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Research area: Product aims

Paper, paperboard and board// Packaging papers and paperboard

Key words:

Food packaging, fibre-based thermo-formable packaging, (bio)polymer coating, barrier functionalities for moisture and oxygen, antimicrobial coating

TITLE:**Active polyvalent packaging based on environmentally friendly fibre material with thermo-formable properties to extend shelf-life of fresh food for the reduction of waste****Background/Problem area**

Currently, the material of choice for trays for fresh food packaging like meat is mainly thermo-formable plastic (PET, PP or PS) or plastic-paper composite materials. As means to reducing the environmental impact of end-of-life packaging, fibre-based materials have long since been proposed as an obvious packaging solution. In order to promote this solution, novel compostable materials have to be developed exhibiting similar barrier properties for the protection of the packaged good as thermo-formable plastic materials. Unfortunately paper itself cannot be converted via thermo-forming, since the strength of paper is dominated by the hydrogen bonding and mechanical entanglement between individual paper fibres. These bonds are stable up to 200 °C. The stretch at break of paper is limited at 5-6%. However special packaging papers achieve values up to 10%. But even this is merely useable for packages with a depth of maximum 15mm. A real thermo-forming process is not possible as cellulose decomposes before melting. To endow paper with thermo-formable properties the interactions between individual fibres in the network have to be modified.

Objectives/Research results

This project aims to develop a novel fibre-based thermo-formable packaging material for the production of compostable trays for fresh food packaging. Further development steps will include barrier functionalities for moisture and oxygen impermeability optimised for thermo-processing and also antimicrobial coatings, both intended to preserve the freshness and edibility of the packaging good and thus extending the shelf-life. Additionally, a bio-based barrier topfilm with antimicrobial properties will be developed, which is sealable on the fibre-based tray. To achieve these goals, the project is divided into 3 phases: I) material development, II) material assessment and III) tray/topfilm demonstration. In the latter phase, the performance of the developed packaging material will be evaluated for different fresh food products.

Within phase I and II different chemical fibre modifications were investigated to create thermo-formable paper like graft-polymerisation or cellulose ring cleavage. Paperboards made out of this material provide high temperature extensibility up to 50% and are used for thermoforming experiments in a new trial device at PTS Heidenau. A packaging demonstrator was generated and the base material was compared with typical thermoforming films by means of technical and economical properties. Polymers for the ductile barrier coating were characterised according to their ability to thermoforming and their impermeability of oxygen, water vapour, fat and oil. Among the investigated coating materials acrylic dispersion coatings showed best fit to the requirement profile. Suitable foils based on biopolymers (PLA, PBAT and mixtures thereof) were produced for use as lid film using small scale pilot plants for compounding, extrusion and calendering. Antimicrobial agents have been incorporated into polymer matrices.

Two different approaches were started within the development of antimicrobial packaging functions:

Superhydrophobic coatings as prevention to form bacteria films: The materials investigated based on sol-gel chemistry showed high efficacy but modifications must be tested in order to get food contact approval.

Coatings with antimicrobial ingredients: Antimicrobial ingredients with food contact approval were defined and their target efficacy confirmed by experiments.

Application/Economic benefits

Novel concepts for packaging materials will open new markets for producers of packaging materials and also fresh food. It is expected that the generated solutions will penetrate the market through the "green thinking" upper middle class, probably around 10% of the market in the participating countries (Germany, Belgium and Poland), and then reach the main stream of users.

The target group of this project are firstly packaging producers which can valorise the project results through different routes: producing paper with extra functionality and offering compostable and biobased alternatives to existing crude-oil based packaging solutions. Secondly, food producing companies, which can broaden their market through the extension of shelf-life of fresh food products and through the biobased and compostable nature of the material aiming amongst others to bio-shops. Thirdly, different developed technologies within this project can be applied in other sectors in order to integrate barrier or antimicrobial coatings on different substrates e.g. processing equipment. The project results will not be immediately suitable for the introduction of new packaging products to the market. Instead, the project delivers valuable knowledge on a new concept for an eco-friendly packaging material for trays and topfilms.

Period of time: 01.05.2015 – 30.10.2017

Remarks

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