Summary for the final report
Low cost multisensory paper & packaging applications (PAPERONICS)

Every year in Germany alone, 80,000 tonnes of baked goods are disposed of because they have reached their best-before date or no longer meet the consumers' desired quality. The development of a heat-resistant and therefore bakeable packaging with additional moisture-regulating properties is intended to counteract this problem.

First tests with different packaging materials (PET, cellulose) show a sufficient heat resistance of the materials at up to 210°C despite slight warping. For moisture regulation, the films are first perforated using a needle roller and then coated with a heat-resistant dispersion lacquer. This combination is supposed to ensure low permeability at low temperatures and, due to the swelling of the lacquer, very high permeability at high temperatures and humidity. The basic functionality could be proven. However, the lacquer layer was not able to close all perforations, which increased the permeability even at low temperatures and therefore increases the risk of drying during the storage. In addition, a mathematical model was developed to describe the course of the relative humidity during the baking process. For this purpose, permeation was calculated using Fick's diffusion approach. The water release of the product during the baking process was determined experimentally and also implemented in the model. The model is primarily intended to predict when water vapour may be released, as this can lower the product quality. The model also allows the comparison of different packaging materials without time-consuming storage tests. However, because of the made assumptions, for example extrapolating the permeability for values of 200°C, the model should only be used as qualitative prediction, not a quantitative one. Finally, comparative baking tests were carried out with different baked goods. Due to the changed heat transport caused by baking in the packaging, certain differences to the reference products become apparent. For example, the products baked in the foil have a less intensive crispy crust. Therefore, for the final large baking tests, mainly products without an intensive crust, such as milk rolls and ciabatta, are examined and sensory evaluated.

The sensory evaluation shows, for example, that the milk rolls baked in PET film are rated sweeter and butterier than the reference products. This can be explained by a change in the kinetics of the Maillard reaction and can be used as a starting point for further and detailed experiments. The different packaging concepts were also tested for their food conformity. For this purpose, the samples were heated to 200°C. to mimic the baking process and examined using gas chromatographic analysis methods. While no significant amounts of problematic substances were detected in the PET film, there were several anomalies in the cellulose film. It must be taken into account that these tests were carried out at dry heat. When baked with product, these give off water vapour, resulting in higher humidity. Conditions at which Cellulose is more stable, according to the manufacturer.

Nevertheless, further trials would need to be conducted before potential application. Another possible application, especially for small and medium sizes companies with limited oven capacities is the combined backing of gluten free and gluten containing bakery products without the risk of contamination.

IVLV members can download the complete final project report from our homepage. All you need is to register in the section “My IVLV”. Non-members can request the final report from the IVLV office at office@ivlv.org.

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