MAP as a conservation method for contemporary art with foodstuffs/ 3 case studies.

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Abstract

This article examines the use of Modified Atmosphere Packaging (MAP), a widely applied preservation method in the food packing industry, for preserving contemporary artworks with foodstuffs. A lot of artworks that use food also appeal to immaterial parameters for which the conservator has to adapt and develop new strategies to conserve those works. The choice of materials and the way in which they are used mostly have important implications for how these pieces must be interpreted, exhibited and how they will change over time and therefore how they are best preserved, or not. This paper presents interdisciplinary research involving art studies and food science that aims to resolve a number of questions relating to the preservation of artworks that contain foodstuffs. The main goal is to analyze these questions systematically on a scientific and multidisciplinary academic basis, taking into account the temporal, ephemeral character of these artworks on the one hand and their material preservation on the other hand and to explore whether and how they can be presented and preserved for future generations. Three case studies are presented for which guidelines are proposed for storing and packing the works in a modified atmosphere environment that can prolong the lifespan of artworks with foodstuffs.

Keywords

Contemporary art, material conservation, food science, modified atmosphere packaging, decision making process, .

0. Introduction

Over the past few years ephemeral art made with food has been causing dilemmas and problems for art institutions and museums. At this point in time, museums exhibit, order, collect and want to conserve these temporary ephemeral artworks. A generally accepted methodology for the conservation of contemporary artworks does not exist. In the meantime artists have been using food creatively in various ways and consequently have been giving different meanings to their materials. The presentation and conservation of contemporary artworks with food is problematic as their inevitable decay is often intrinsic to their meaning. Artists who use foodstuffs realize that such materials are degradable. Some artists treat the foods against degradation (whether or not in cooperation with conservators or scientists), by treating their surface, by adding chemicals, etc. For other artists it is important to replace the foodstuffs in their works on a regular basis. For a lot of artists who use food the decomposition itself is part of the concept of the artwork. For these works conservators can use scientific preservation methods from the food industry. However, scientific preservation methods should be applied with consideration for the concept/meaning of the work of art and the additional impact these preservation techniques can have.

In this paper I will describe some of the results of a scientific research project entitled ‘The Packaging and Storage of Contemporary Artworks with Foodstuffs’ which I conducted in 2001 in cooperation with University College Ghent, Ghent University and the Museum of Contemporary Art in Ghent. The goal of this research was to explore which preservation strategies taken from the food industry could offer solutions for certain conservation issues in ephemeral artworks. This research was predominantly scientific in nature, in that it focused on measuring the degradation mechanisms of three different artworks made from foodstuffs (by Zoe Leonard, Joseph Beuys and Peter De Cupere), by making dummies of them. Modified atmosphere Packaging (MAP), a frequently applied preservation technique in the food industry was researched for the 3 cases. In researching the preservation of food products used in contemporary art, the relevance of the storage of these foods firstly needs to be looked into. Next to their materiality, certain contemporary productions draw on a lot of immaterial parameters for which the conservation specialist has to adapt and develop new value systems. In doing so a compromise needs to be found between the material authenticity and the conceptual authenticity in maintaining all due respect for the work of art (Durand 2009, 13). The search for the most feasible and effective conservation strategy for these artworks can lead us in different directions, depending on the values that are felt to be the most important by conservators and curators during their working practice.

Although not all contemporary artworks with food can be conserved in a material sense, in some cases, it is possible for museums to rely on preservation solutions that have been developed in the food industry. It is interesting at this stage to reflect on the observations and measurements that were carried out and to asses whether and how they feed into actual conservation practice or not. This paper will briefly review the salient findings of the research done in 2001.

The purpose of this paper is to specify storage guidelines for art works (partially) made of foodstuffs.

1. Experimental Methods and Materials

1.1. Modified Atmosphere Packaging

A lot of research in the field of food science has focused on preservation technology. Packing and storing foodstuffs is closely tied with their preservation. MAP may be defined as 'the enclosure of food products in gas barrier materials, in which the gaseous environment has been changed' (Gilman 2001). The gases most commonly used in MAP are CO_2, N_2 and O_2. Different mixtures of these gasses are required for different products. One of the bottlenecks in MAP is defining the optimal gas atmosphere for a food product in combination with a specific packaging design. This optimal atmosphere depends on the intrinsic parameters of the food product (acidity (pH), water activity (a_w), fat content, type of fat) and gas/product volume ratio in the chosen package type. The a_w of a food product is the ratio between the vapor pressure of the food itself, when in a completely undisturbed balance with the surrounding air media, and the vapor pressure of distilled water at the same temperature. It represents the availability of water for microbiological (bio)-chemical transformations. The intrinsic parameters will determine the sensitivity of the product to specific microbial, chemical and enzymatic degradation reactions (Devlieghere 2004, 275-276). But not all preservation methods used by the food industry can be directly extrapolated to the preservation of works of art. In the food industry, organoleptic and safety factors usually play a key role. In the art world on the other hand, other limitations exist and these may vary from case to case. Furthermore, food is often combined with other materials in art, giving rise to new chemical and physical interactions, which may cause yet unknown or only partially documented problems (Gilman 2001).

The use of creating an anoxic environment has been explored in the field of conservation of museum collections. Anoxia has been successfully used for pest management and has functioned for a variety of historic materials (Burke 1996, 3 & Elert 1997, 250). The effects of long-term anoxic storage on works of art on paper and on textiles have been studied (Heath 2010 & Brennan 2008, 748). Methods involving a low oxygen concentration such as the use of vacuum, nitrogen and carbon dioxide infusion, oxygen scavengers, absorbers and/or indicators were applied separately or in combination for the packing of mummies and textiles. Barrier films are mostly applied as packing materials (Brennan 2008, 749 & Maekawa 1998).

For this research project, three case studies were selected, the emphemerality of which had to be conserved. Each case study required an individual approach, but used the same technique as a preventive conservation method.

1.2. Decision-making for Conservation

Conceptual and ephemeral art involving food is prompting conservators to assume an increasingly pivotal role in the museum. They think of the piece over its lifetime, following principles of minimal and reversible intervention and careful documentation, and "wear many hats", including that of the artist, scientist, mediator, ethicist, etc. In setting policies on collection care they determine museum-wide initiatives for storage, display, handling and maintenance (Barker 2006, 86). The Decision-making Model for the Conservation and Restoration of Contemporary and Modern Art, developed by the Foundation for the Conservation of Contemporary Art (SBMK) and the Netherlands Institute for Cultural Heritage (ICN) during the project 'Conservation of Modern Art' (1996-97), illustrates the importance of basic elements in the decision-making strategy for the protection of cultural heritage (Hummelen 1999). In the field of art history the manner in which food in art should be handled cannot be generalized. Its use is not tied to one single trend in art. This confronts us with widely diverse concepts of artworks with foodstuffs. Balancing the primacy of the original material is a frequent intellectual dilemma for conservators. With each treatment, they have to choose how far to take an intervention and how to ascertain what is most important (Van Damme 2006 & Gilman 2006, 169). Each treatment/conservation strategy is a compromise between the material and conceptual authenticity (Gilman 2011).

In order to take a stance on the way in which works of art should be preserved it is important to conduct extensive research into the art history, art theory and art aesthetics of a particular subject. The art historic, theoretical and philosophical terms of reference for this kind of research (into the meaning and interpretation of works of art) are of crucial importance in wishing to know how to preserve a work of art (Gilman 2001).

It is crucial in this respect is to determine the significance of the food products and techniques used, the diversity in production methods and the complexity of the context of those artworks. The main goal is to analyze systematically on a scientific and multidisciplinary academic basis questions about the conservation of artworks that contain food, taking into account their temporal, ephemeral character on the one hand and their material preservation on the other hand and to explore whether and how these artworks can be preserved for future generations (Gilman 2010).

The impact of deterioration is of importance at the visual, pictorial and semantic level. If the deterioration process of the work of art is of key importance and the physical actions of the artist have played a major role in the use of organic materials, the relics should be handled with extreme care. In such cases the relationship between artist and materials has become stronger and more personal. In order to preserve these works of art for as long as possible, measures can be taken in the storage area and, in some cases, during the presentation, without altering the material substance of the exhibit. The extent to which the decomposition process is countered usually depends on the different levels of non-tangible and tacit information (Hummelen 2004).

A. Beuys: Butter and Beeswax, Basic material 4/b (1975, SMAK):

<<fig.1>>

Joseph Beuys pioneered the practice of using organic materials (such as fat), in probing such concepts as warmth, energy and transformation. The problem with Beuys's position on decay, change and damage is that it varies from statement to statement and from piece to piece. Since we are deprived of a reliable stance from the artist himself, collaborative discussions with conservators, curators and the artist's estate can engender sensitive forms of decision-making (Barker 2005).

The artwork 'Butter and Beeswax, Basic material 4/b' was created in 1975 and comprises 4 cardboard boxes with 40 packets of butter in each box and a single pile of 7 staked beeswax plates in a display case. It remained unfinished till the artist's death. This piece is liable to many processes of degradation such as: fermentation of the butter and disintegration of the cardboard in contact with the butter due to fat impregnation, and the production of rancid odors as a result of fat oxidation. Moreover, some parts of the wax plates are broken. All these processes are an integral part in this art piece, however. For Beuys the presence of fat was more important than its form. The decay is considered as being a part of the artwork, which shows the energy proper to the material itself. Stopping this process by carrying out too intensive conservation treatment would kill this evolutionary part of the work. Based on this, any intervention into this work would easily be the subject of criticism, as it might destroy the work both materially and conceptually (Huys 2008). For Beuys the 'patina' of his artwork is an essential element. The Municipal Museum of Contemporary Art (SMAK) in Ghent already consolidated some parts of the piece and wishes to preserve the artwork in relation to the natural decomposition of the object (Huys 2008). Storage in MAP conditions could offer a solution in prolonging the lifetime of the artwork.

B. PDC: Eggs (1997, SMAK)

<<fig.2>>

'Eggs' contains 23 eggs, surrounded with sewed chicken skin, laid in a metal egg basket, which the artist found on a flea market. Peter De Cupere identifies his egg objects and installations with the corresponding smell as attributing meaning to his art. He is in fact suggesting the presence of a smell, but somehow he's hoping that the eggs will never break (De Cuppere, 2001).

This piece of art is liable to decay , some of the eggs are broken and the chicken skin is coming loose from others. The artist's opinion concerning the conservation is not clear. On the one hand, he wants the broken eggs to be replaced by new ones (he gave the museum a clear description about the production process) and on the other hand, he wants degradation processes to be visible (Huys 2000).

Analyzing the changing attitude of the artist and exploring the trajectory of the artwork over the years is very important in making a well-informed decision. At this stage, preventive preservation in storage, which MAP is, is the only way to deal with this artwork.

C. Zoe Leonard: 'Strange Fruit (for David)' (Philadelphia Museum of Art)

Strange Fruit (for David) includes pieces of fruit peel sewed back together with zippers, wires, thread and buttons, and presented several conservation problems. After curator Ann Temkin expressed interest in acquiring this piece of art for the Philadelphia Museum of Art, Zoe Leonard considered employing preservation methods such as a form of chemical treatment that would stop the decay of the organic components without destroying the other materials. After much testing, Ch. Sheidemann developed a solution that consisted of shock-freezing the pieces and then soaking them with the consolident Paraloid B72 under vacuum. Finally, the artist opposed this preservation strategy, feeling that the ongoing process of decay was part of the installation. The museum acquired the piece and presents it intermittently in order to visualize the evolution in decomposition (Temkin 1999, 47). The process of deterioration is documented through photography, which represents an ongoing, diary-like project. For the storage however, they agreed to use optimal storage conditions in order to limit the impact of these periods of dormancy on the life span of the piece of art (Buskirk 2000, 145). It is during storage that preventive conservation techniques, such as MAP, can be useful.

1.3. A Simulation of the Ageing of the Artworks

To simulate the ageing of the artworks a couple of laboratory dummies were made of each piece of art. For the dummies of Beuys and De Cupere works the same materials were used as in the art works (Huys 2008). One of the dummies was stored under MAP conditions while the other was not. Both dummies were stored for 3 to 4 days each in acclimatized rooms, at different temperatures, and under different RH and lighting conditions. The simulated ageing was based on the actual handling during storage, transport (internal and external) and exhibition. The conditions of the acclimatized rooms are described in table 1. Because of restrictions in size (dummies ‘Eggs’) we could not use the same climate chamber for all dummies.

For the Beuys dummy the butter was packed both in a closed and in an open cardboard box and degradation could also be monitored visually throughout the storage period.

<<table 1>>

1.4. MAP Design :

1.4.1. Deterioration Processes of the Foodstuffs

To define the optimal gas atmosphere for the food product in those specific cases, it is important to know what the sensitivity of these products is to microbial, chemical and enzymatic reactions. The intrinsic parameters of these products will determine their sensitivity (Devlieghere 2004, 274). All values are described in table 2.

The a_w and pH of the foodstuffs were measured. pH was measured by a pH electrode (Knick pH meter, Berlin, Germany) and the a_w was checked by using an a_w -kryometer Typ AWK-20 (NAGY messysteme GmbH, Gaufelden, Germany). All media were filter-sterilized (Ø 0.02 µm, Nalge Nunc International, Rochester, USA).

The a_w of a food component is one of the factors influencing the growth of micro-organisms. Gram-negative organisms have a minimum a_w requirement of 0,93 to 0,96 for growth, whereas Gram-Positive non-spore formers can grow to lower a_w’s of 0,90 to 0,94. Molds and yeasts have lower a_w requirements (0,62 to 0,88).

Most microorganisms grow at pH values of around 7.0, with some molds growing between pH 0 and 11, bacteria growing between pH 3 and 11 and yeast growing between pH 1.5 and 8.50 (Cutter 2002, 154).

Oxygen may cause rancidity due to oxidative decomposition in products of high fat content (butter and baked chicken skin). These products need to be packed in oxygen-free atmospheres (Philips 1996, 470).

Products that are susceptible to microbial spoilage due to the development of Gram- negative bacteria and yeasts, such as the eggs surrounded with the baked skin and the fruit peels, were packed in a CO_2 enriched atmosphere as the growth of those microorganisms is significantly retarded by CO_2. In general, oxygen is excluded from the gas mixture (Devlieghere 2004, 280-281). Since hydrolytic decay is mainly influenced by a_w the MAP conditions used would have unlimited impact; therefore hydrolytic rancidity was not considered in this study.

<<table 2>>

1.4.2. Packaging

The packaging material used for this experiment was Plexiglas boxes, specially constructed for the purpose of the experiment and provided with a Plexiglas lid and rubber seal. To pump the gasses into the box two valves were integrated into each side of the box. The Plexiglas boxes were filled with the dummies and some materials for cushioning artworks (ethafoam, spin polyester). Only cushioning material with a gas permeability can be integrated into an MAP. The reason of using Plexiglas boxes in this experiment is that polyacrylate offers a good barrier towards O_2, N_2 and CO_2, (Devlieghere 2004, 280-281). Moreover, Plexiglas is resistant to mechanical damage (viz. its use in art shipping and storage) and a box allows artwork to be kept together. After sealing it with silicone gel and screws, the lid of the box was closed. The boxes were flushed with the appropriate gas composition traditionally used for the different foods. (Table 2) The modification of the atmosphere in the packages was carried out by using a gas packaging unit (gas mixer , WITT M618-3MSO, Gasetechnik, Germany). Air products (Vilvoorde, Belgium) supplied the gases O_2, CO_2 and N_2. When the box was filled with the particular gas mixture silicone plugs were used to close the side-openings (Jacxens 2002, 337). Afterwards storage was started (time 0).

1.4.3. Determination of Headspace Gas Composition

The composition of the headspace was measured during the flushing period by using a CO_2/O_2 gas analyzer (Servomex food packaged, series1400, UK).

Every 2 days the dummies were evaluated for visual changes, a gas sample (from the MAP dummy) was taken periodically through an air-tight septum and analyzed by gas chromatography as described by C. Van der Steen et al (2002, 53).

Determination of Visual and Sensory Quality (case 1 & 2)

All the cases were evaluated visually in a descriptive manner every two/three days: structure and color evolution and mould development in all the materials in both conditions. The visual characteristics of all were evaluated under daylight. The organoleptical properties (odor/smell) of the butter (case 1) were monitored as well for both the reference as the other sample.

A sample of the butter (case 1) and one of the baked chicken skin (case 2) were used for determining the degree of oxidative rancidity by assessing the peroxide value on isolated lipid (AOCS official Method Cd 8b-90, 1989). The Peroxide value of an oil or fat is used as a measurement of the extent to which rancidity reactions have occurred during storage. Measuring the peroxide value is useful for assessing the extent to which spoilage has advanced. It is defined as the amount of peroxides (meq) per kilogram of fat or oil. Other methods are available but peroxide value is the most widely used. The lipid from the butter sample was obtained after melting and centrifuging the butter from the skin, the lipids were extracted with petroleum ether.

1.4.4. Determination of the Microbial Levels (case 2)

After opening the packages, the growth of relevant spoilage microorganisms was traced using classical enumeration methods. A dilution series was made and the microbial levels of the baked chicken skin determined. Samples were pour-plated and spread-plated on specific media. Total aerobic psychotropic count (TPC) was pour plated on plate count agar (PCA,Oxoid, CM325) and incubated at 22°C for 5 days. Lactic acid bacteria (LAB) were counted on a plate with a top layer of de Man, Rogosa, Sharpe agar (MRS, OXOID, CM361) after 3 days of incubation at 30°C. A spread plate with oxytetracycline glucose agar

(OGA,Diagnostics Pasteur,Marnes-la-coquette, France, 64894) with an additional supplement (oxytetracycline supplement, Oxoid SR073A) was used to allow enumeration of yeasts (after 3 days of incubation) and molds (after 5 days of incubation).

2. **Results**

2.1. Determination of Headspace Composition, Visual and Sensory Decay.

A. Beuys: Butter and beeswax, basic material 4/b (1975 - …, SMAK)

After 62 days, there was no visual decay and no development of molds perceptible on the beeswax. There was no mold development on the butter. The course of the development of the color, structure and odor of the butter is tabulated in Table 3.

Unexpectedly, after 36 days, however, the butter in the MAP box became rancid. After terminating the experiment a leak was noticed. It seemed that for these samples the gas composition was similar after 36 days as in the controlled experiment. The box was reflushed with the optimal gas composition (100% N_2). If no MAP was used butter became rapidly rancid, as after 15 days of storage the structure, color and odor of the butter had changed.

The degree of the oxidative rancidity of the butter in open and closed cardboard was also measured after the experiment (day 61) by determining the peroxide value. The butter in the open cardboard (3.1 meq O_2/kg in 100% N_2 and 13.8 meq O_2/kg in normal air conditions) was more rancid than the one in closed cardboard (0.7 meq O_2/kg in 100% N_2 and 0.6 meq O_2/kg in normal air conditions).

<< table 3>>

B. : Peter De Cupere: Eggs (1997, SMAK)

Visually we could not see a lot of difference in decay between eggs in the MAP and in normal air conditions. There was no decay noticed on the thread used to sew the chicken skin together and no mold development on the chicken skin either in air or in gas conditions. The course of the color and structure of the chicken skin is tabulated in table 4.

The peroxide value determination shows us that the baked chicken skin in MAP (2.7 meq O_2/kg) is less liable to rancidity than the one in normal air conditions (64.8 meq O_2/kg).

<<table 4>>

C. Zoe Leonard: Strange Fruits

The mandarin peel dried out in both conditions after day 4, but the one in normal air conditions seemed more shriveled. Also the color in normal air conditions was darker than in MAP conditions.

There was no decay noticed on the banana peel in gas condition (50% CO_2, 50 % N_2). The evolution of color, structure and mold development of the banana peel in air conditions is tabulated in table 5. In contrast to the MAP-stored peels, the banana peels in air already showed visible mould growth after 11 days, which further gave rise to discoloration of the product after 28 days, due to mold sporulation.

<< table 5>>

2.2. Determination of Microbial Levels: PDC

The determination of the microbial levels of the baked chicken skin is tabulated in table 6.

The amount of microorganisms (TCP) on the baked chicken skin in gas composition are decreased (4,0 x 10^7/g). Yeasts and LAB stay almost the same. Apparently chicken skin baked like this is quite stable.

<<Table 6>>

Discussion

In this article the use of MAP as a preventive conservation method for contemporary art with foodstuffs is examined. Guidelines are offered for the conservation of artworks with foodstuffs taking into account the need for individual approaches to ephemeral art.

For the artworks of Beuys and Leonard investigated in this article the ongoing process of decay is part of the piece and must be visible when the work is installed. But when the artworks are in their storage environment MAP can be used, so the period of dormancy of the artworks will impinge as little as possible on their life span. Also in the case of the artwork by Peter De Cupere we can use MAP to avoid further decay in storage conditions, even though there is no clearness regarding the artist's intention. Conservators must approach art that comprise foodstuffs with an understanding of the context in which these artworks were created. As MAP is a well-known preventive preservation method used in the food industry, it can also be used in the conservation of art works with food.

In the case of 'Butter and Beeswax', MAP is an ideal conservation method that can slow down the rancidity to which butter is sensitive. If no leak were noticed in MAP, this butter would not have become rancid, because the rancidity is much slower in MAP conditions. Moreover the rancidity stopped after reflushing. In normal air conditions the rancidity in butter in a closed cardboard is minimal (light is excluded and there is less contact with oxygen). The conclusion is that cardboard also offers good protection against rancidity. As the cardboard boxes are damaged in the artwork (loss of strength), MAP can still provide a solution at this stage.

Also in the case of 'Eggs', MAP slows down the rancidity process in the baked chicken skin. Visually there was no decay noticed. The peroxide value at the end of the tests shows us that baked chicken skin in gas composition is less sensitive to rancidity than that in normal air conditions.

In the case of 'Strange Fruit' the decay was already visible after 4 days in normal air conditions. At the end of the test the banana peel in gas composition was still the same as in the beginning. The one in air conditions was shriveled, black and moldy. The mandarin peel in gas composition dried out a little at the end, but the one kept in normal air conditions had completely shriveled. In this case, MAP is an ideal preventive conservation method.

Conclusion

As newer art, with its focus on ephemerality and concept, is being created, and museums are clearly committed to preserving such art pieces, it would be useful for conservators to look into scientific research on food preservation. The results of this research cannot be implemented as such, but it is interesting at this stage to reflect and contextualize the findings of this research and to asses whether they can feed back into actual conservation practices or not and if so how. The intended "end user" is the conservator. Their search for the most feasible and effective conservation strategy can lead them in different directions, depending on the value they consider to be the most important. In that sense, practitioners have to apply these scientific findings conscientiously. Thus the use of MAP cannot be generalized, as each artwork needs an individual approach, since other norms and values apply. Nevertheless, the introduction of the expertise of food scientists as value operator to the decision-making process would offer conservators the possibility to preserve the original materials of the artwork and thus to maintain the material authenticity of the artwork.

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