

Research Institute:

PTS Heidenau
Pirnaer Straße 37
01809 Heidenau

Head of the research institute:

Dr. F. Miletzky

Project leader:

Dr. Carsten Schönfeld
Tel: 03529 / 551-622
Fax: 03529 / 551-899
E-Mail: carsten.schoenfeld@ptspaper.de

Internet: www.ptspaper.de

Research area: Product aims

Paper, paperboard and board // Packaging papers and paperboard

Key words:

Cyclodextrin, thymol, antimicrobial, surface modification

Title: Functional Coatings Exhibiting Antimicrobial Properties Via the Gas-Phase**Background/Problem Area**

Frequently, paper and board is used to package goods that are sensitive to biological attack. This relates not only to food packaging, where the problem is obvious, but also to certain organic goods in the non-food area, like wood-products, textiles, organic fibres and the like. The higher the humidity in a container, the bigger the risk of biological attack will be.

Commercially the most successful solution to this challenge is to control the ambient conditions in the container by including pads or sachets containing humidity and/or oxygen absorbing chemicals. A second strategy, thus far less applied, is to coat the polymeric foil used for wrapping with volatile or non-volatile agents or even include such agents in the polymeric packaging material itself. For non-volatile agents, however, direct surface contact is required. Volatile agents, on the other hand side, suffer from a steep concentration decrease over time.

Objectives/Research Results

The project aims at implementing a novel concept to achieve antimicrobial properties in packaging. Cyclodextrin, a cyclic oligo-saccharide, is known to be able to bind certain molecules to its inner surface forming a 1:1 host-guest complex. As water competes with the guest molecules due to the mass action law, higher humidity decreases the stability of such complexes. If the guest molecule is chosen to be thymol, which is known for its strong antimicrobial effect, desorption-adsorption equilibria can be utilized to control the concentration of thymol in the gas phase of a packaging unit.

So far the following goals have been achieved in this project.

- Potential packaging applications have been identified and evaluated regarding their susceptibility to the project concept. It turns out that regardless of the availability of alternative approaches (see above) a very economic solution could be of interest for a seamless scale up in industry.
- Under consideration of the respective packaging application and economic constraints papers (boards) have been identified and coating recipes with various amounts of thymol/cyclodextrin have been developed. The most promising application being a simple starch based surface coat or surface sizing containing thymol/cyclodextrin.
- The antimicrobial potential of the coated samples has been proven using growth experiments of bacteria and fungi on culture media. Quantification of the preliminary results is currently being worked on.
- The release of thymol to the gas phase depending on temperature and humidity is being studied using GC/MS.
- Short time water contact has no significant effect on the thymol concentration of the coating formulation. Wet coating processes are thus applicable.

Application/Economic Benefits

According to a PIRA-study from 2007 a significant market growth for flexible packaging with antimicrobial finish is to be expected. Another study estimates the growth in production of polymers with antimicrobial finish to rise by almost 10 %. Both studies show a rising demand that can according to the aims of this project be accommodated by a superior technology.

The results to be elaborated in this project are economically interesting for several links in the value chain, namely producers of paper and board for packaging, print shops, biotechnological enterprises like suppliers for herbal agents, biotechnological oriented analytical laboratories and suppliers for additives.

Finally the end users will benefit from reduced packaging costs that will result from dismissing extra polymer based wrapping of sensitive goods and the emergence of packaging waste can be reduced.

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Remarks

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