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Development of Antifungal Packaging Coating for Bread

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Introduction

Various studies on sustainable materials are underway. However, their common drawback is the expensive and lengthy manufacturing processes that lead to the use of plastic again. Another most commonly used packaging type is paper. Because of absorbency and permeability, paper packaging is unsuitable for certain types of food, but if the plastic is inserted, the packaging becomes not recyclable. So, to overcome this problem, it is necessary to develop an all-natural packaging.
Most of the products sold in the market come with packaging. They all have different requirements to be used as packaging for different types of goods. When it comes to food products, they are subject to even stricter rules because their safety depends on their packaging. Packaging can not only help preserve product quality but also increase it. Proper selection of packaging materials can extend the shelf life of microbiologically sensitive foods.

Problem Description

One of the crucial problem is the environment. Plastic waste generated in greater vast each year is accumulating and taking more and more space not only on land but also in water and even air. This is because plastic is cheap, strong and quickly made material leading to being the main type of packaging nowadays and creating this loophole situation. By combining naturally occurring substances, new packaging can be created to have the needed qualities.

Methods

The bread was chosen from the market leader in Lithuania – which occupies 21,8% of the market share [1]. For the experiment were selected three different names (A, B, C) for bread were. All of them are mixed rye bread, which does not have preservatives and contains grains and(or) seeds. This type of bread contains a lot of moisture. Table 1 shows the compositions of chosen bread types.

Table 1 *Ingredients of tested types of bread [2]*

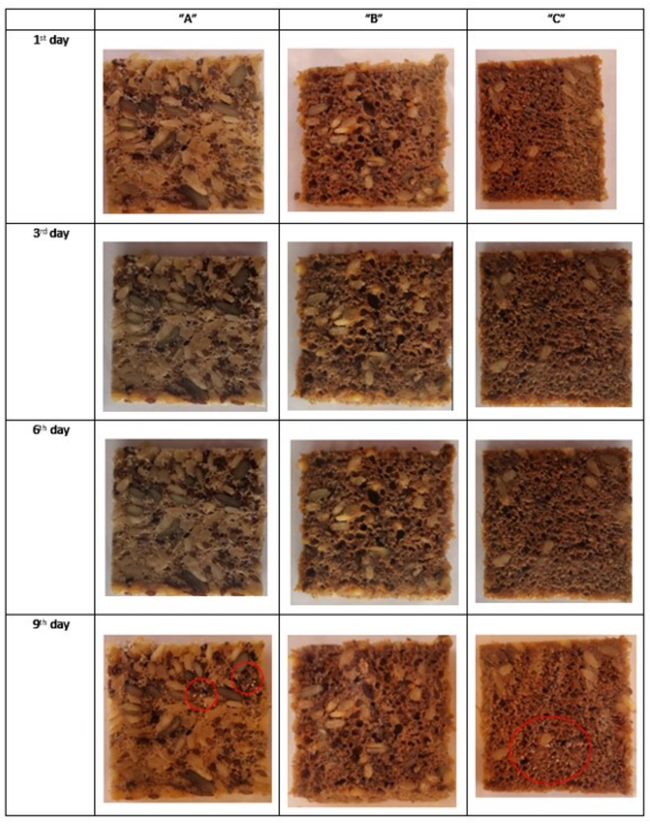
Product	Ingredients
Seed bread "A"	Water, rye flour, sunflower seeds (15.4%), wheat flour, pumpkin seeds (10.3%), watermelon seeds (10.3%), flaxseed (9.0%), sugar, yeast, wheat gluten, iodized salt, wheat fiber, rye malt, caraway seeds, flour treatment agent ascorbic acid.
Black sliced bread „B" with seeds	Rye flour, water, wheat flour, sunflower seeds (13.7%), flaxseed (8.8%), pumpkin seeds (7.6%), sugar, yeast, iodized salt, wheat gluten, rye malt, barley malt extract, wheat fiber, flour treatment agent ascorbic acid.
7 grain dark sliced whole grain bread „C"	Wholegrain rye flour (23.9%), water, rye flour, wheat flour, sunflower seeds (6.5%), broken rye (3.3%), broken wheat (3.1%), barley malt extract, wheat gluten, barley groats (2.5%), sugar, flaxseed (1.3%), soy grits (1.3%), yeast, iodized salt, peeled sesame seeds (0.5%), wheat fiber, rye malt, caraway seeds, flour treatment agent ascorbic acid.

These three products are similar in composition. All three types use 11 components - water, rye flour, sunflower seeds, wheat flour, linseed, sugar, yeast, iodized salt, wheat fibre, rye malt, and flour processing agent ascorbic acid. Therefore, their recipes are similar. The difference between C bread is that its main ingredient is whole grain rye flour, and this good thing has more different components such as grains and other seeds.

Results

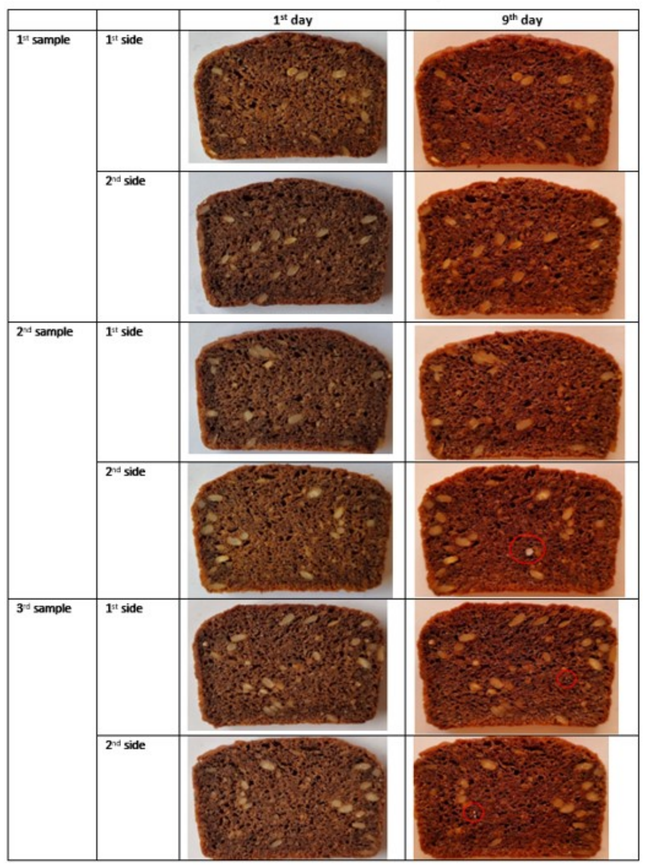
The pictures of bread on the 1 st, 3rd, 6th and 9th day are presented in Table 2.

Table 2 *Results of bread shelf-life comparison*



On the 9th day, signs of mold observed in the bread "A" and "C". Sample "B" was intact. As "C" specimen had the bigger affected space by the unwanted fungus activity, this leads to the conclusion that this type of bread is most susceptible for mold. This bread ("C") was choosing to continue further tests. The samples in boxes containing citral and eugenol EO mix coating at two designated times are exhibited in Table 3.

Table 3 *Samples, kept in boxes with citral and eugenol coating, on 1st and 9th day*



The bread slice in the 1st box does not have any noticeable dissimilarities. However other 2 had observable changes: 2nd sample had a fuzzy mold grown on the non-contact side, 3rd had noticeable mold on both halves.

Discussion / Conclusion

In the performed experiment, wax coating with synergetic EO mix capacity was evaluated. 2 layers of the wax coating were enough to reduce the paper's air permeability, and keep the bread moist and susceptible to mold. 2 of 3 tested pairs, citral with thymol and carvacrol with thymol, showed no growth after 8 days of storing in an active coating covered box. Both blends contain thymol, meaning it could be the main constituent determining the effectiveness.
Control and eugenol-thymol coating samples demonstrated similar results, which means the mixture was not effective.
Second, precise concentrations, not approximate ones, are critical to produce synergistic effects. Only specific values of both components can create synergy. To determine the exact values of the materials, it is necessary to apply a larger quantity of the coating or to use more accurate equipment.
Finally, sensory analysis is required. It shows this may or may not be acceptable to consumers depending on the smell and may become an advantage or disadvantage.

REFERENCES

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