EFFECTS OF RESIDENTIAL FOOD WASTE DISPOSERS ON MUNICIPAL WASTEWATER AND SOLID WASTE MANAGEMENT

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INTRODUCTION

Disposal of putrescible solid wastes remains a challenge for municipalities and local authorities. Decomposing wastes breed odors, attract vermin, are costly to collect, transport and process, and, if disposed of in landfills, generate leachate, organic compounds, some toxic, and large quantities of global warming gases. Most municipalities have sought to reduce this burden by encouraging use of kitchen food waste disposers (FWD), integrating treatment of food and sewage solids. In most of the United States, the proportion of food waste in the municipal solid waste (MSW) stream has decreased over the period 1960 to 1994 from 13.9% to 6.7% of the MSW collected[1]. This is attributed more to the growing use of food waste disposers than to the increase in non-organic waste[2]. However some municipalities are accompanying use of FWDs with separate collection of food wastes or mixed waste processing to produce a biosolid for land application. Moving in a different direction, recently, two wastewater treatment agencies have adopted policies restricting use of FWDs by commercial food establishments.

CHARACTERISTICS OF FOOD WASTE DISPOSERS

FWDS are used to dispose of food wastes in about 45% of U.S. households[3]. On average, the in-sink appliances grind about half of the 0.30 lbs/capita/day of wet food waste generated in a typical household, leaving 0.15 lbs/cap/day of food waste, 70% of which is water[4], to be added from the FWDs via the collection system to wastewater treatment plants (WWTPs) where they add 0.05 lbs/capita/day of food solids to sewage solids. The remaining 0.15 lbs/cap/day of wet food waste are added to MSW.

USING WASTE WATER COLLECTION SYSTEMS TO COMPOST FOOD WASTES

In 1996, the New York City Department of Environmental Protection, with the participation of the NYC Department of Sanitation, undertook a study of the impact of allowing citywide residential use of FWDs on all aspects of the waste water treatment system and the environment[5]. It was based on measurements of the discharges of three sets of comparable buildings, with and without installation of FWDs. It was found that food solids would increase the typical daily per/capita total suspended solids by .047 lbs/cap/day. The combined sewage and FWD solids are dewatered to 25% solids, producing biosolids that may be further processed into compost, pellets, or other form, or be transported directly for land application[6]. The value of biosolids to enrich arid soils helps to offset the cost of transport and processing. Some products, i.e. Milorganite of Milwaukee have a well-established commercial value for fertilizer.

COMPOSTING FOOD WASTES VIA SEPARATE COLLECTION

The alternative approach to managing food wastes is to collect them separately as solid waste and process them into compost. Some organizations (e.g. Walt Disney World at Orlando, Florida) and municipalities, have responded to state mandates to increase the percentage of MSW that is recycled by shifting food wastes from the wastewater stream to MSW in order to be able to get credit for the MSW converted into compost. Major food generators, like restaurants, are encouraged or directed to replace in-sink disposal of food wastes with segregation and separate collection of food wastes.

When municipalities have ample land area for open composting, remote from public exposure to odors and scavenging birds, as is the case in Disney World, the open compost process is less expensive than the cost of siting, building and operating in-vessel composting. A recent study reported in-vessel compost costs of $16.60/100 kg of food wastes for a medium-size city, (Madison, WI) with transport demands of 66 miles per day[7]. The Compost produced by either method, like other biosolids, is used to enrich soils.

Two cities represent the range of waste management approaches to food solids. Based on reported data from Orlando that showed lower BOD and SS after removing FWDs from restaurants, the City of San Diego issued a recommendation for the removal of in-sink commercial FWDs from food waste generating establishments[8]. In contrast, the City of Philadelphia promulgated the so-called "Dumpster Law" that requires all generators, including restaurants, using dumpsters in excess of one cubic yard to obtain a permit, and to install garbage disposals[9]. Both San Diego and Philadelphia are coastal cities with equal pressures to maintain harbor water quality. While the premise of the San Diego program is the estimate that BOD and SS can be reduced as much as 30% by eliminating FWDs, officials in Philadelphia and the Pennsylvania Department of Environmental Protection report that the use of FWDs in Philadelphia households and restaurants has never been regarded as compromising either wastewater treatment or receiving water quality[10]. Similarly, Chicago, Minneapolis/St. Paul, and Boston have responded to inquiries, and have not expressed any concern for adverse effects from the use of FWDs.

EFFECTS OF USE OF FWDs ON RECEIVING WATERS

After 16 years of banning FWDs in areas of New York City served by combined sewers, due to fears of effects on harbor water quality and sewer maintenance, the New York City Department of Environmental Protection (NYC DEP) was directed by the City Council to conduct a pilot study at three representative sites[11]. The study, which took place at three sets of comparable residential buildings over a period of 21 months, is probably the most exhaustive one of its kind, examining the impacts on all aspects of wastewater treatment.

The New York City study concluded that after 35 years, when 38% usage was predicted to be attained, the effectiveness of the combined sewer overflow (CSO) control system will be sufficient to cause a *de minimis* reduction of dissolved oxygen (DO) in harbor waters, most likely 0.12 mg/l, which is marginal compared to the state minimum DO standard of 4.0 mg/l. In the most constricted part of the harbor, 38% usage could result in BOD and SS increases of 5% and 2% to CSO discharges, respectively, with a maximum local reduction of dissolved oxygen content of 0.07 mg/l, considered to be *de minimis* compared to a summer minimum harbor survey DO of 3.5 mg/l. This finding is consistent with the experience of cities that have had both a high usage rate of FWDs, and high standards of harbor water quality. For example, the Director of Water Quality for the State of Massachusetts reported that in his opinion, solids from FWDs would not impair Boston's ability to meet state water quality standards[12].

For those waterways where nutrients pose a problem, nitrogen in food wastes can be reduced by the same nitrogen control measures that will be employed to remove nitrogen from sanitary wastes.

EFFECTS OF FWDs ON SEWAGE SLUDGE QUALITY

The quality of biosolids is affected by composition of various waste streams. The New York City study conducted extensive physical and chemical analyses of solids discharged in the effluent from pairs of buildings, as closely matched as possible; where a significant percentage of dwellings in one building were equipped with FWDs with none in the control building. The differential in heavy metal concentrations was so low as to be deemed immaterial for further study. Some municipalities rely on the low metal content of food waste to dilute the concentrations of metals in sludge due to sanitary wastewater, bringing them down to an acceptable level for land application. A comparison of metals in a compost prepared for separately collected food wastes, with metals in New York City wastewater sludge showed that the metal concentrations in food waste were consistently an order of magnitude lower than in the sewage sludge[13]. In Los Angeles County, the official in charge found that for the part of its total output of sludge that was composted, the addition of ground food waste was an essential ingredient for successful composting[14].

COST COMPARISON OF FOOD COMPOSTING TO UTILIZATION OF SEWAGE SLUDGE WITH ADDED FWD EFFLUENT

The costs of these two systems have been analyzed in comparison to Publicly Owned Treatment Plants (POTW) that represent the high and low end of POTW costs. One, based on Madison WI experience, arrives at a life-cycle incremental POTW cost of $04.44/ ton of food wastes.[15] In New York City, where all POTW costs are higher, including electricity, sludge processing and disposal, and where additional capital investment is needed systemwide to provide adequate retention time for sludge digestion and to reduce nitrogen from all effluent, the incremental cost of food solids is considerably higher. Based on the NYCDEP corrected annualized operating and capital costs for the most likely scenario, to process food solids from 28% of households with increased aeration nitrogen controls, the cost in 1997 dollars can be calculated at $116/ton of food waste processed[16]. The net agency cost to New York City would be reduced further to $66/ton, accounting for the reduction in solid waste landfill costs proportional to the reduction of food waste in MSW. No credit was assumed for reduced collection or transfer costs, or for higher future waste export costs. Neither do these costs account for the avoided social and environmental costs of vehicular transport of a waste stream that is 70% water by weight. Added public agency savings can result from reducing the frequency of collection costs due to lower putrescible content. Los Angeles attributes its once a week collection of MSW to the low food content of refuse due to the almost universal use of FWDs.

In comparison, the cost of collecting and composting food waste has been estimated for a city comparable to Madison, WI, at a total of $153.75/ton[17]. This is consistent with 1991 estimate in the NYC Solid Waste Management Plan of $197/ton for separate collection of food wastes and in-vessel composting[18].

In view of these comparative attributes, and the legalization of FWDs in New York City in 1997, the NYC Department of Sanitation has revised its Solid Waste Plan. In its most recent draft submitted to the City Council, April 8, 1998, it was stated that the use of FWDs will "...have a positive impact on City residential waste management as their installation and use increases over the long term...in addition, garbage grinder use would result in significant savings in the City's costs over the long term for exporting solid waste after the closure of Fresh Kills landfill in 2001"[19]

Another consideration is the quality of solid waste that is collected and transported. Reduced putrescible content of MSW will attract less vermin in households and on the street, cause less odor from trucks and transfer stations and when landfilled will generate less organic emissions, carbon dioxide and methane, and leachate.

CONCLUSION

Overall, the widespread use of FWDs represents a more reliable and cost-efficient method of recovering and converting food wastes to compost, by utilizing existing wastewater and collection and treatment system, than by difficult-to-implement and maintain separate collection of food wastes for processing. Taking food wastes out of the MSW stream lessens emissions to the atmosphere by reduced vehicular transport of water-laden putrescible waste, and less decomposition of wastes in a landfill that generates toxic and organic compounds and global warming gases.

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