Organic Loadings and Impacts on Wastewater Treatment Plants from Food Grinder Waste

Prepared by: Frank Nkansah-Boadu, UBC Sustainability Scholar, 2017

Prepared for: Sarah Partanen, Project Engineer, Source Control group, Liquid Waste Services and Linda Parkinson, Program Manager, Source Control group, Liquid Waste Services, Metro Vancouver

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Executive Summary

Food waste disposers (FWDs), also known as food grinders, are used for the disposal of food waste by some residents in the Metro Vancouver region. According to a detailed food characterization study conducted by Metro Vancouver in 2014, about 46% of households have FWDs out of which 44% use their FWD on a daily basis. The provincially approved Integrated Liquid Waste and Resource Management Plan requires Metro Vancouver to investigate the implications of the use of domestic FWDs. The Integrated Solid Waste and Resource Management Plan encourages source separation of organics and the highest and best use of organic material. In 2015, Metro Vancouver introduced the Organics Disposal Ban to target organics for recycling and energy recovery to reduce the disposal of organic materials to landfill.

The purpose of this study was to determine the additional organic loading (Biochemical Oxygen Demand and Total Suspended Solids) that FWDs contribute to the wastewater treatment system in the Metro Vancouver region.

This experimental study was conducted by preparing different samples of food based on information provided by a subset of Metro Vancouver residents participating in the "Love Food, Hate Waste" food waste study (Metro Vancouver, 2014). The residents indicated in their food diaries what and how much they disposed of using food disposers. The food samples were ground using an Insinkerator Badger 5XP, which is a best-selling FWD in North America. A standard amount of water (12 litres per kilogram of food waste) (Thomas 2011, Marashlian and El-Fadel 2005) was used to grind each food sample. The ground food waste slurries were analyzed to characterize the different organic constituents: total suspended solids (TSS), total and soluble chemical oxygen demand (tCOD and sCOD) and total and soluble 5-day biochemical oxygen demand (tBOD and sBOD). The results show a range in all the parameters measured for all the food samples as shown in Table 1. This may be attributable to the range of compositions of food included in each of the samples.

Table 1: Results of this study

	sCOD, mg/l	tCOD, mg/l	sBOD, mg/l	tBOD, mg/l	TSS, mg/l
Mean	7497	26875	3685	9943	10192
Standard Deviation	1168	7263	933	2321	2294
Minimum	5769	17675	2353	6319	6044
Maximum	9817	43568	5495	15450	14257
Median	7335	25977	3714	2321	10427

Most of the average values determined in this study fell within the range reported in other literature as shown in Table 2 below. The exception to this is the TSS, which is an order of magnitude higher than the values reported in the reviewed literature. Limited comparable studies have been conducted to date and most of these studies were conducted in different parts of world.

Table 2: Comparison with other studies in the literature.

Study	sCOD, mg/l	tCOD, mg/l	sBOD, mg/l	tBOD, mg/l	TSS, mg/l
Marashlian and El-Fadel (2005)				7042	1537
Thomas (2011)	7895	18500	4084	8370	1781
This study	7497	26875	3685	9943	10192

The variation in the values for the various parameters indicates that the effect of FWDs depends to a large extent on the type of food grinded. Food waste composition is dependent on factors such as culture and diet. This reinforces the value of conducting the current study with region-specific data.

Determining the s- and tBOD and s- and tCOD enabled the organic load contributed by FWDs to primary and secondary treatment plants to be estimated. The sBOD and sCOD fraction is of particular interest because of the effect on primary treatment plants in Metro Vancouver (Lions Gate Wastewater Treatment Plant and Iona Island Wastewater Treatment Plant), which cannot remove the soluble organics. Allowing the ground mixture of food and water to sit for approximately 16 hours gave an indication of the effect of travel time to the treatment plant on the sBOD concentration contributed by ground food waste. The sBOD concentrations measured for the two samples left sitting for 16 hours were 4905 mg/l (standard deviation 120 mg/l) and 5375 mg/l (standard deviation 120 mg/l) respectively. These results were among the highest sBOD concentrations measured. These results indicate that there may be an increase in solubilisation of organics by the time the ground food waste slurries reach the treatment plants. As this may have consequences for the primary treatment plants in the region, it is recommended that the relationship between solubilisation of organics and travel time be studied further.

The study recommends that additional data should be collected to investigate the effects of FWDs on the wastewater treatment plants in the Metro Vancouver region. Other parameters, such as fats, oils, and grease (FOG), total solids, volatile solids, and nutrients should be determined to provide a holistic picture of the effects of FWDs on the waste water treatment system. In order to test the effect of time on BOD and COD solubilisation, the length of time that the food waste slurry sits should be recorded systematically. A profile of sBOD and sCOD versus time left sitting could then be developed. A settlement test is also recommended to determine the proportion of easily settleable solids present in the food waste slurry, as this may have impacts on the wastewater collection system.