

## THE USE OF PLANT OIL EXTRACTS FOR THE ENHANCEMENT OF BREAD MICROBIOLOGICAL SAFETY

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**Abstract:** This research is focussed on the impact of oil extracts on sensory, physicochemical and microbiological parameters of bread prepared from 1<sup>st</sup> grade flour with addition of 1% (replacing 1% of sunflower oil) and 2% oil extracts. The physicochemical and sensory characteristics of the samples containing oil extracts were better than the ones of controls. The results of baking test showed that the introduction of rosehip and hawthorn oil extracts during bread making increases the shelf life of bread by 24 hours. In the case of the sample containing 2% of sea buckthorn oil, the shelf life was extended up to 96 hours, by slowing down the development of rope spoilage.

**Keywords:** plant oil extracts, bread, microbiological safety, quality

### Introduction

At present, food manufacturers pay more attention to food safety. The problem of bakery products is associated with high microbial contamination of grains and low-quality flour [1].

The increase of safety can be carried out by adjusting the chemical composition of products when conventional raw material are used and by introducing a variety of biologically active food additives which would also allow to obtain products with functional properties [2]. Consequently, the search for new natural ingredients that can prevent microbial spoilage of wheat flour bread in order to improve and preserve its quality is highly relevant [3].

Oil extracts of plant origin are promising ingredients. Vegetable raw materials are one of the main sources of biologically active substances that even in minimal doses have a bactericidal effect. This factor is related to the presence of components such as phenols, vitamins, flavonoids, carotenoids, phytoncides, tannins in the plant material. It is most advisable to use local wild resources such as wild rosehip, hawthorn and sea buckthorn as plant raw materials [4].

The aim of this work was to study the possibility of using oil extracts of rosehip, sea buckthorn and hawthorn in the technology of white bread preparation in order to control the quality and to increase its microbiological safety.

### Materials and methods

Conventional and special organoleptic, physicochemical and microbiological methods were used to study the properties of raw materials and finished products. Plant oil extracts were obtained by extraction in sunflower oil and subsequent vacuum filtration.

A baking test was conducted using 1<sup>st</sup> grade wheat flour with the introduction of oil extracts in doses 1% (replacing 1% sunflower oil) and 2% by weight of flour to

determine the effect of oil extracts on sensory, physicochemical and microbiological parameters of finished products.

The bread was prepared by direct method of the recipe.

Conditions were created for the development of bread rope spoilage i.e. relative humidity  $85 \pm 2\%$  and temperature  $37 \pm 1^\circ\text{C}$ , in order to test the effectiveness of the addition of plant oil extracts

### Results and discussions

Vegetable-oil extracts were obtained by extraction in sunflower oil and subsequent vacuum filtration. The sensory characteristics of vegetable oil extracts were:

1. Clear liquid of rich yellow color in the case of sea buckthorn and hawthorn extracts.
2. Clear liquid of orange color in the case of rosehip extract.

All obtained extracts did not contain any impurities and sediment, had odor and taste characteristic for the respective type of berry. The physicochemical properties of rosehip, sea buckthorn and hawthorn extracts are presented in Table 1.

*Table 1.* Physicochemical parameters of plant oil extracts

Parameter	Value
Acid component, mg KOH/g, no more	4
Peroxide value, mmol/kg, no more	10
Mass share of foreign particles in oil, %, no more	absence
Mass fraction of volatile matter, %, no more	0.2
Relative density (relative to the density of water at $t = 20^\circ\text{C}$ )	0.920 – 0.925
Refractive index ( $t = 20^\circ\text{C}$ )	1.476
Saponification value, mg KOH/g of oil (oil extract)	190 - 209

A baking test was conducted to determine the effect of oil extracts on the organoleptic, physical, chemical and microbiological parameters of finished products. The bread was made using 1<sup>st</sup> grade wheat flour to which 1% (replacing 1% sunflower oil) or 2% of oil extracts were added. A sample prepared with 2% sunflower oil served as control. Ready-made products were analyzed 20 hours after baking to determine the effect of rosehip, sea buckthorn and hawthorn oil extracts on the quality parameters of bread. The results are summarized in Table 2.

The analysis of data presented in Table 2 showed that the samples with added extracts were superior in terms of the physicochemical parameter porosity. The porosity is an important factor for the digestibility of bread. The higher the porosity of bread, the better the food is impregnated with gastric juices and better absorbed by the body [5].

Thus, according to the results, crumb porosity was increased by 4.4 ... 8.8 % at a dosage of 1 % oil extracts and 1.5 ... 7.4 % at the introduction of 2 % rosehip, sea buckthorn and hawthorn plant oil extracts, in comparison to control sample. Apparently, the introduction of plant oil extracts containing biologically-active substances, simple sugars and vitamins into dough provides additional energy for yeast cells. Due to this addition, the fermentation intensifies, therefore the ability to inflate dough is enhanced which improves bread crumb porosity [5].

**Table 2.** The influence of plant oil extracts on the physicochemical parameters of bread

Quality parameter	Control	Rosehip oil extract		Sea buckthorn oil extract		Hawthorn oil extract	
		1%	2%	1%	2%	1%	2%
Humidity, %	43.0	43.2	43.5	42.5	42.7	42.8	43.0
Acidity, degrees	3.5	3.6	3.7	3.8	3.9	3.5	3.6
Porosity, %	68	73	71	71	69	74	73
Dimensional stability	0.47	0.50	0.54	0.54	0.55	0.50	0.49

The results of further studies have shown that berry oil extracts influenced positively the product sensory indicators. The samples had a smooth brightly colored crust, a nice and moderately pronounced flavor and a well-developed, thin-walled uniform porosity. As a result of sensory evaluation of bread (figure), a chart with 30 point rating scale was made [6]. The analysis has shown that the dosages of 1% and 2% of rosehip extract; 1% sea buckthorn extract and 2% hawthorn are optimal for sensory and physicochemical parameters.

Furthermore, comparative tests on bread quality change during storage were conducted in order to identify the impact of tested extracts on the microbiological safety. The conditions for the development of bread rope spoilage were created to test the effectiveness of the addition of rosehip, sea buckthorn and hawthorn plant oil extracts. The detection of rope spoilage was done by laboratory baking test with subsequent storage under optimal conditions for the development of rope spoilage i.e. temperature  $37\pm 1^\circ\text{C}$  and relative humidity of  $85\pm 2\%$ . The baked product was cooled, wrapped in moist paper and incubated until signs of rope spoilage appeared. The results are summarized in Table 3.

**Table 3.** The influence of plant oil extracts on the development of rope spoilage in bread during storage

Storage time before the appearance of rope spoilage signs, hours	Control	Rosehip oil extract		Sea buckthorn oil extract		Hawthorn oil extract	
		1%	2%	1%	2%	1%	2%
24	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-
72	+	-	-	-	-	-	-
96	++	+	+	+	-	+	+
120	+++	+++	+++	+++	+	+++	+++

"-" No signs of microbial spoilage; "+" - initial signs of rope spoilage; "++" - average degree of rope spoilage (stickiness, unpleasant smell); "+++" - strong development of the rope spoilage (increasing unpleasant odor, stickiness, mucilage).

The analysis of data showed that sea buckthorn oil extract, in a dose of 2% by weight of the flour has a bacteriostatic effect on spore-forming bacteria, by delaying their development (enzyme activity) and thereby delaying rope spoilage of bread.

The results of the test laboratory baking showed that the introduction rosehip and hawthorn oil extracts during the production of studied bread increases its shelf life by 24 hours, while the addition of 2% of sea buckthorn extract helped to increase the shelf life by up to 96 hours, by slowing the development of rope spoilage in bread.

### Conclusions

Thus, the results of the research showed the possibility of using oil extracts to improve the microbiological safety of bread by reducing the intensity of bread degradation by rope spoilage which extends shelf life.

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