

DIAGNOSIS OF WATER CONSUMPTION IN TRADITIONAL CHINESE RESTAURANTS

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ABSTRACT

The catering industry in Hong Kong has been expanding rapidly in the past decade to become a significant segment of the hospitality sector in the city. Considering all restaurant-types available in the country, Chinese dim sum restaurants have the largest numerical count in Hong Kong. A major concern in the Chinese dim sum restaurant sector over the recent years has been the diverse and harmful forms of pollutants which accompany the food production process. Notably, Chinese restaurants are believed to consume more water and produce more sewage than restaurants serving other cuisines (Deng and Burnett, 2002). This study investigated the water consumption pattern of Chinese dim sum restaurants in a case study. Both qualitative and quantitative data from primary and secondary sources were collected. Results show that the dish washing section used the most amount of water (48%). The factors which affect the extent and nature of water consumption in local dim sum restaurants were also identified. It was found that the number of patrons was the chief determining factor with regard to the volume of water consumption in local Chinese restaurants. The gross floor area and operating hours of the restaurant also had an effect on total water consumption. Subsequent to analyzing water use patterns and identifying potential water abuse, some recommendations were made to industry practitioners. By reducing water consumption and sewage generation, the water charge, sewage charge and trade effluent surcharge of a restaurant can be cut down. Restaurant operators can therefore benefit from reduced operating expenses.

Keywords: Water, Consumption, Chinese, restaurant

INTRODUCTION

The catering industry in Hong Kong has been expanding rapidly in the past decade to become a significant segment of the hospitality sector in the city. As a very popular Asian tourist city, Hong Kong has earned its well-known reputation as one of the most notable “*gourmet paradises in the world*”, proffering a local cuisine which is famous for its exotic blend of Eastern and Western flavours (HKTB, 2007).

Considering all restaurant-types available in the country, Chinese dim sum restaurants have the largest numerical count in Hong Kong, making up 13% of the local restaurant industry in 2004 (FEHD, 2005; CSD, 2007). The term “dim sum”, which first appeared in the Tang Dynasty, generally refers to all common Chinese-style snacks. There is a wide range of Chinese dim sum dishes available in local Chinese restaurants. They are prepared by steaming, and some of them are prepared by pan-frying and deep-frying. Dim sum is one of the most common food choices of local people for breakfast and lunch. A survey conducted in 2003 found that about 13% of the respondents reported having Chinese dim sum as their breakfast at least twice per week, and around 18% reported having lunch in Chinese restaurants at least twice a week (Chung, 2003).

A major concern in the Chinese restaurant sector over the recent years has been the diverse and harmful forms of pollutants which accompany the food production process (Deng & Burnett, 2002; EMSD, 2005; Lee et al., 2001; Ming Pao, 2005, 2006; Su, 2005). Notably, Chinese restaurants are believed to consume more water and produce more sewage than restaurants serving other cuisines (Deng and Burnett, 2002). Poor sewerage systems account for the damage caused by major pollutants which inevitably follow the washing of food ingredients, the cooking processes, the washing up of utensils and the cleaning of kitchen floors after cooking. Effluents from these restaurants typically contain heavy metals, pathogens, preservatives and other chemicals (EPD, 2004). When the effluent is discharged into the river system, it may cause poisoning in aquatic organisms and human beings.

More important is that restaurant sewage generated by its daily kitchen activities contains greasy stuffs – fats, oils and greases (FOGs). These substances are basically triglycerides consisting of straight-chain fatty acids attached, as esters, to glycerol. The fatty acids may differ in chain length, may be saturated or unsaturated, and may contain an odd or even number of carbon atoms (Wakelin and Forster, 1997). According to EPD (1996), restaurants and the food processing industry are the main sources of wastewater with FOGs. The FOG concentration of a restaurant’s effluent depends on the menu, and the types of cooking fats and oils used in the kitchen. When these substances accumulate in the drainage pipe, the drainage system may be blocked. Overflows, offensive odours and an unhealthy environment are possible consequences.

Objectives

Eco-awareness is gaining momentum across the world. The tightening of government regulations, as well as the increasing “green demand” from customers, are the major driving forces. Given the environmental impacts of sewage generated by Chinese dim sum restaurants, this study seeks to conduct an investigation into the water consumption and sewage generation processes of Chinese dim sum restaurants. The main research objectives of this study were to:

1. Document/determine the volume and pattern of water consumption in local Chinese dim sum restaurants;
2. Identify factors which affect the extent and nature of water consumption in local dim sum restaurants; and
3. Suggest ways to reduce the volume of water consumed by kitchens in local dim sum restaurants.

METHODOLOGY

A case study approach was used. Quantitative and qualitative data were collected from both primary and secondary sources. According to Yin (2003), the case study is the preferred strategy when the focus is on a contemporary phenomenon within some real-life context. A non-random convenience sampling method was employed. The selected dim sum restaurant was located in a large-scale shopping mall at Kowloon Bay. It started operation in June 2007 and operates 13 hours a day, from 11am to 12 midnight, with a seating capacity of around 600 persons.

Archival records of the restaurant's water bills from October 2007 to March 2008 were collected for analysis. Additionally, the water consumption pattern of the selected restaurant was observed and recorded by field measurements over a period of 4 months (from December 2007 to March 2008). This was achieved by the installation of water flow meters in different functional zones in the restaurant as listed in Table 1. These meters measured the volume of water used by a particular functional zone, and a regular log was kept after reading the meters

Table 1: Water Flow Meters Installed

	Location	Functional Zone
1	Steaming machine	Dim Sum section in kitchen
2	Cold water thawing station	Dim Sum section in kitchen
3	Hot running water near stoves	Frying wok station in main kitchen
4	Cold water thawing station	Barbeque section in kitchen
5	Soup and sauce making station	Main kitchen
6	Sauce making station	Barbeque section in kitchen
7	Dish washing section	Dish washing section
8	Hot drinking water machines	Front-of-the-house area

Complementary to the quantitative data collected by field measurements, some qualitative data were collected via interviews. The respondents of interviews

comprised personnel from different hierarchy levels, including restaurant owners, managers, engineers, chefs and operation staff. In addition, the researcher took the role of a complete observer and scrutinized the daily operation of the restaurant.

RESULTS

Water Consumption Patterns in a Chinese Dim Sum Restaurant

In Hong Kong, local water tariffs comprise three components, namely water charge (WC), sewage charge (SC) and trade effluent surcharge (TES). WC and SC are applicable to all water accounts, while TES is only for the business sector. From the restaurant archival records, it was found that the average monthly WC, SC and TES for the last six months were HK\$8 924, HK\$1 999 and HK\$7 196 respectively. The average monthly water bill is HK\$18 119 in total.

Figure 1 presents the variation in water consumption by the restaurant in the past 6 months. On average, the restaurant consumed 2 379.5 m³ of water per month, i.e. 77.6 m³ of water per day. From December 2007 to February 2008, the volume of water used was higher than the other months. The increase in water consumption could be explained by the increase in the number of patrons because this period was the peak season for Chinese restaurants when many local citizens dine out to celebrate traditional festivals such as Christmas and the Chinese New Year.

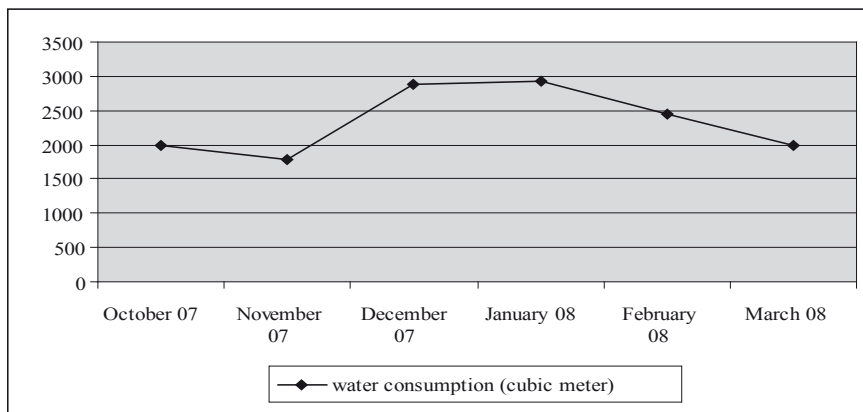


Figure 1: Monthly Water Consumption

The breakdown of water consumption by different functional zones is shown in Figure 2. The dish washing section accounted for almost half of the total water consumption in the kitchen (48%). The cold-water thawing stations in the barbeque section (17%) and dim sum section (10%) were second and third respectively. The two cold-water thawing stations made up 27% of the total water

consumption On the other hand, the proportion of drinking water for guests was not significant.

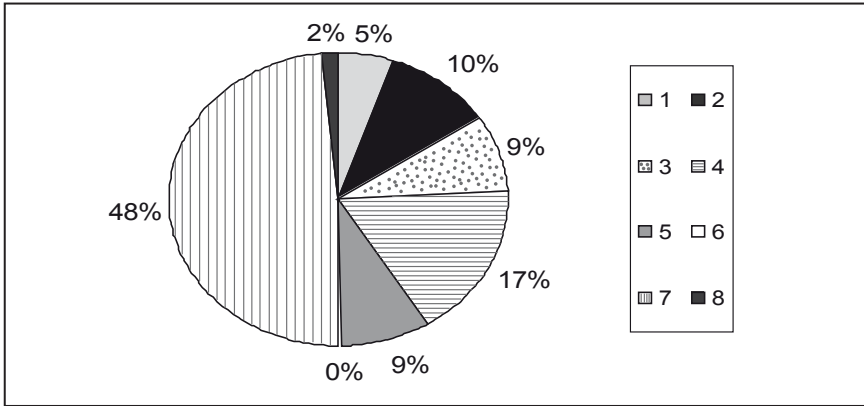


Figure 2: Water Consumption in Different Functional Zones

The average volumes of water consumed on weekdays and weekends were compared in Table 2. Water used on weekends was apparently more than that on weekdays. According to the Chief Engineer of the restaurant, the number of patrons was the determining factor with regard to the volume of water consumption in local Chinese restaurants. Given the higher level of patronage on weekends, this appears to be a legitimate reason why water usage was significantly higher on weekends compared to weekdays. However, the Chief Engineer added that apart from the number of patrons, the gross floor area and the operating hours of the restaurant might also have an effect on total water consumption.

Table 2: Water consumption figures

	Weekday ^a Avg (m ³ /day)	Weekend ^b Avg (m ³ /day)	Overall (m ³ /day)	Percentage (%)
1	3.62	3.92	3.88	5%
2	7.74	7.78	7.76	10%
3	6.88	7.02	6.98	9%
4	12.98	13.22	13.19	17%
5	0.17	0.20	0.19	0%
6	6.75	7.00	6.98	9%
7	36.99	37.92	37.25	48%
8	1.46	2.02	1.55	2%
Total	76.59	79.08	77.6	

a – weekday: Monday to Friday

b – weekend: Saturday and Sunday

Water Consumption Features of Chinese Restaurants

Findings from interviews and observations revealed that the unique features of commercial Chinese cooking and serving raised the level of water consumption particularly, and these features are explained below.

- **Cold-water thawing**

Cold-water thawing” is a unique preparation procedure in commercial Chinese cooking in which food stuffs, such as dried shark fins, frozen meat, chicken feet and seafood, are placed under running tap water, and thaw until they became defrosted and tender. By doing so, the unwanted tastes of frozen food ingredients are expelled and impurities are removed (Chan and Au, 1998). However, if the thawing time is not well-controlled, it tends to cause wastage of water. In order to minimize water wastage, the Head Chef of the studied restaurant said they would not carry out cold-water thawing unless it was necessary. Defrosting would be done by leaving frozen food at room temperature. Only shrimps, prawns and scallops would be thawed by cold water.

- **Hot water supply at the frying wok station**

The other unique preparation was found at the frying wok station (Figure 3). Hot water from a running tap was collected in a small pot which was placed next to the stove. The hot water in the pot was used for cooking and washing. During peak hours, the chefs often kept turning the tap on, so that hot water could be supplied consistently. However, it was observed that the chefs sometimes forgot to turn the tap off after peak hours, resulting in water wastage.

- **Tableware for dining**

In the dish washing section of Chinese restaurants, used tableware is treated by a high pressure water shower first. This process helps to remove the leftovers on the tableware. However this is also the most water consuming step. Then the tableware is immersed in water with detergent in order to remove the grease. Finally the tableware is sterilized in the dish washing machine.

Dim sum is served in small portions, i.e. three to four pieces per dish usually which increases the use of tableware in dim sum restaurants. In addition, many utensils are provided to the patrons on the dining table. According to the Restaurant Manager, a standard table setting for a patron includes a pair of chopsticks, a chopstick holder, a spoon, a small bowl with an underplate, a tea cup with an underplate, and a sauce dish. For some high standard Chinese restaurants, the bowls and underplates are changed after each course. The dish-washing section load is thus very high.

RECOMMENDATIONS

Dish washing section

In order to reduce the load of the dish washing section, it is suggested that only necessary tableware should be provided to patrons. Provision of underplates and chopstick holders may not be essential. It is also suggested that the leftovers on used plates can be removed by hand instead of high pressure water showers. Then these plates can be washed by recycled water from the last rinse in the dish washing section.

Cold-water thawing

As mentioned above, cold-water thawing is a unique water consuming process in commercial Chinese cooking. In order to cut down the volume of water for cold-water thawing, it is suggested that a thawing machine can be installed, which can save around 50% of the water used for thawing. The Chief Engineer disclosed that a thawing machine costs around HK\$20,000 and the manufacturer could offer, a “profit-sharing scheme” if the restaurant was unable to pay the initial cost. There are different models of thawing machines of varying size and capacity which can suit the needs of a particular restaurant. The maintenance cost is low, and the in-house engineers can fix most of the malfunctioning problems of the machine.

Apart from thawing machines, an “environmentally-friendly cold-water thawing method” (Leung, *et al*, 2005) was also advocated recently. A stainless steel rack is placed at the upper part of a large container and frozen food stuffs are spread evenly on the rack and immersed in water. Unlike traditional cold-water thawing, water is injected from the bottom of the container. This can increase the efficiency of thawing. Previous experiments showed that up to 90% of water could be saved by employing this method. More importantly, this method is cheap and easy to operate in most commercial kitchens.

CONCLUSIONS

This article first presented the water consumption pattern in local Chinese dim sum restaurants. Dish washing and cold-water thawing are the two production procedures that use the most amount of water. The identification of potential areas for improvement aids the development of amelioration strategies, as well as subsequent legislative requirements and policies. It is also found that the number of patrons is the determining factor of water consumption in the selected restaurant. Subsequent to analyzing water use patterns and identifying potential water abuse, some recommendations were made to industry practitioners, such as adoption of environmentally-friendly thawing methods, use of dish washing machines, and installation of flow regulators in guest toilets. By reducing water consumption and

sewage generation, the water charge, sewage charge and trade effluent surcharge of a restaurant can be cut down. Restaurant operators can therefore benefit from reduced operating expenses.

The volume of relevant data continues to accumulate as the field measurement is still being conducted and will continue for another two months. These data will be used to establish the base load volume and Water Use Index (WUI) for local Chinese dim sum restaurants later. It is hoped that the base load and WUI would become an industry norm which can aid the benchmarking of the performance of different restaurants.

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