



# Generation and collection of restaurant waste: Characterization and evaluation at a case study in Italy



Fabio Tatàno\*, Cristina Caramiello, Tonino Paolini, Luca Tripolone

DiSPeA – Department of Pure and Applied Sciences, Environmental Section, University of Urbino “Carlo Bo”, Campus Scientifico “E. Mattei”, 61029 Urbino, Italy

## ARTICLE INFO

### Article history:

Received 15 July 2016

Revised 14 December 2016

Accepted 15 January 2017

Available online 30 January 2017

### Keywords:

Composition

Customer equivalent person

Interception rate

Separate collection

Restaurant waste

Unit generation

## ABSTRACT

Because restaurants (as a division of the hospitality sector) contribute to the generation of commercial and institutional waste, thus representing both a challenge and an opportunity, the objective of the present study was to deepen the knowledge of restaurant waste in terms of the qualitative and quantitative characteristics of waste generation and the performance achievable by the implementation of a separate collection scheme. In this study, the generated waste was characterized and the implemented separate collection was evaluated at a relevant case study restaurant in a coastal tourist area of Central Italy (Marche Region, Adriatic Sea side). The qualitative (compositional) characterization of the generated total restaurant waste showed considerable incidences of, in decreasing order, food (28.2%), glass (22.6%), paper/cardboard (19.1%), and plastic (17.1%). The quantitative (parametric) characterization of the generated restaurant waste determined the unit generation values of total waste and individual fractions based on the traditional employee and area parameters and the peculiar meal parameter. In particular, the obtained representative values per meal were: 0.72 kg meal<sup>-1</sup> for total waste, and ranging, for individual fractions, from 0.20 (for food) to 0.008 kg meal<sup>-1</sup> (for textile). Based on the critical evaluation of some of the resulting unit waste generation values, possible influences of restaurant practices, conditions, or characteristics were pointed out. In particular, food waste generation per meal can likely be limited by: promoting and using local, fresh, and quality food; standardizing and limiting daily menu items; basing food recipes on consolidated cooking knowledge and experience; and limiting plate sizes. The evaluation of the monthly variation of the monitored separate collection, ranging from an higher level of 52.7% to a lower level of 41.4%, indicated the following: a reduction in the separate collection level can be expected at times of high working pressure or the closing of a seasonal business (typical for restaurants in tourist areas); and the monthly variation of the separate collection level is inversely correlated with that of the unit generation of total waste per meal. The interception rates of the different restaurant waste fractions collected separately presented a ranking order (i.e., 96.0% for glass, 67.7% for paper/cardboard, 34.4% for food, 20.6% for metal, and 17.9% for plastic) similar to the order of efficiencies achievable at both small and large urban levels. Finally, the original concept of the customer equivalent person ( $P_{ce}$ ) was introduced and behaviorally evaluated at the case study restaurant, providing the values of 0.42 and 0.39 kg  $P_{ce}^{-1}$  day<sup>-1</sup> for the food waste generation and the landfilling of biodegradable waste by the customer equivalent person, respectively. These values were compared, respectively, with the food waste generation per person at the household level and the landfilling of biodegradable waste per inhabitant at the territorial level.

© 2017 Elsevier Ltd. All rights reserved.

## 1. Introduction

According to the regulative strategy at the European level (Directive 2008/98/EC), the sustainable approach to waste management should be based on an integrated, hierarchical system with the following priority order: prevention, reuse, recycling,

energy recovery, and final disposal. Putting this integrated system into practice plays a central role in the recently planned efforts to favor the transition towards a more circular economy (European Commission, 2015a). Within the mentioned system for integrated waste management, the implementation of separate collection represents a fundamental condition for fostering high quality and quantity recycling (European Commission, 2015b), thus permitting an important contribution to waste minimization (OECD, 1998).

\* Corresponding author.

E-mail address: [fabio.tatano@uniurb.it](mailto:fabio.tatano@uniurb.it) (F. Tatàno).

Indeed, a comprehensive perspective of sustainable and integrated management should consider all waste (European Commission, 2015a), not only limited to the majority that is generated by households but also considering the non-negligible contributions of commercial and institutional waste, which includes restaurants as a significant waste generation source (Hogan et al., 2004; Christensen and Fruergaard, 2010). Based on business classification, restaurants represent a division of the hospitality sector, which, in most parts of the world, is recovering after the 2008 global economic crisis with growth expected in the next few years (Pirani and Arafat, 2014). In general, restaurants can be diffused throughout countries (Draper/Lennon, Inc. and Atlantic Geoscience Corp., 2001), and can thus be seen as a particular type of territorial proximity service for customers (FIPE, 2011). Considering some indicative analyses available on food consumption patterns in Italy (Leclercq et al., 2009; Monteleone and Dinella, 2009), Austria (Glanz, 2008), and the UK (UK Cabinet Office, 2008), a tendency to eat out of the home more often has been shown, which is synthetically attributable to increasing professional, spatial, and social mobility. Notably, this increase is also accompanied by an increasing interest in the production and provenance of food (with local food in higher demand) and in healthy and quality food options.

In terms of waste management, restaurants represent both a challenge and an opportunity (Draper/Lennon Inc., 2002): the challenge is related to the efforts required to organize measures of waste management at individual restaurant establishments; on the other hand, because of their general diffusion and density over a territory, restaurants may be seen as logical and useful targets for territorially organized and integrated schemes of overall waste management. However, little research (and correlated technical-scientific literature) is available on waste management in the overall hospitality sector, which includes restaurants; instead, references are mainly in the form of reports from different organizations (Pirani and Arafat, 2014). Therefore, it is necessary to increase the knowledge of the qualitative and quantitative characteristics of waste that can be generated at varying types and operating modes of restaurants, which could be used to create data inventories on restaurant waste generation with dual usefulness: (1) in individual restaurant establishments, for reliable planning, implementation, and monitoring of effective prevention and other waste management measures (including the food fraction) (King, 1993; Hollingsworth et al., 1995; Silvennoinen et al., 2012; Drewitt, 2013; WRAP, 2013a); and (2) in territorial areas, including tourist areas (such as those on the seaside), by the responsible service authorities for proper planning and implementation of rational and integrated handling of restaurant waste in the overall municipal waste management systems (Spooner, 1971; Bradley et al., 2009; Purcell and Magette, 2009; City of Chicago, 2010). Moreover, a contextual technical-scientific need is the monitoring of waste separate collection schemes implemented for varying types and operating modes of restaurants. Evaluating, sharing, and comparing experiences of separate collection could provide a basis or even a benchmark for other individual restaurants and local service authorities (Drewitt, 2013) and could place more emphasis on businesses recycling, which is currently not a focus compared to the much higher emphasis on household recycling (Thomas et al., 2006). Finally, a methodological effort is needed to identify, quantify, and evaluate peculiar aspects of the waste behavior ascribable to a suitable concept of person units representing the restaurant customers; this could provide useful indications broadly applicable to the research area of sociological and behavioral investigations in waste management (De Feo and De Gisi, 2010; De Feo and Polito, 2015).

To deepen the technical-scientific knowledge of restaurant waste, this paper addresses an experimental study performed on the characterization of generated waste and the evaluation of

implemented separate collection at a relevant restaurant located in a coastal tourist area of Marche Region (Central Italy, Adriatic Sea side). The case study restaurant, called here “PA” based on the acronym for the Italian denomination indicative of the peculiar use of “blue fish” (a descriptive terminology for oily fish), can be categorized as fast casual restaurant. This type of restaurant is a quality variant of quick (or limited) service restaurants, generally characterized by higher quality of food (which is expected to be fresh, healthy, and hand-crafted), service, and atmosphere and by higher or even complete eat-in ratios compared to the traditional variant of fast food restaurants (Pizam and Holcomb, 2008; Drewitt, 2013; Hitt et al., 2015). The following figures show the significance of quick service restaurants: this sector took priority over other restaurant categories in the US in terms of retail sales (McLaughlin and Gómez, 2015) and in the UK in terms of total meals served per year (UK Cabinet Office, 2008). Moreover, the “PA” case study restaurant represents a relevant example for meeting the aforementioned demand for local, natural, and healthy food options; in fact, the case study is consistent with the renowned Mediterranean diet, especially the regular use of cereals, raw vegetables, olive oil, and the characteristic oily fish (which reduces the risk of cardiovascular disease), accompanied by a moderate intake of wine during the meals served (UK Cabinet Office, 2008; Monteleone and Dinella, 2009; Bach-Faig et al., 2011). Finally, the “PA” case study restaurant, in terms of number of persons employed, falls into the class of small enterprises, which makes a substantial contribution to the food and beverage services sector at the European Union level in terms of shares of sectorial workforce and total value added (Eurostat, 2016).

This study first determined the qualitative (in terms of composition) and quantitative (in terms of parametric unit generations) characteristics of the waste generated at the “PA” case study restaurant during the monitored business season. The critical evaluation of some of the obtained unit generation values highlighted possible restaurant practices, conditions, or characteristics that influence waste generation. Then, the implemented separate waste collection at the “PA” case study restaurant was evaluated during the monitored business season by quantifying performance parameters reflecting also the efficiency levels and improvement margins in the interception of individual waste fractions. Finally, a quantitative evaluation was conducted for the behavior ascribable to a proposed concept of person units representing the customers at the “PA” case study restaurant for food waste generation and biodegradable waste residual going to landfill.

## 2. Materials and methods

### 2.1. Case study restaurant and experimental monitoring period

The “PA” case study restaurant is located in the municipal territory of the sea town of Fano in the upper coastal area of the Marche Region (Fig. 1). The restaurant was established to cook the products from the local fishing fleet. At the time of this study, the restaurant facility included a kitchen area for the on-site preparation and cooking of meals, a dual tray-line serving system, two spacious dining halls for the customers, and an external area with the waste collection bins. Customers had the opportunity, at the lunch or dinner opening times, to arrange the meals in the plate trays based on either a proposed complete menu (detailed in Fig. 1) at a standard, limited price or a reduced menu (also detailed in Fig. 1) at a lower price. After dining, customers were expected to directly place their trays into the trolleys available in the halls. The restaurant staff were in charge of the trays’ extraction from the trolleys, cleaning, and overall management of waste collection at the restaurant facility. During the monitoring period considered

Download English Version:

<https://daneshyari.com/en/article/5756979>

Download Persian Version:

<https://daneshyari.com/article/5756979>

[Daneshyari.com](https://daneshyari.com)