ANTIMICROBIAL ACTIVITY OF INDIAN SPICES AGAINST COMMON FOODBORNE PATHOGENS IN MODEL FOOD PRODUCTS

By

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Dedicated to

The Almighty Lord

who sent his angels in the form of

My Parents.

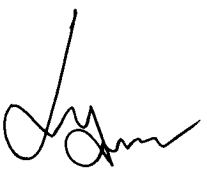
Silence grows into the horizon of wisdom and

with that unexplainable silence;

I owe Mathew

Certificate

This is certified that the thesis entitled **"ANTIMICROBIAL ACTIVITY OF INDIAN SPICES AGAINST COMMON FOODBORNE PATHOGENS IN MODEL FOOD PRODUCTS"** being submitted by **Ms. Sofia P.K.** to the Indian Institute of Technology, Delhi is worthy of consideration for the award of the degree of **'Doctor of Philosophy'** and is a record of the original bonafied research work carried out by her under our guidance and supervision. The results obtained in this thesis have not been submitted, in part of full, to any other university or institute for the award of any degree or diploma.



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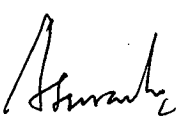

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Abstract

Food safety is a very important part for any food industry. Every year millions of people around the world become sick as a result of consuming contaminated and unsafe food. In recent years, the occurrence of serious outbreaks of food borne disease on practically every continent has demonstrated both their public health and social significance. Besides human suffering the consequence of food borne illness for a country like India is particularly severe. **Food hygiene and safety thus needs to begin from our houses.**

Spices are indigenous to India. These are extensively used in rural and urban households both. These are used for flavor enhancing properties. They are now also used for value addition in the form of essential oils and oleoresins. Research on the antimicrobial properties of spice oleoresin and essential oils in modular food products is a relatively new field. Lots of Indian literature talks about health benefiting properties of spices.

Considering their natural and indigenous origin and the significance of food borne diseases, the antimicrobial properties of Indian spices and their extracts, essential oils, oleoresins and principal compounds were evaluated on some model food products commonly consumed in Indian households and commercial outlets.

Preliminary experiments were conducted on crude spice extracts of clove (*Syzygium aromaticum*), cinnamon (*Cinnamomum tamala*), mustard (*Brassica nigra*), garlic (*Allium sativum*), ginger (*Zingiber officinale*) and pepper (*Piper nigrum*) in synthetic media. Common food borne pathogens *E.coli, S.aureus* and *B.cereus* were used for the experiments. Experiments were conducted to study the effect of incubation period

(ageing) on the antimicrobial properties of spices. It was observed that Indian spices exhibited very good antimicrobial properties and could play an important role in the preservation of some of the commonly consumed food products in India. Behavior of spices was also studied in some model food products simulated with food borne pathogens.

The four most potent antimicrobial spices were screened from among these for further simulatory experiment in model food products vis-à-vis pomegranate juice, cucumber salad and whole moong sprouts. Essential oils and oleoresins of clove (*Syzygium aromaticum*), cinnamon (*Cinnamomum tamala*), mustard (*Brassica nigra*), garlic (*Allium sativum*) and ginger (*Zingiber officinale*) were studied. Simulatory or poison food experiments were conducted with the food borne pathogens *E.coli, S.aureus* and *B.cereus* on the model food products of pomegranate juice, cucumber salad and whole moong sprout.

The principal components of the two strongest antimicrobials narrowed from the simulatory experiments were procured and their antimicrobial property was studied against the pathogens *E.coli, S.aureus* and *B.cereus* on the above used model food products. It was observed that eugenol and cinnamaldehyde exhibited excellent antimicrobial properties in the selected model food products.

Experiments on the antimicrobial activity of Indian spices were complimented with sensory or organoleptic evaluation which is very important for any food product to be accepted by the consumer. Sensory evaluation was done using a 9 point hedonic scale for whole spices, essential oils, oleoresins and principal compounds in the model food products i.e., pomegranate juice, cucumber salad and whole moong sprouts.

Use of Indian spices as part of hurdle technology was also evaluated under the study. It was observed that Indian spices can be used as an additional hazard to the growth of pathogens *E.coli, S.aureus* and *B.cereus* along with refrigeration.

The food preservation data for the selected Indian spices shows that they can be used as biopreservatives in foods especially ready to eat foods against food borne pathogens *E.coli, S.aureus* and *B.cereus*. With the world moving towards green consumerism, Indian spices as natural preservatives hold a very important and key role in safety against food borne pathogens.

Table of Contents