Antibacterial activity of cloves and cinnamon extracts against Food borne Pathogens and spoilage microorganisms

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Abstract
Ethanol, aqueous extracts, and essential oils of cloves (Syzygium aromaticum), and cinnamon (Cinnamomum cassia) were analyzed for determination of antibacterial activity against 21 food borne pathogens: Listeria monocytogenes (5 strains), Staphylococcus aureus (4 strains), Escherichia coli O157:H7 (6 strains), Salmonella Enteritidis (4 strains), Vibrio parahaemolyticus and Bacillus cereus and 5 food spoilage bacteria: Pseudomonas aeruginosa, P. putida, Alcaligenes faecalis, and Aeromonas hydrophila (2 strains). Screening of cloves and cinnamon extracts showed antibacterial activity against the test organisms. The MIC values of cloves and cinnamon extracts were determined for sensitive test organisms. The MIC values for ethanol, aqueous extracts, and essential oil from cloves ranged from 0.5 to 5.5 mg/ml, 0.8 to 5.5 mg/ml, and 1.25 to 5%, respectively. The MIC values for cinnamon, aqueous extracts, and essential oil from cinnamon ranged from 1.0 to 3.5 mg/ml, 2.5 mg/ml, and 1.25 to 5.0%, respectively. The effect of temperature and pH on the antibacterial activity of essential oils of cloves and cinnamon against cocktails of different strains of L. monocytogenes, E. coli O157:H7 and Salmonella Enteritidis were determined. The essential oils (EO) of cloves and cinnamon showed antibacterial activity after treatment at 100°C for 30 min suggesting that the high temperature does not affect the activity of these EO. The highest antibacterial activity was found at pH 5.0 for EO of cloves and cinnamon against most of the bacterial cocktails except for L. monocytogenes, where the highest activity was found at pH 7.0. The EO of cloves 5% and 10% were applied in ground beef inoculated with a cocktail of 5 strains of L. monocytogenes and E. coli O157:H7. The result showed that 10% EO of clove inactivated L. monocytogenes or E. coli O157:H7 cells within a 5 days of exposure, irrespective of storage temperature. However, 5% EO of clove was found inactivated E. coli O157:H7 with time at all the temperature studied, however, L. monocytogenes population was not found inactivated through out the 15 days incubation period. Therefore, 10% EO of clove could be useful to control L. monocytogenes or E. coli O157:H7 in ground beef meat.

Materials and Methods

Cloves to ground cloves and cinnamon to ground cinnamon

Results

In vitro study showed the antibacterial activity against food borne pathogen and spoilage microorganisms. Figure shows the symbolic representation of antibacterial activity of plant extracts against food borne pathogens and spoilage bacteria.

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<tr>
<th>Cocktails of test organisms</th>
<th>Plant essential oils (EO)</th>
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<tbody>
<tr>
<td></td>
<td>Clove Extract</td>
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<td></td>
<td>Cinnamon Extract</td>
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<tr>
<td>1.0%</td>
<td>2.5</td>
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<td>0.1%</td>
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<td>0.01%</td>
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Comparison of Antibacterial Activity of EOs of Clove and Cinnamon with Commercially available Eugenol and Clove Oil and Cinnamon oil and Trans-Cinnamaldehyde.

Conclusion

Screening of cloves and cinnamon extracts showed antibacterial activity against almost all the test organisms and application of clove essential oil inactivated Listeria monocytogenes and E.coli O157:H7 in ground beef meat within 1 day of exposure. Use of clove and cinnamon essential oil can provide an adequate degree of protection against foodborne pathogens and spoilage organisms in processed foods. However, there are some limitations in using spices like clove or cinnamon, i.e., the strong flavor. The flavor of the food products may not be acceptable by some consumer groups if large amounts of spices are added to inhibit the food borne pathogens. Therefore, the use of spices along with preservatives such as acid, salt, sugar and with processing and storage conditions can help in controlling microorganisms in food products.

References