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Short communication

Chemical and sensory characteristics and microbiological safety of fresh finely chopped parsley packed in modified atmosphere

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Abstract

For the determination of the shelf-life of minimally processed finely chopped parsley two assays were performed packing the product under passive and active atmosphere. Quality parameters were assessed for 13–15 d on the samples stored at 5 °C and 90% relative humidity: chemical characteristics, sensory characteristics and gas concentration inside the bags. Microbiological analyses were performed for the samples of the second process. Under the studied conditions parsley packed in passive atmosphere resulted in a better product when compared to the one packed in an active modified atmosphere showing quality and stability for a 6 d period.

Keywords: MAP; Parsley; Safety; Shelf-life

1. Introduction

The inclusion of parsley (*Petroselinum crispum* Miller) in the Portuguese gastronomy is a long lasting tradition. Very often parsley is used finely chopped in the recipes, either incorporated with all the ingredients or added raw, to the finalisation of the recipe for decoration and specific flavour (green salads, cold and hot dishes). The use of parsley in this form, requires a previous preparation of the herb (selection, washing and disinfecting, centrifugation and fine chopping) which is a time consuming task, produces a large amount of waste and difficult the prediction of product quantification, specially in catering. The ideal situation for both final consumers and caterers would be the existence of ready to use finely chopped parsley (minimally processed) to be used as according to the solicitation, leading to an optimisation of food preparations and human resources. Nevertheless, the production of such a product requires adequate processing conditions for the maintenance of the sensorial characteristics of parsley as well as its preservation.

Fresh-cut products, which previously were called lightly or minimally processed products have been available for many years, but the types and quantity have expanded tremendously in the past decades. Initially, the food service industry was the main user of fresh-cut products, but the use has expanded to restaurants, supermarkets and warehouse stores. The food service industry and restaurants favour fresh-cuts because manpower for preparation and special systems to handle waste are not required and specific forms of fresh-cuts can be delivered on short notice. Fresh-cut products are thus convenience foods with the additional benefit of reduced wastage for retail consumers (Watada, Ko, & Minott, 1996).

Fresh-cut products differ from the intact fruit and vegetables in terms of their physiology, handling and storage requirements. Fresh-cut process results in tissue and cell integrity disruption, with a concomitant increase in enzymatic, respiratory and microbiological activity and therefore reduced shelf-life (Watada et al., 1996; O'Beirn, Francis, & Thomas, 1999). This effect might be minimised

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by the use of adequate temperature management and modified atmosphere packaging (MAP). This is a technological process that has shown promise, and had success in the preservation of many fruits and vegetables. MAP involves either actively or passively controlling or modifying the atmosphere surrounding the product within a package made of various types and/or combinations of films (Farber et al., 2003). In parsley some studies have showed that the decrease in pigments was less in leaves held in a Controlled Atmosphere with 10% O_2 and 10% CO_2 then when held in fresh air (Yamauchi & Watada, 1993) and that parsley flavour and aroma were retained better in perforated film packages than in sealed film packs (Manzano, Citterio, Maifreni, Paganessi, & Comi, 1995).

The aim of this work was to evaluate the chemical and sensory characteristics and microbiological safety of fresh chopped parsley packed in modified atmosphere (MAP) in order to determine the shelf-life of this product for it's convenient use by both final consumers and food caterers.

2. Materials and methods

2.1. Samples

A first process was carried out using fresh parsley bought from a local shop in Lisbon, Portugal. In a cleaned room at 15° ± 5 °C parsley stalks were cut; parsley leaves were selected, washed and disinfected with a sodium hypochlorite solution (10% w/v) (100 ppm Panreac), according to Good Hygienic Practices. After centrifugation in a salad spinner for 3–5 min to remove excess of water, parsley was finely chopped in cutting boards with a knife.

40 g portions of the minimally processed finely chopped parsley, were packed in a passive (A1) and in an active modified atmosphere (A2). Active MAP was carried out by flushing a gas mixture of about 88% N_2 + 2% CO_2 + 15% O_2. The gas composition was the recommended by the gas supplier (PRAXAIR, Portugal). An Oriented Polypropylene film bag was used (OPP) (40 μm, with permeability at 23 °C and 80% RH of 20 ml/m^2 24 h atm for O_2 and with permeability at 38 °C and 90% RH of 15 ml/m^2 24 h atm for Water Vapour; THM for vegetables, Krehalon, unpublished data), with a 207 mm × 225 mm size. This film was indicated by the supplier as being recently adopted by the industry for the packaging of vegetables.

Eleven bags from each storage condition, kept at 5 ± 1 °C with 90% relative humidity were assessed for quality parameters for 13 d, at day 1, 3, 6, 9 and 13: gas concentration inside the bags, chemical characteristics (weight loss, colour, exudate and °Brix) and sensory characteristics.

A repetition of the process (A3), separated in time, (second process) was undertaken in order to confirm the results that gave a better preservation tendency only (in this case it was the passive atmosphere) and to make the microbiological evaluation of the samples. For that purpose fresh parsley was again acquired and minimally processed. The stored samples were analysed at day 1, 3, 6, 9 and 15.

2.2. Quality analysis

Gas concentration inside the bags (volume % of O_2 and CO_2) was analysed immediately after the closing of the bags and in each sampling day in duplicate, with a gas analyser (PBI Dansensor, CheckMate 9000).

The *weight loss* was determined in each sampling day by weighting always the same sample of each modified atmosphere.

Colour was measured by reflectance using a colorimeter (Minolta RS 232C, USA), calibrated with a standard tile and observed under the International System L*, a* and b*. Ten measures were performed for each sample.

Exudate determination was performed in duplicate according to Carlin, Ngugen-The, Chambroy, and Reich (1990). Four grams of parsley was placed between two discs of filter paper (Papers Qualitative Circles, 150 mm Ø 1004150) and pressed for 10 s under 10 kg weight. Results were expressed as g of released juice/100 g of parsley.

Soluble solids content was determined individually for each of the samples with a hand-held sugar refractometer model Atago PR-201, with the results expressed as degree Brix.

Sensory quality evaluation procedure was adapted from Jacxens, Devlieghere, Van Der Steen, and Debevere (2001) Jacxens, Devlieghere, Ragaert, Vanneste, and Debevere (2003) and was carried out using a panel of 4–6 trained judges. The first part (organoleptical characteristics as taste, crispness and texture evaluation), odour (off flavour) was judged under red light to exclude interference of visual judgement. Under daylight, the visual characteristics, such as colour, general appearance and general freshness were evaluated. Scores were given from 1 (= excellent fresh) until 10 (= completely deteriorated). The sample was considered as unacceptable for a sensory characteristic when the score was higher than 5 (= just acceptable).

Growth of the most important groups of *microorganisms*, associated with the spoilage of minimally processed vegetables, was followed during the storage of second process experiment only. Fresh parsley was also analysed prior to washing and disinfecting. Twenty-five grams of parsley was weighted aseptically and homogenised in a Stomacher 400 (Steward Laboratory, London, UK) for 2 min with 225 ml of sterile buffered peptone water (BPW, BK). Further decimal dilutions were made with the same diluents. The total number of mesophilic microorganisms was determined on Plate Count Agar (PCA, Oxoid) following the pour plate method, incubated at 30 °C for 72 h. For the detection of faecal coliforms, Violet Red Bile agar plates were used, following the pour plate method, and incubated at 44.5 °C for 24 h. *Enterococcus* were enumerated by plating on Kanamicyn Aesculin Azide agar base (Oxoid) + Kanamicyn selective supplement (Oxoid) following the