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Research area: Product aims

Paper, paperboard and board // Technical speciality papers

Key words:

antimicrobial paper, regenerated cellulose

TITLE:**Formation of antimicrobial paper properties by integrating functional cellulosic fibrils into the paper structure****Background/Problem area**

A demand for limiting the risks of infections with microorganisms can be found in all areas of human life. Bacteria, mould fungi, yeasts and viruses like for example Salmonella, E. coli- and several Candida strains can make people suffer from severe illnesses. A particular demand arises in the environment of elder and weakened people like for example in hospitals and homes for the aged.

Air filtration papers are aiming at high air permeability with low resistance. However a filtration effect regarding particles to be separated must be ensured. Present products meet these requirements but come up with the drawback that the developing filter cakes are a perfect breeding ground for microbial growth. Secondary effects are fast reduction of filter efficiency by coating with microbes and release of toxic substances into the filter environment. These hygienic and procedural drawbacks can be limited when the filter material already suppresses the microbial growth.

Wall paper also represents a perfect breeding ground for microbial growth due to many condensation cycles of water saturated air in particular on outer walls of buildings. This process can be found in old buildings and insufficient ventilated new buildings. Microbial loaded air in public buildings deteriorates this situation. An antimicrobial loading of wall paper could increase the value of wall paper as well as the responsible lifetime for these wall papers. The development of procedural basics for the preparation of such paper components is the major objective in this project.

The preparation of antimicrobial fibres from regenerated cellulose is state of the technology. In particular antimicrobial fibres prepared by the lyocell technique can be found in functional textiles like under wear, socks and medicine. But from paper technology point of view filament staple fibres prepared by the lyocell technique have limits regarding strength development due to low surface area and suffering a tendency to spin.

Objectives/Research results

This project aims at the antimicrobial loading of speciality papers to limit the growing of germs or fungi and bacteria and to limit their distribution in the room air. Ag⁺, Cu⁺ and ZnO are used as potent substances for limiting the growth of bacteria and mould. The antimicrobial substances are fixed permanently in the paper sheet by including them in fibrils made from regenerate cellulose followed by mixing the fibrils to chemical pulp fibers for paper making.

The role of the 2 involved research institutes is the following: TITK is responsible for development of fibrils which are similar in morphology and fibre bounding behaviour to standard paper making fibers. The best solution for physical or chemical fixation of the antimicrobial and antifungicide additives to the fibrils has to be worked out. Part of PTS is the assessment of the produced fibrils from papermaking point of view and the production of functionalized papers in lab and pilot plant. The antimicrobial and antifungicide protection of the final paper samples will be evaluated followed by economical and environmental studies on the use of the functional additives.

The results in fibrils production demonstrated equal properties from the paper technology point of view. In addition to that antimicrobial agents can be included into the spinning solution and fibres + fillers with antimicrobial loading can thus be obtained. Analyses of the strength properties of lab sheets including up to 10 % cellulose fibrils verified the similarity with common hardwood kraft pulp fibres.

After including antimicrobial loaded fibrils into the paper structure the test methods confirm the effectiveness of the used additives. The amount of bacteria and mould was reduced strongly when using silver ions. Also very low concentration of less than 0.01 % active silver led to promising results.

Application/Economic benefits

The results of this project will be used for papermakers producing speciality papers like for the preparation of filter media and wall paper and where antimicrobial properties are desired. The concept of the preparation of functional papers by including functional fibrils can be further extended to all kinds of functional speciality paper application by loading fibrils with other chemicals needed for a certain purpose.

Period of time: 01.11.2011 – 31.10.2013

Remarks

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