PRODUCTION OF LACTIC ACID WORT-BASED BEVERAGES WITH MINT ESSENTIAL OIL ADDITION

Magdalena Trendafilova[1], Bogdan Goranov[2], Vesela Shopska[1], Rositsa Denkova-Kostova[3], Velislava Lyubenova[4], Georgi Kostov[1]

[1]University of Food Technologies, Department "Technology of wine and beer", Plovdiv, Bulgaria; [2] University of Food Technologies, Department "Microbiology", Plovdiv, Bulgaria

[3]University of Food Technologies, Department "Biochemistry and molecular biology", Plovdiv, Bulgaria; [4] Institute of Robotics, Bulgarian Academy of Sciences, Sofia, Bulgaria

INTRODUCTION

Lactic acid fermented wort-based beverages are non-alcoholic, with low pH value (3.5-4.5) and produced by the fermentation of wort by lactic acid bacterial (LAB) strains. Despite the acknowledged health benefits of lactic acid fermented wort beverages, they are poorly accepted by consumers because of their sour or worty-like taste and aroma. Therefore, the main challenge for producers is to improve their sensorial characteristics. Mint (*Mentha piperita*) is used for flavoring different food and beverages and for treatment of different deceases in folk remedy. Therefore, mint essential oil is suitable for use in functional beverages production.

RESEARCH AIM

The aim of this study was to investigate the influence of mint essential oil addition on the production of functional lactic acid wort-based beverages. The dynamics of the concentration of viable LAB, phenolic compounds and antioxidant activity was determined in order to estimate the biological value of the beverages produced. The sensorial characteristics of the beverages were also described.

MATERIALS AND METHODS

- ✓ Microorganisms - *Lactobacillus casei* ssp. *rhamnosus* LBRC11, isolated from home-made cheese.
- ✓ Wort production – 4.5 kg mixture of 60% Pilsen malt, 20% Vienna malt and 20% Caramel Munich II malt was milled and mixed with water at a ratio of 1:5. Mashing was conducted in laboratory Braumeister by increasing the temperature by 1°C/min and by maintaining rests at the following temperatures: 30 min at 50°C and 60 min at 77°C. Lautering and boiling (30 minutes without hop addition) were also conducted in the same Braumeister. After hot trub removal, the wort was autoclaved at 121 °C for 30 minutes. The wort extract was 11 % (w/w) and the pH was 5.30.
- ✓ Fermentation - Wort was divided into 3 equal parts: with 0.025 % (v/v) mint essential oil, with 0.05 % (v/v) mint essential oil and a reference sample. 250 cm^3 of the wort variants were placed in plastic bottles and inoculated with 2% of the obtained LAB suspensions to obtain initial concentration of 10^7 cells/cm^3. Bottles were incubated at a constant temperature of 25±1°C.
- ✓ Analytical methods and procedures

1. Extract and pH according to EBC standard methods [9].
2. Determination of the number of viable LAB cells - pour plate method on LAPTg10–agar medium.
3. Determination of Phenolic Compound Content with FC reagent and by the Glories methods - after dilution with methanol at a ratio of 1:5
4. Determination of Antioxidant Potential - against the DPPH radical, by the FRAP (ferric reducing ability of plasma) method, by the ABTS (2,2′-azinobis-(3-ethylbenzothiazoline-6-sulfonate)) method, by the CUPRAC (cupric reducing antioxidant capacity) method

- ✓ Sensory analysis – by descriptive analysis and ranking method

CONCLUSION

Addition of mint essential oil in concentration of 0.025 and 0.05 % (v/v) inhibited lactic acid fermentation but improved the sensory profile of the beverage obtained only when 0.025% mint essential oil was added. The reference was characterized by the lowest content of total phenolic compounds, phenolic acids and flavonoid phenolic compounds at the end of the study process, but it showed the highest antioxidant activity against the DPPH radical, against Cu^{2+} and Fe^{3+}. The addition of mint essential oil was the main reason for the higher phenolic compounds content, but exopolysaccharides were the main reason for the higher antioxidants activity of reference. The results obtained will be used for modelling of lactic acids fermentation for production of lactic acid wort-based beverages.

RESULTS

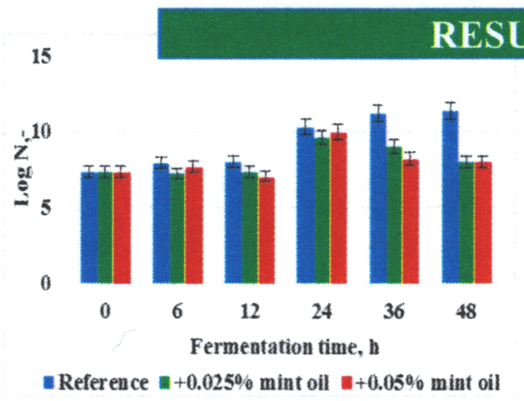

Fig. 1. Changes in the viable cell concentration during fermentation.

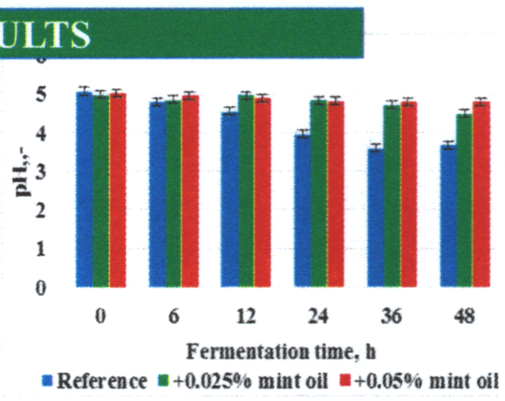

Fig. 2 Changes in the pH during fermentation.

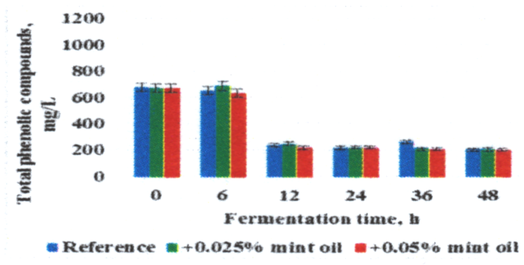

Fig. 3a. Changes in the total phenolic compound content, measured using the FC method.

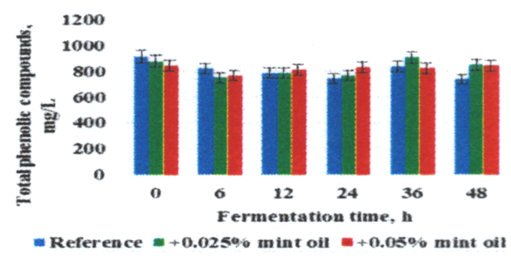

Fig. 3b. Changes in the total phenolic compound content, measured using the modified Glories method.

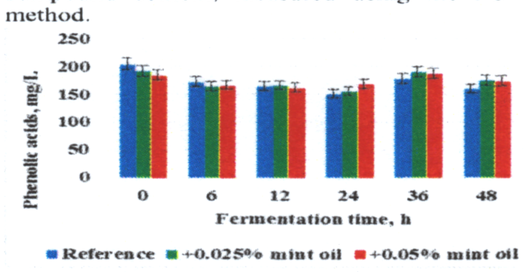

Fig. 3c. Changes in the phenolic acid content, measured using the modified Glories method.

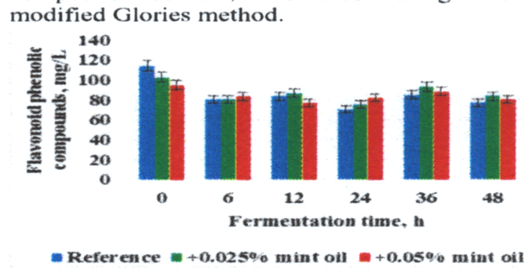

Fig. 3d. Changes in the flavonoid content, measured using the modified Glories method

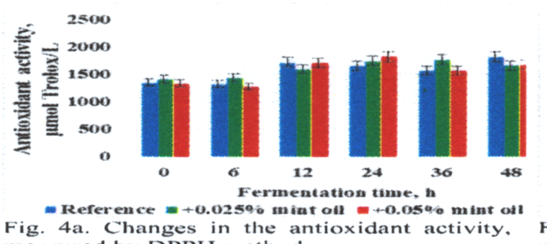

Fig. 4a. Changes in the antioxidant activity, measured by DPPH method

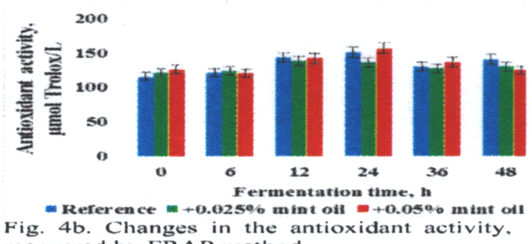

Fig. 4b. Changes in the antioxidant activity, measured by FRAP method

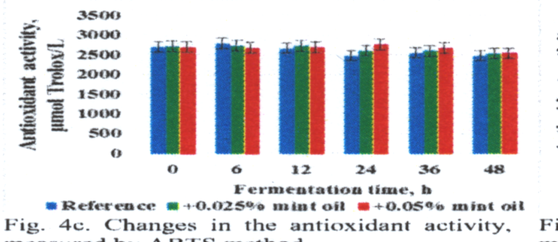

Fig. 4c. Changes in the antioxidant activity, measured by ABTS method

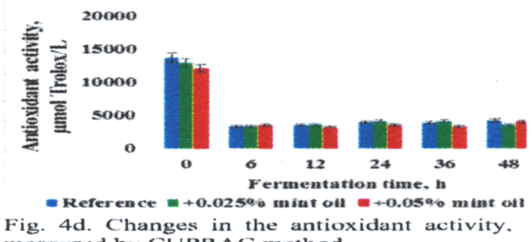

Fig. 4d. Changes in the antioxidant activity, measured by CUPRAC method

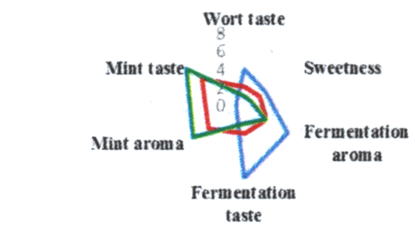

Fig. 5 Sensorial evaluation of the beverages produced

ACKNOWLEDGEMENT

The research has been funded by the National Scientific Fund of Bulgaria under the Grant КП-06-Н3/23 "Interactive System for Education in Modelling and Control of Bioprocesses (InSEMCoBio)"