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Case study

# Modified atmosphere packaging and irradiation to preserve contemporary food-based art: An experimental study

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ABSTRACT

This paper evaluates the application of modified atmosphere packaging (MAP) and irradiation for preserving contemporary food-based art. Both techniques are used in the food industry for preservation of foodstuffs present in the food chain. An experimental study on the artwork *Eggs* (1997, S.M.A.K.) by the Belgian artist Peter De Cupere was performed. The context for conservation was determined by analysing the production method of the artwork, the artist's intention and the degradation processes of the food materials used. Experimental laboratory studies involved accelerated ageing tests using test samples of the work. From the results obtained specific guidelines to preserve the work were proposed. This study showed that food preservation techniques could contribute to the development of effective strategies for the conservation of perishable contemporary art respecting the overall context.


## 1. Research aims

By introducing the principles of food science and food preservation into the decision-making process for conservation of perishable contemporary art, more insight is gained regarding conservation and presentation possibilities. For the artwork *Eggs* by the Belgian artist Peter De Cupere, which contains raw eggs and baked chicken skin, traditional food preservation techniques such as modified atmosphere packaging (MAP) and irradiation were evaluated to store the artwork. The goal of this study was to discuss and assess the role of food preservation science and technology in the conservation of perishable works with food.

## 2. Experimental

### 2.1. Introduction

The presentation and conservation of food-based art is challenging due to the perishable nature of applied food materials. Degradation processes in such artworks can be of various natures and include physical, microbiological and biochemical degradation. In order to preserve food-based art, knowledge about the behaviour of foods and in particular about food preservation is required. By applying preservation techniques used in the food industry during the storage and/or display of food-based art, the decay of such artworks may still occur but under slower rates and under a more controlled manner.

However, not all preservation methods used by the food industry can be directly extrapolated to the preservation of works of art. Aspects such as safety and organoleptic quality, which are key in food preservation, are not always relevant for art conservation enabling more effective preservation strategies.

In this paper the results of an experimental research (2001)[1] with respect to conservation possibilities for the food-based artwork *Eggs* (1997, S.M.A.K) (Fig. 1), containing raw eggs covered with baked chicken skin, by Peter De Cupere was discussed. For this specific artwork two food preservation techniques contributing in extending the shelf-life of food were evaluated: modified atmosphere packaging (MAP) and irradiation. Therefore replicas of

[1] The experimental research was performed in cooperation with the Museum of Contemporary Art in Ghent (S.M.A.K.) and the Laboratory of Food Microbiology and Food Preservation at The Ghent University (Ugent). It focused on the packing and storing of 3 food-based artworks *Butter and Beeswax* by Joseph Beuys, *Eggs* by Peter De Cupere and *Strange Fruit* by Zoe Leonard. The goal was to explore which preservation strategies taken from the food industry could offer solutions for certain conservation issues in ephemeral artworks. This technical research focused on identifying and monitoring the degradation mechanisms of the food materials used in the artworks. For more information about the results of the application of MAP see [30].

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**Fig. 1.** *Eggs* (1997, S.M.A.K.) by Peter De Cupere.

the artwork were made as test samples, which were subjected to accelerated ageing.

### 2.2. Creating context for conservation

#### 2.2.1. Artist intention

Peter De Cupere made several artworks containing eggs and identifies them with their corresponding smell. When producing his art he generates a meta-sensory experience for which he exploits the subjective and associative impact of smells in combination with visual images [1]. In addition, the artist is especially interested in the metamorphosis of the materials and in the different stages of their transformation [2].

The artwork *Eggs* contains 23 raw eggs, surrounded with baked chicken skin sewed together, laid in a metal egg basket. With this specific work De Cupere is suggesting the presence of a smell, but somehow the artist hoped that the eggs would never break. To evoke the sensory perception of a breaking egg De Cupere tried to visualise the physical degradation of the surrounding chicken skin. According to Huys (head of conservation at S.M.A.K. at that time) degradation processes visible on the baked chicken skin are allowed [3]. After personal communication De Cupere confirmed that the skin is allowed to crack, the threads to lose strength and the fat in the skin to become rancid [2].

Thus the impact of deterioration in this work is of importance at the visual, pictorial and semantic level. In order to preserve the original decaying materials as long as possible, measures to "freeze" the work could be taken in the storage area.

#### 2.2.2. Condition of the artwork and deterioration processes of different parts of the work: raw eggs, baked chicken skin, threads and metal basket

The artwork *Eggs* had suffered some decay since its acquisition in 1997: some of the eggs had broken and the chicken skin, which was dried out, became detached on some places from each other and from the eggs (Table 1). The artist Peter De Cupere agreed to replace the broken eggs by new ones and gave the museum a clear description about the production process [2,3].

**Table 1**
Deterioration processes observed on the artwork.

| Materials | Deterioration | Remarks |
|---|---|---|
| Raw eggs | Some eggs are broken = physical degradation | |
| Baked chicken skin | Skin releases from the eggs<br>Cracking of the skin | After the baking process the skin became dry, because of fat crystallization<br>The skin became brittle due to lipid oxidation (fat) |
| Threads | – | |
| Metal basket | – | |

To determine the sensitivity of the food products to degradation one must understand the sensitivity of these products is to microbial, chemical and enzymatic reactions. Such reactions can be very matrix dependent. Nevertheless, it is possible to identify some generic intrinsic parameters of foods, which enable to predict to some extent their vulnerability to a variety of degradation mechanisms, especially considering microbiological spoilage. These parameters are the acidity value (pH, being the–log (proton concentration) and the water activity [$a_w$]) [4]. pH is expressed on a scale from 0 to 14. It has been established that most microorganisms grow best at values around 7.0 [5]. $a_w$ expresses the availability of water inside a food matrix to support microbiological growth and varies between 0 (no free water) and 1 (pure water). Foods with values in between 0.65 and 0.99 can be subject to microbial spoilage [4].

Before starting the tests on the test samples, values of pH (measured by a pH electrode: Knick pH meter, Berlin, Germany) and $a_w$ (measured with a cryometer: Typ AWK-20 (NAGY messysteme GmbH, Gaufelden, Germany) of liquid egg and the baked chicken skin were measured. The pH of the liquid egg was 6,86 and the $a_w$ was 0,99. Thus it can be concluded that the interior part of eggs are likely to spoil microbiologically, especially because the shell is permeable to microorganisms. The presence of various antimicrobial components in the egg white (lysozyme, which is also used as a preservative in for instance cheese) will slow down microbial growth, but nevertheless after a sufficient amount of time, microorganisms will reach the egg yolk. This will finally result in the production of hydrogen sulphide, a process known as egg rotting [6]. The pH of the baked chicken skin was 6.34 and the $a_w$ was 0.97. The reduced $a_w$ will make the product less sensitive to microbial growth, mainly for some bacteria type [4].

The eggshell is obviously prone to physical degradation (e.g. broken eggs in the artwork) but also to moulding. Moulds can grow on the shell when the relative humidity of the surrounding air is sufficiently high (RH > 50). Upon infestation of the shell, the moulds mycelium will penetrate within the egg white, causing so called mould rot, which is manifested by gelation of the egg white (also known as jelly production) [4].

To produce the test samples chicken with the skin was pan-fried using a significant amount of butter (fat) and spicy herbs (following the production method of the artist) until it was ready to eat. The baked chicken skin was separated from its carcass and then stitched around the raw eggs. The fat crystallized upon cooling [7]. The appearance of the fried and stitched skin became firm because of fat crystallisation. The skin lost water during the frying process and the fat was absorbed. Therefore the $a_w$ value was reduced. As a result of the applied heat, the microorganisms present on the raw skin were also inactivated. Because of moisture uptake however and because of microbiological contamination from the environment during storage of the test samples, the skin can be considered to be microbiologically unstable and is mostly likely prone to moulding