Zbornik referatov / Collection of Papers
ISBN 978-961-93153-8-5
2. znanstvena konferenca z mednarodno udeležbo
Konferenca VIVUS – s področja naravovarstva, kmetijstva, hortikulture in živilstva
»ZNANJE IN IZKUŠNJE ZA NOVE PODJETNIŠKE PRILOŽNOSTI«
24. in 25. april 2013, Biotehniški center Naklo, Strahinj 99, Naklo, Slovenija
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2nd Scientific Conference with International Participation
Conference VIVUS – Environmentalism, Agriculture, Horticulture, Food Production and Processing
»KNOWLEDGE AND EXPERIENCE FOR NEW ENTREPRENEURIAL OPPORTUNITIES«
24th – 25th April 2013, Biotechnical Centre Naklo, Strahinj 99, Naklo, Slovenia

BIOLOGICAL ACTIVITY OF BEETROOT EXTRACTS

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Abstract
The beetroot is a plant that has natural antianemic, antibacterial, anticarcinogenic, antipyretic, antioxidant, antisclerotic, detoxicant and diuretic properties. This medicinal plant has been used as a medicine for 2000 years. The two processes involved the use of extracting agents having different water and ethanol concentrations and different pH values. The extracts obtained were evaluated for extraction efficiency and antimicrobial activity using Eur.Ph., diffusion and MIC methods, and *Staphylococcus aureus ATCC 25923, Klebsiella pneumoniae ATCC 13883, Escherichia coli, ATCC 25922, Proteus vulgaris, ATCC 13315,* and *Proteus mirabilis ATCC 14153.*
Differences have been noted in MIC concentrations in same strains among extracts E_1 and E_2. Extract E_1 has been the most efficient on *S. aureus, K. pneumoniae* with minimal inhibitor concentration (39,10 µg/ml), while extract E_2 has been the most efficient besides *S. aureus, K. pneumoniae, P. mirabilis* (78,12 µg/ml) and on *E.coli* and *P. vulgaris* (156,25 µg/ml).Maceration at an elevated temperature (50°C) induced increased extraction efficiency and a stronger antimicrobial effect of the extracts on the Gram-positive bacterial species tested. However, the extraction rate and the low temperature used in the process to prevent thermal degradation of bioactive components make

ultrasonic extraction the method of choice in the preparation of beetroot extracts that show the highest antimicrobial activity.

Key words: beetroot, maceration, ultrasonic, antimicrobial activity

Introduction

Different parts of plants (roots, leaves, flowers, fruit, stem, bark) have been successfully used to treat numerous diseases . Owing to their antioxidant activity, they can influence a number of physiological processes, thus protecting the organism from the damaging effect of free radicals and inhibiting the development of unwanted microorganisms (Ames, 1995). However, synthetic antioxidants, such as butylated hydroxyltoluene (BHT) and butylated hydroxyanisole (BHA), known for their ability to terminate the chain reaction of lipid peroxidation, have been proven to be carcinogenic and to cause liver damage. The use of plants in the food industry in place of synthetic preservatives, antioxidants or other food additives has significantly increased over the last few years due to their ability to produce biologically active substances .

Materials and Methods

Chemicals used

All chemicals and reagents were of analytical grade and were purchased from Sigma Chemical Co. (St Louis, MQ, USA), Aldrich Chemical Co. (Steinheim, Germany) and Alfa Aesar (Karlsruhe, Germany). The plant material used in the experiment included dried tomato and pepper grown under plastic-covered greenhouse conditions in Cacak.

Preparation of the extracts

Dried beetroot leaves (20 g) were macerated in a mixture of 95% ethanol (250 ml) and 0.5% glacial acetic acid at room temperature for 24 hours. The resulting macerate was filtered and the maceration procedure was repeated once (Begamboula, et all., 2003). The extracts obtained were combined and concentrated until dry in a rotary vacuum evaporator to produce the (E_1) macerat and vacum extract (E_2).

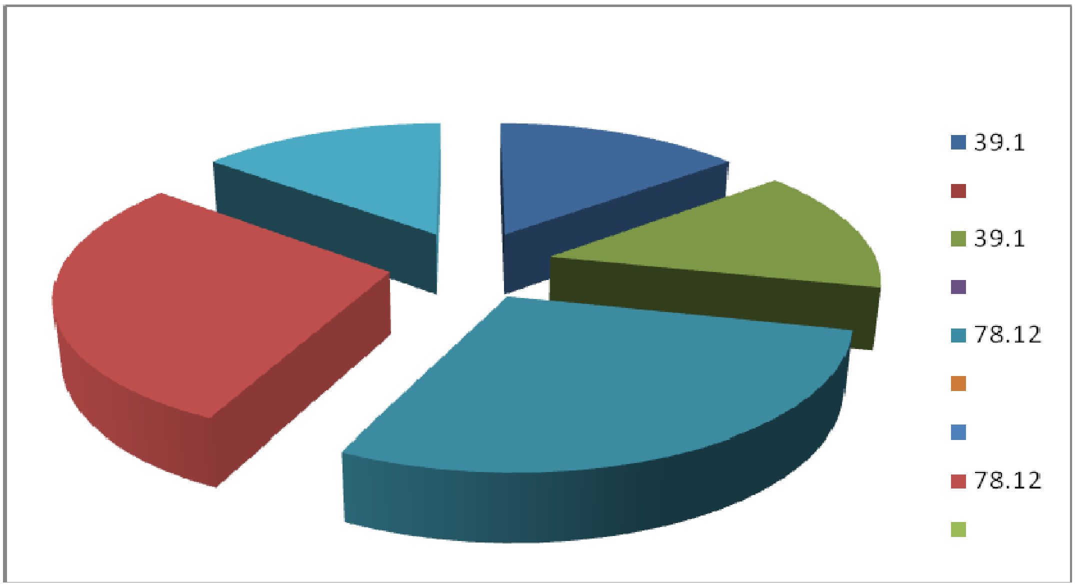
Results and discussion

Table 1. shows results on MIC and inhibition zone of the ethanolic extracts E_1 and E_2, and the antibiotic amracin (A).

Microbial strains	**E_1**	**E_2**	***A***
Staphylococcus aureus ATCC 25923	39.1 *28*	78.12 21	0.97 30
Klebsiella pneumoniae ATCC 13883	39.1 22	78.12 20	0.49 30
Escherichia coli ATCC 25922	78.12	156.25	0.97

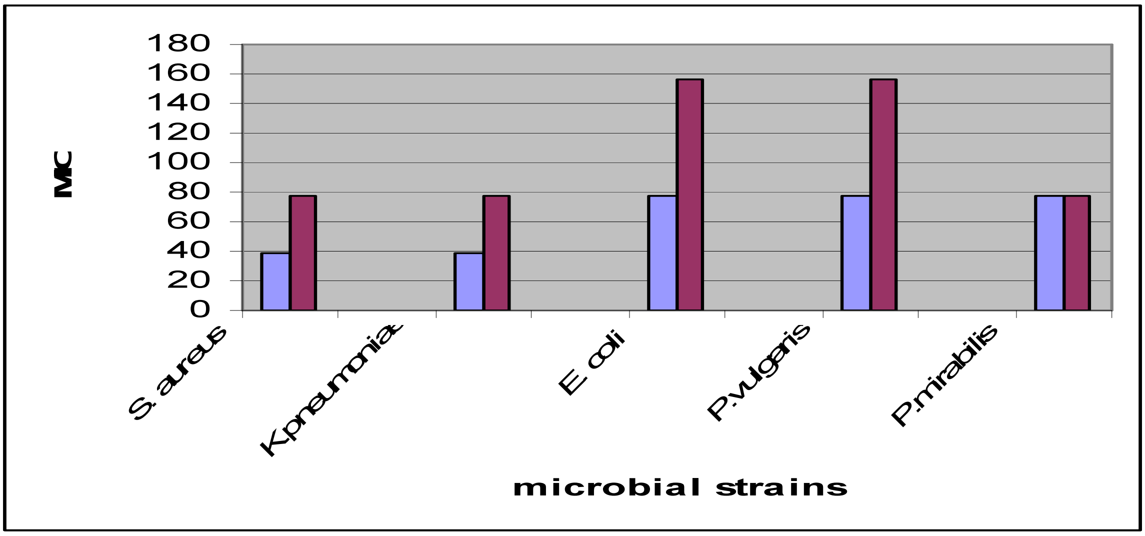
	22	16	30
Proteus vulgaris ATCC 13315	78.12 20	156.25 14	0.49 30
Proteus mirabilis ATCC 14153	78.12 18	78.12 16	0.49 30

Table 1: Minimum inhibitory concentration and inhibition zone of extracts E_1 and E_2



Graf. 1. Minimum inhibitory concentration and inhibition zone of extracts E_1 and E_2

Results show that ethanol beetroot extracts of all bacteria. Differences have been noted in MIC concentrations in same strains among extracts E_1 and E_2. Extract E_1 has been the most efficient on *S. aureus, K. pneumoniae* with minimal inhibitor concentration (39,10 μg/ml), while extract E_2 has been the most efficient besides *S. aureus, K. pneumoniae, P. mirabilis* (78,12 μg/ml) and on *E.coli* and *P. vulgaris* (156,25 μg/ml).



Graph 1: Minimum inhibitory concentration of extracts E_1 and E_2

One way to overcome the problem is to use novel antimicrobial agents available, specifically focusing on vegetables . Beetroots have characteristic intense color which is associated with the presence of phenolic compounds and antimicrobial activity (Benavente-Garcia, 1997).The present laboratory study on the antimicrobial reaction of beetroot extracts involved analysis of their potential use in the food industry, specifically focusing on future tendencies with respect to food preservation using beetroot extracts as “natural preservatives”.

Conclusion

This study suggests that beetroot extracts E_1 and E_2 show good antimicrobial activity. Importantly in practical terms, beetroot extracts can be used in the food industry not only to protect against microorganisms, but also due to their numerous biological and pharmacological activities.

Acknowledgments

This study is part of the TR 31 059 project entitled “A New Concept in Breeding Vegetable Cultivars and Hybrids Designed for Sustainable Growing Systems Using Biotechnological Methods”, financially supported by the Ministry of Science and Technological Development, Republic of Serbia.

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