Pulsed Electric Fields (PEF) to enhance the desalting of cod

Jessica Genovese[1], Silvia Tappi[2], Urszula Tylewicz[1,2], Santina Romani[1,2], Pietro Rocculi[1,2];
[1]Department of Agricultural and Food Sciences, University of Bologna, Piazza Goidanich 60, 47521 Cesena, ITALY [2]Interdepartmental Centre for Agri-Food Industrial Research, University of Bologna, Via Quinto Bucci 336, 47521 Cesena, ITALY

INTRODUCTION

Salted cod is a highly appreciated product, traditionally imported by Mediterranean countries and commercialised with different moisture content depending on the extension of the drying process. Prior to consumption, the fish must be desalted, and this step could last up to 5 days. This process is usually carried out immersing the product in stagnant water, resulting not only in the loss of salt but also in sample rehydration [1].

Market trends evolve towards ready-to-use products; thus, the cod industry should adapt to consumer requirements including the desalting step among the industrial operations. However, the industrial-scale cod desalting presents many problems mainly linked to long processing times and the quality of the final product. For this reason, many researchers have focused on finding new desalting methods to improve the mass transfer processes, such as the use of vacuum pulses [2], high pressures [3] or high-intensity ultrasounds [4].

The application of pulsed electric fields (PEF) has been proposed as an alternative method to enhance the mass transfer phenomena in many food processes. However, there is no previous literature on the use of PEF to improve the desalting of foods. Therefore, the aim of this work was to evaluate the possibility of applying PEF treatment in cod desalting from the study of mass transport kinetics.

MATERIALS AND METHODS

Salted cod (*G. morhua*) fillets were supplied by a local importer, and prior to desalting experiments, they were manually cut in cubic-shape pieces (2x2x2cm), obtained from the upper part of the fillet, and kept refrigerated at 4 ± 1 °C.

PEF pre-treatments of cod samples were performed using a lab-scale PEF unit (Mod. SP7500, Alintel, Italy), and providing monopolar rectangular-shape pulses at two different current intensities of 10A ($PEF_{(1)}$) and 20A ($PEF_{(2)}$).

The desalting process was carried out in cold tap water (5 ± 0.5 °C) using a ratio of cod:water of 1:10 (w/v).

Weight gain, water activity†, NaCl and water content† were determined at 0, 4, 6, 24, 48, 72, 96,120 and 144 h of the desalting process. Five cod samples were used at each sampling time. The changes in the water and cod electrical conductivity† were also tested throughout the desalting experiments. Changes in water electrical conductivity were registered using a conductimeter (Mod. Basic 30, Crison, Spain), while the electrical conductivity of samples was determined using a precision impedance meter (Mod. LCR-8105G, GW Instek, Taiwan) connected to a needle-probe with a 2 mm gap between electrodes.

RESULTS AND FIGURES

Total weight changes (ΔM^o_t) determined as shown in Eq. 1 (being M^o_t and M^o_0 the cod weight at the sampling time t and 0, respectively) can be observed in Fig. 1.

$$\Delta M^o_t = (M^o_t - M^o_0) / M^o_0 \quad (1)$$

These results show that the application of PEF significantly accelerated the desalting kinetic of samples, although no differences appeared between the two PEF intensities applied.

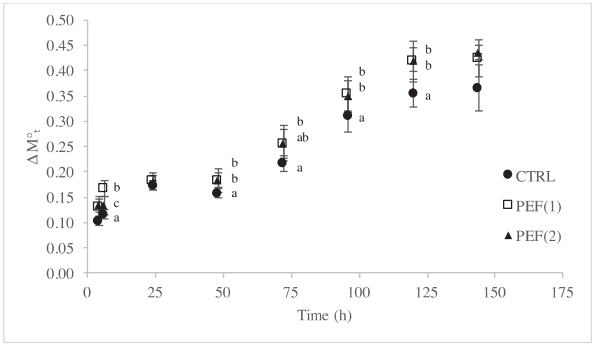

Figure 1: Total weight changes (ΔM^0_t) of untreated (CTRL) and treated samples ($PEF_{(1)}$-$PEF_{(2)}$) throughout the desalting process. Different letters indicate significant differences between the groups ($p<0.05$) (one-way ANOVA).

This preliminary study showed that the application of pulsed electric fields should be investigated further as an alternative method in cod desalting process to decrease this time-intensive industrial operation.

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