

Research Institute:

PTS München
Hess-Str. 134
80797 München

Head of the research institute:

Dr. Frank Miletzky

Project leader:

Dr. Markus Kleebauer
Tel: 089 / 12146-387
Fax: 089 / 12146-36
E-Mail: markus.kleebauer@ptspaper.de

Internet: www.ptspaper.de

Research area: Product aims

Paper, paperboard and board// Packaging papers and paperboard

Key words:

Food packaging, permselectivity to oxygen and carbon dioxide, (bio)polymer coating, plastic material

TITLE: Food packaging materials with oxygen/carbon dioxide selective permeability**Background/Problem area**

The European Union is the fifth largest fruit and vegetable producer, with about 8.3% of the global production, but also the leading fruit and vegetable importer. Further, the market of „freshcut“ products (freshly cut fruits and vegetables) and fresh, individually portioned cheese is strongly growing, but an effective packaging solution for this type of food is not available. Nowadays, micro- and nano-perforated plastic films are used for food packaging. They do not allow packaging under modified atmosphere, which is necessary to prolong the shelf-life of the product. Also materials with high barrier properties are used as packaging material. The respiration of the fruit, vegetable or cheese is not considered and the MAP in the high barrier materials is modified by the respiratory activity of the produce, with a risk of anoxia of the foodstuff after a while. Neither of these materials is optimised for produces that need to breathe, such as vegetables, fruits, and certain kinds of cheese.

Objective/Research results

This project aims to develop a packaging material with oxygen / carbon dioxide selective permeability for the packaging of fresh produce. The project will target produce such as fresh cut fruits mix and vegetables mix, and “camembert type” cheeses, and aim to improve the shelf-life of these breathing produce by regulating the gas exchanges and therefore the oxygen and carbon dioxide permeabilities of the packaging materials.

The materials used in the project were mainly biobased and/or recyclable, in order to develop sustainable packaging solutions: on the one hand, paper coated with a permselective film; on the other, materials made entirely of polymers (multilayer and compounds).

The project was roughly divided into three phases. In the first step different materials were screened according to their permeability to oxygen and carbon dioxide. The materials were modified by adding different additives (e.g. cyclodextrines, bentonite, zeolithes and silica). In parallel, a numerical model to calculate the optimal atmosphere of the packed products was developed and this model was verified and optimised by case studies. In phase two, two types of packages, one coated cartonboard based and one plastic based package were produced according to the material study and the computer simulations. With the help of shelf life tests and permeation measurements the model was verified. In the last stage a profitability study and end of life investigations (biodegradability and recyclability) were made.

To the present day a mathematical model was set up successfully, which describes the gas permeation through the package, the respiration of the product and the change of the headspace atmosphere with the help of mathematical equations. Knowledge on metabolism parameters and respiration data of fresh and sensitive food products were gained and implemented in the model.

Extensive knowledge on formulation of aqueous biopolymer dispersions and binary blends for plastic films were acquired. Based on this knowledge several test packages (test trays) were made in the final stage of the project. The materials for the test packages were produced using pilot plants for coating and polymer processing. Production, filling and closing of the test tray were done manually.

Using this test packages it could be shown by storage tests that the EMAP concepts (EMAP = Equilibrium Modified Atmosphere Packaging) works when the permeabilities for O₂ and CO₂ are adjusted in right manner and negative effects like pinholes and microbiological contamination could be neglected.

Application/Economic benefits

The development of concepts for packaging with selective permeable materials will target several market sectors. It is very important for paper coating and plastic (synthetic and biopolymers) industry, but also for the packaging supplier and food retailers. The project obviously aims at targeting the needs of all the concerned market sectors, i.e. the entire food and packaging value chain. Once the concepts for new packaging materials have been developed, paper and plastic packaging manufacturers and suppliers will be able to propose new, improved packaging materials to their customers; food producers will get better packaging and therefore improve the shelf-life of their products and thus their cost-effectiveness; chemical manufacturers will have new uses for their materials, and finally food retailers will reduce waste by marketing products with a better shelf-life.

However, the project itself is still in the pre-competitive stage. Its goals are not to introduce new packaging to the market directly, but to provide the companies from the whole value chain with knowledge and concepts.

Period of time: 01.05.2014 – 31.07.2016

Remarks

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