Food as wastewater ingredient

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Food quite obviously is the most common component of wastewater. Be it as kitchen waste, or indirectly as feces flushed down the toilet. From the point of view of biological waste water purification, foods (meat, cereals, vegetables, fruits, fat and oil as a bulk) contain the same proportions of carbohydrates, nitrogen and phosphorus as activated sludge without chemical phosphorus precipitation does. That is approximately

- 100 kg COD (Chemical Oxygen Demand) as a measure for carbon plus hydrogen,
- 3 kg N (Nitrogen) primarily from protein, and
- 0.3 kg P (Phosphorus).

That means such a sewage could be entirely consumed by bacteria.

Since food is not the only ingredient of wastewater (there are detergents and industrial wastes, too) and the COD of the consumed food is greatly reduced by human digestion, raw sewage in wastewater treatment plants contains a surplus of nitrogen and phosphorus. Usually 100 kg of COD comes with 15 kg N and 2.5 kg P. Hence there is always a surplus of nitrogen and phosphorus in the effluent of a sewage treatment plant.

During my time as a sewage professional, we often had accidents in food processing companies. A dairy lost 5 tons of cream once. Another time, wine was mistakenly pumped from a tank trunk into the sewer system instead of into storage tanks. As a consequence, in both examples, the waste water treatment plants were overloaded and failed.

How to find out who was responsible and how much was actually discharged? How much compensation was needed to pay for this? I kept notes on these accidents and recorded the wastewater equivalents for all the different foodstuffs. The following table may also be used for an estimation of wastewater fees to be paid by food companies.

This table may be helpful to you too.

Product	pH	COD	BOD_5	Kjeldahl Nitrogen	Total Phosporus		BOD5 People-Equivalents
	-	g O2/kg	g O2/kg	g N/kg	g P/kg		Equiv./kg food
Wheat flour	-	1,500	390	17.4	1.1		7.8
Sugar	-	1,100	930	0.16	0.020		19
Beer (Lager)	4.3	125	84	0.65	0.41		1.7
Sweet cider	3.3	120	89	0.14	0.085		1.8
Milk (cow)	6.6	180	135	8.5	0.92		2.7
Whey (Swiss cheese[1])	6.4	56	50	1.1	-		1.0
Cream (cow)	6.7	1,104	565	3.15	0.71		11.3
Whey-cream (cow)	6.3	1,024	593	1.81	0.29		11.9
Jogurt	4.1	220	195	13.4	1.9		3.9
Egg (without shell)	7.5	490	350	46	4.0		7.0
Wine (Beaujolais)	3.1	320	155	0.17	0.076		3.1
Blood (pig)	7.7	270	110	14.2	0.17		2.2

The biological equivalents are calculated using the Swiss basis of 50 g BOD5/day determined in settled sewage.

1) Note, for making Swiss cheese, milk is diluted with 10% water prior to precipitation

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