BIOLOGICAL ACTIVITY OF CLOVE OIL

Yoana Stoyanova, N. Georgieva*, N. Lazarova-Zdravkova*, D. Tsanova*, D. Peshev***

*Department of Biotechnology, Faculty of Chemical and System Engineering, UCTM, Sofia, Bulgaria
**Department of Chemical Engineering, Faculty of Chemical and System Engineering,, UCTM, Sofia, Bulgaria

INTRODUCTION

The clove essential oil isolated from the buds of the species Eugenia caryophyllata (Myrtaceae) also found in the literature as Syzygium aromaticum is widely used and widely known for its healing properties. Clove oil has a number of benefits, ranging from anti-inflammatory for oral infections to treating toothache and acne. Due to its widespread use in the pharmaceutical, flavoring and food industries, demand for clove oil is expected to increase to 6000 tonnes by 2022.

The aim of this work is to study the antibacterial and antioxidant activity of clove oil. Gram-negative *Escherichia coli* K12 407 and Gram-positive *Bacillus subtilis* 3562 bacterial strains were used to study the inhibitory ability of the clove oil. The agar-diffusion method was used to test the susceptibility of the bacteria when treated with clove oil. Antioxidant activity was determined spectrophotometrically using the DPPH method.

ANTIBACTERIAL ACTIVITY

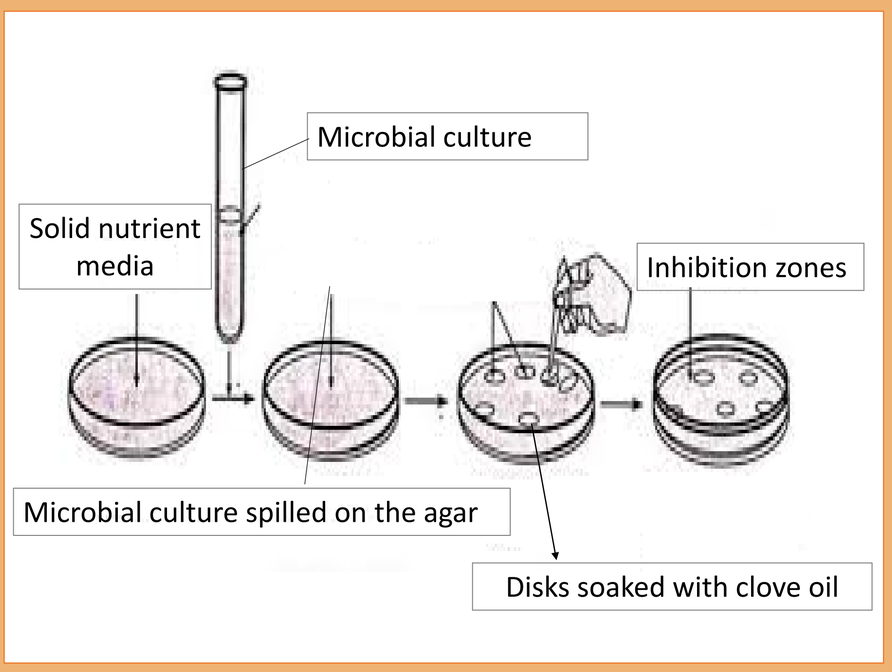


Figure 1. Scheme of agar-diffusion method

Table 1. Antibacterial test results of cloves essential oils produced by steam distillation against *B. subtilis* 3562 and *E. coli.*

Sample Name	Inhibition zone [mm]	
	B.subtilis 3562	E.coli K12
SDW1 clove oil	14.8	16.65
SDB1 clove oil	14.33	15.17
SDW2 clove oil	14.33	14.83
SDB2 clove oil	14.5	14.33

Table 2. Antibacterial test results of cloves essential oils produced by hydrodistillation against *B. subtilis* 3562 and *E. coli.*

Sample Name	Inhibition zone [mm]	
	B.subtilis 3562	E.coli K12
HD1 clove oil	13.8	14.11
HD2 clove oil	12.8	13.72
HD3 clove oil	15	17
HD4 clove oil	15	16.5

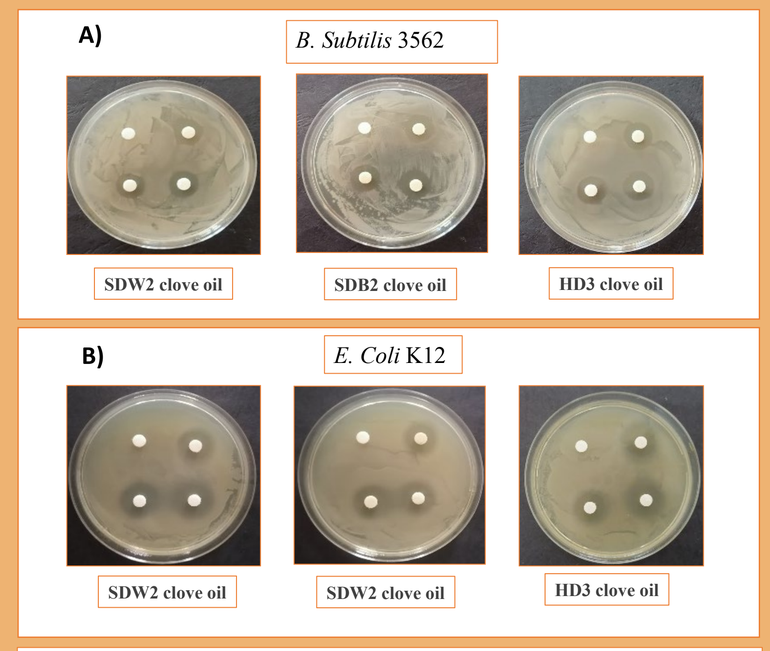


Figure 2. Antibacterial test of some of the clove samples against B. Subtilis 3562 (A) and E. Coli K12 (B).

ANTIOXIDANT ACTIVITY

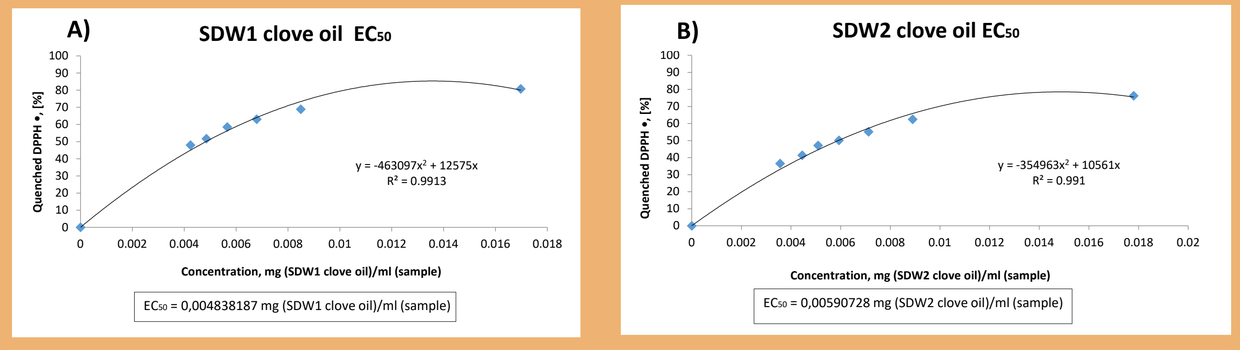


Figure 3. Experimental data and curve fitting for DPPH• quenching for 60 min by cloves oil (A) and (B) produced in the beginning of steam distillation versus concentration of antioxidant in the samples. The antioxidant power was characterized by the EC_{50} value.

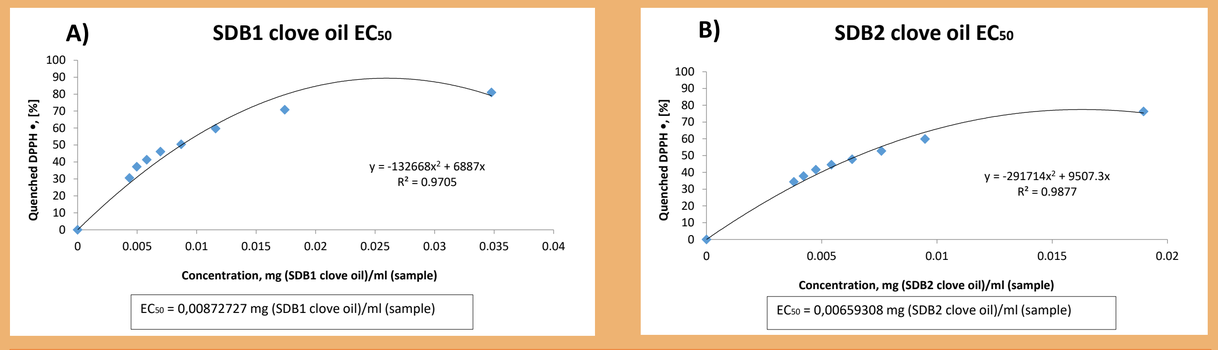
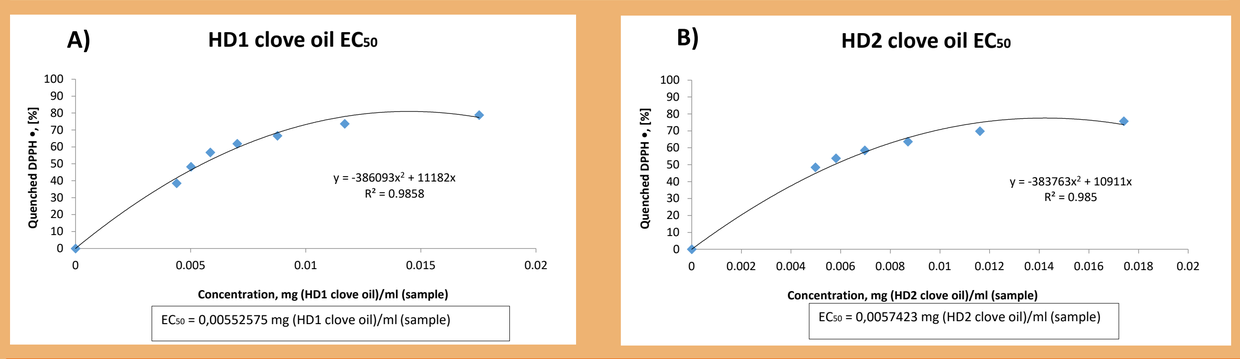


Figure 4. Experimental data and curve fitting for DPPH• quenching for 60 min by cloves oil (A) and (B) produced after 2 hours of steam distillation (darker color) versus concentration of antioxidant in the samples. The antioxidant power was characterized by the EC_{50} value.



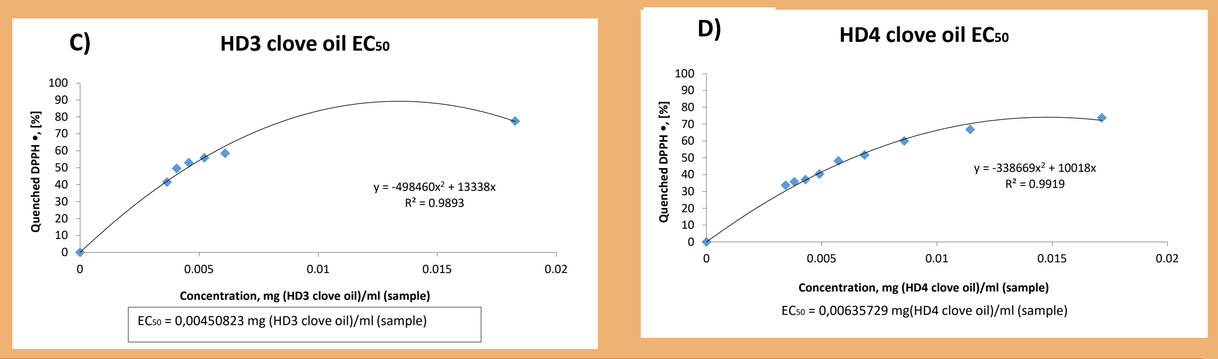


Figure 5. Experimental data and curve fitting for DPPH• quenching for 60 min by cloves oil (A), (B), (C) and (D) produced by hydrodistillation versus concentration of antioxidant in the samples. The antioxidant power was characterized by the EC_{50} value.

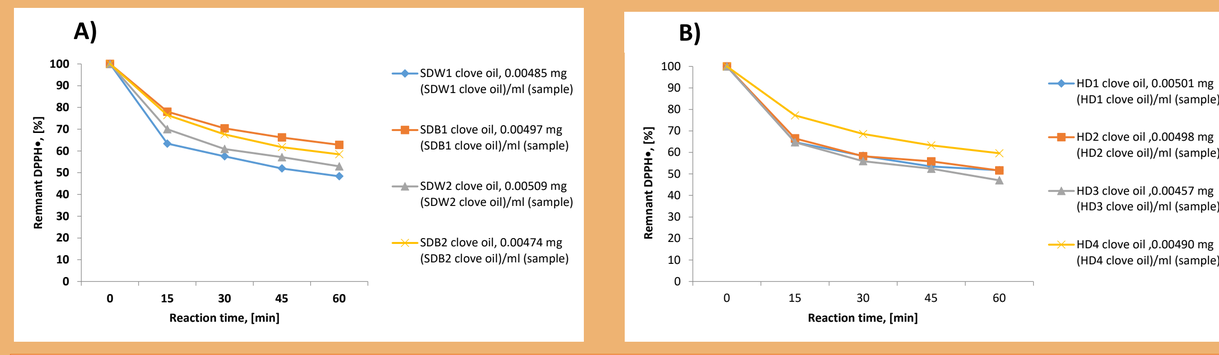


Figure 6. Kinetics of the characteristic radical scavenging reaction of clove essential oil produced by steam distillation (A) and clove essential oil produced by hydrodistilation with DPPH•

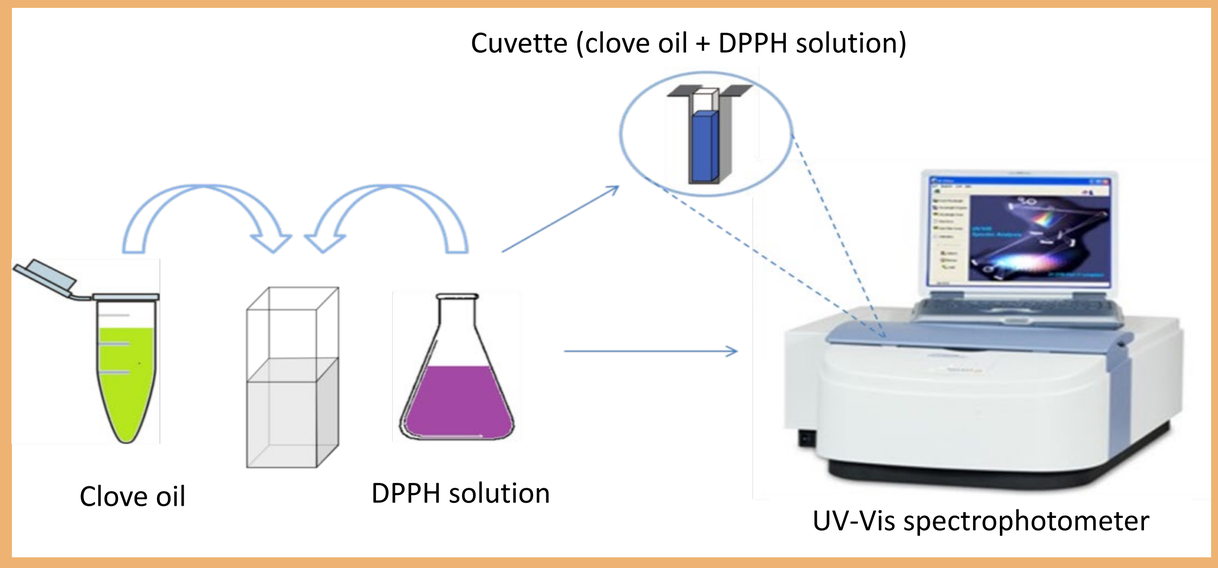


Figure 7. Scheme of DPPH • method

ABBREVIATIONS

SDW – Clove oil produced by steam distillation in the beginning of the process
SDB – Clove oil produced by steam distillation after 2 hours of the process
HD – Clove oil produced by hydrodistillation

CONCLUSION

- ✓HD3 clove oil showed the highest antibacterial activity against B. subtilis and E. coli.
- ✓The lowest EC50 value which characterized the antioxidant power was showed by HD3 clove oil and the highest was showed by SDB1 Clove oil.
- ✓All of our findings suggest that all of the clove oil fractions are good candidates for future applications as preservatives in the cosmetics, food and pharma industry.

ACKNOWLEDGEMENTS

This work was supported by the Bulgarian National Science Fund (contract KP-06-H37/14).