 ± 4,160	7.0 ± 0.6

Table 4. Poultry slaughterhouse wastewater characteristics reported by researchers.

Source	Animals slaughtered	BOD mg/l	COD mg/l	TSS mg/l	Oils mg/l	pH
Aziz et al., 2018	Poultry, Malaysia	573 to 1,177	777 to 1,825	395 to 783	2,362 to 3,616	6.3 to 6.9
Bazrafshan et al., 2012	Poultry, Iran	2,543 ± 362	5,817 ± 473	3,247 ± 845	34 ± 9	7.31 ± 0.12
Delforno et al., 2017	Poultry, Brazil		1,790 to 4,760	2,133	114 to 640	
Meiramkulova et al. 2020.	Poultry, Kazakhstan	653	2,042	116		7.4
Pierson & Pavlostathis, 2000	Poultry, U.S.		2,319	2,000		6.7
Rajakumar et al., 2011	Poultry, India	750 to 1,890	3,000 to 4,800	300 to 950	800 to 1,385	7 to 7.6
Ramdani et al., 2019	Poultry, Indonesia		676 to 770			
Salminen, 2002	Poultry, Finland	730				
Septiana et al., 2019	Poultry, Indonesia	3,216	6,406			
Wu & Mittal, 2012	Poultry, Canada	1,648 ± 859	3,321 ± 2,234		ND	7.0 ± 0.3

Definition of terms

BOD – Biological Oxygen Demand – the amount of oxygen consumed by microorganisms during the decomposition of organic matter.

COD – Chemical Oxygen Demand – the amount of oxygen equivalents consumed through the chemical oxidation of organic matter.

TSS – Total Suspended Solids – particles larger than 2 microns.

Conclusion

Design of a slaughterhouse facility can be a challenging process including many unknowns, estimates and guesses. Making informed choices on design parameters, like water use requirements and wastewater characteristics, will help improve project success. This fact sheet provides a summary of water use and wastewater characteristics collected and reported by reliable references. Contact fapc@okstate.edu for assistance or additional information.

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President for Agricultural Programs and has been prepared and distributed at a cost of 20 cents per copy. September 2021 GH.