AUCTORES
Globalize your Research

Biotechnology and Bioprocessing
Sherifa Mostafa M. Sabra *

Open Access

Review Article

The Effectiveness of Using Curcuma longa Linn to Protect Food from Micro-organisms Spoilage

Sherifa Mostafa M. Sabra

S. Const., Prof., Dr. Microbiology.

***Corresponding Author:** Sherifa Mostafa M. Sabra, S. Const., Prof., Dr. Microbiology.

Received date: January 16, 2026; Accepted date: January 29, 2026; Published date: February 10, 2026

Citation: Sherifa Mostafa M. Sabra, (2026), The Effectiveness of Using Curcuma longa Linn to Protect Food from Micro-organisms Spoilage, *J, Biotechnology and Bioprocessing*, 7(1); **DOI:10.31579/2766-2314/178**

Abstract

Curcuma longa essential oil affected food spoilage micro-organisms. The importance was according on the preserving food from micro-organisms spoilage using medicinal plants which helped to keep the food for a long time. The aim was to use the Curcuma longa essential oil against the food spoilage micro-organisms in order to prove the benefit of the Curcuma longa essential oil in eliminating food spoilage micro-organisms. A laboratory experiment was conducted on the micro-organisms with exposure to the Curcuma longa essential oil, and the micro-organisms growth was monitored after exposure.

The growth was (00%, 00%, 00%, and 00%) after one day exposure to 100% concentration of the Curcuma longa essential oil. There was after overnight exposure were (6%, 7%, 4%, and 7%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis). The 50% had growth (3%, 4%, 3%, and 5%) after one day, and after overnight was (19%, 18%, 15%, and 20%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis). The growth was (4%, 5%, and 7%) after one day exposure to 100% concentration, and after overnight exposure were (13%, 14%, and 16%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.). The 50% had growth (11%, 11%, and 12%) after one day and was after overnight (41%, 42%, and 43%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.). The growth was (7%, 8%, and 10%) after one day exposure to 100% concentration, and after overnight exposure were (29%, 31%, and 32%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.). The 50% concentration had growth (20%, 21%, and 22%) after one day, and was after overnight (61%, 62%, and 65%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.). The growth was (00%, 00%, 6%, 5% and 6%) after one day of 100% concentration, and after overnight were (8%, 9%, 16%, 14%, and 13%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.). The 50% had growth (2%, 3%, 12%, 14%, and 11%) after one day, and after overnight was (18%, 17%, 43%, 44%, and 42%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.).

It was concluded that, the effect of the Curcuma longa essential oil was eliminating the food spoilage micro-organisms. It was recommended that, an implementing a practical system to determine the appropriate amount of the Curcuma longa essential oil for preserving food without harming the food or public health.

Key Words: curcuma longa essential oil; staphylococcus aureus

Introduction

Curcuma longa Linn has the primary active turmeric, a yellow spice native, turmeric comprises 3%-5% curcuminoid derivatives, including curcumin 70%, dimethoxy-curcumin 20%, and bisdemethoxy-curcumin 10% [1]. Curcuma longa is a di-feruloyl-methane molecule (1,7-bis) 4 hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), consisting of two ferulic acid residues connected by a methylene bridge [2]. Curcuma longa has hexa-hydro-curcumin, hydro-curcuminol, demethoxy-curcumin, tetra-hydro-curcumin, di-hydro-curcumin, curcumin sulfate and glucuronide [3].

Curcuma longa known in outdated medicine for its therapeutic and biological possessions. ability, and metal chelation contribute meaningfully to its health benefits [4]. Curcuma longa 's chemical composition has bioactive substances, including curcuminoids, essential oil, and poly-saccharides. The

yellow color of the rhizomes is caused by a class of poly-phenolic chemicals called curcuminoids, have a number of biological functions. It has bi-sdemethoxy-curcumin and di-methoxy-curcumin, are the main curcuminoids found. An essential oil, which are responsible for the plant's distinctive flavor and perfume. Turmerone, ar-turmerone, and curlone, which make up the majority of the essential oil, possess antibacterial effects. The third main type is polysaccharides, are repeating sugar units that make up high molecular weight carbohydrates. The essential oil has antibacterial and antifungal effect [5]. Curcuma longa turmeric rhizomes used as antibacterial effects. Turmeric essential oil and extract are antimicrobials prevent the pathogenic micro-organisms development [6]. Curcuma longa essential oil has antimicrobial effects, and antibiofilm activity, it's by blocking the bacterial quorum sensing systems and eradicating preexisting biofilms. It destroys the bacterial motility by cell membrane damaging [7]. Curcuma longa essential oil binds to the bacterial cell wall, cooperating its integrity, and cell membrane damages leading to cell lysis [8].

Curcuma longa essential oil affected gram-positive than gram-negative bacteria because of the different types of cell walls [9]. Curcuma longa essential oil inhibits bacterial growth by targeting various cellular structures, including the bacterial cell membrane, cell wall, proteins, and DNA, or by interfering with the bacterial quorum sensing system [10]. Curcuma longa essential oil has antimicrobial activity reflects that on bacterial inhibition primarily arises from the disruption of basic cellular division processes and the induction of the temperature sensitive protein filamenting mutant Z (FtsZ). The bacterial cytoskeleton is crucial for cell growth and division, whereas the FtsZ protein, which is key to microbial cell replication, is the first to appear at the future division site. In fact, curcumin can prevent the assembly of FtsZ and the Z loop, both crucial for bacterial cytokinesis, thereby blocking bacterial proliferation [3].

Curcuma longa essential oil had antibacterial effect against bacteria for Gram-negative & Gram-positive [11].

Curcuma longa essential oil showed effective antimicrobial action against Escherichia coli, Staphylococcus aureus, and affected molds [12]. Curcuma longa essential oil exhibited strong antimicrobial possessions, particularly against bacteria, counting its antibiofilm action. It had affected Staphylococcus (aureus and sp.), and Enterococcus faecalis, Escherichia coli, and Salmonella typhimurium [13]. Curcuma longa essential oil stimulation in cell kill Escherichia coli [14]. Curcuma longa essential oil killed Escherichia coli, Streptococcus pyogenes, Micrococcus tetra, Staphylococcus (aureus, and epidermidis) [15].

Curcuma longa essential oil has potent antifungal activity by chemical constituents, iso curcuminol, curzerene, curcumin, germacrene, curcuminol, curdione, β-elemene, and curcumol [16]. Curcuma longa essential oil damages the cell wall by intrusive with beta-(1,3)-D-glucans, the primary component production of the fungal cell wall. Then they enter the cell by attacking the membrane cholesterol and forming a transmembrane pore or ion channel. Ergosterol, the leading membrane lipid component, regulates the membrane's permeability, fluidity, and thickness. Combined with microdomains sphingolipids, it contributes to the membranes proper function. Curcuma longa essential oil aids in preventing the ergosterol

synthesis, so leading to abridged fungal action. That by obstructive electron transfer in the respiratory cable between the flavoprotein, cytochrome B, and NADH-dehydrogenase. It constrains ATP mitochondria group of Fusarium graminum by constraining the SDH and NADH oxidase act. It disturbed the protein and enzymes creation, so it halts the fungi growth [17]. Curcuma longa essential oil inhibited the growth of fungi and Candida albicans [18]. Curcuma longa essential oil reserved the development of molds, and yeast [19].

The importance it was according on the preserving food from micro-organisms spoilage using harmless and inexpensive medicinal plants which helped to keep the food for a long time. The aim was to use the Curcuma longa essential oil against the micro-organisms that caused food spoilage in order to prove the benefit of the Curcuma longa essential oil in eliminating food spoilage micro-organisms. A laboratory experiment was conducted on the micro-organisms with exposure to the Curcuma longa essential oil, and the micro-organisms growth was monitored after exposure to the Curcuma longa essential oil.

Methodology:

Essential Oil Extraction:

The sample was collected from the central market, then it was cleaned and dried. The essential oil was extracted by "Hydro-Distillation" using a "Clevenger-Type Device". The dried samples were crushed by sterile mixer, then was added 30 g ground powder + 600 mL distilled water in 1000 mL bottle covering 600 mL, the mixture was boiling for 5 hours. The extracted essential oil yield was available as mL/100 g dry matter, then anhydrous Na_2SO_4 was dehydrated and kept in dark glass container at 4◦C, so that it was used in 100% and 50% concentration [20].

Food Spoilage Micro-organisms:

They were collected from the "Private Laboratory" and were isolated and identified from the spoiled food. They were included Staphylococcus aureus, Streptococcus sp., Bacillus sp., Clostridium sp., Lactobacillus sp., Salmonella sp., Shigella sp., Escherichia coli, Campylobacter jejuni, Yersinia enterocolitis, Mucor, Aspergillus sp., Alternaria sp., Fusarium sp., and Candida sp. They were cultured on the "Molar Hinton" medium and were incubated for 24 hours at 37 °C. The pure colonies were mixed with the "Peptone Water", so the micro-organism suspension was made [21].

Laboratory Experiment:

An equal amount of the essential oil and the micro-organism suspension were placed in each hole of the "Titration Plate", and were made three holes for each micro-organism. The plate mixing was carried by using an electric vibrator. The plate was incubated at (35-37) °C, then was monitored every overnight and one day. A loopful amount of the mixture was taken from each hole for culture on the "Molar Hinton" medium and was incubated for 24 hours at (35-37) °C. Then the amount of micro-organism growth after exposure to the essential oil was determined [22].

Analyzing Results:

The laboratory experiment results were compiled, and then the "Excel Method" was used to analyze the results and presented them in a table for easy interpretation [23].

Results and Discussions:

Micro-organism	Time	Curcuma longa essential oil		
		100%	50%	Mean
Clostridium sp.	Overnight	6% (+)	19% (+)	12.5%
	One Day	00% (-)	3% (+)	1.5%
Shigella sp.	Overnight	7% (+)	18% (+)	12.5%
	One Day	00% (-)	4% (+)	2.0%
Campylobacter jejuni	Overnight	4% (+)	15% (+)	9.5%
	One Day	00% (-)	3% (+)	1.5%
Yersinia enterocolitis	Overnight	7% (+)	20% (+)	13.5%
	One Day	00% (-)	5% (+)	2.5%

0% (-), 1-25% (+), 26-50% (++), 51-75% (+++), 76-100% (++++)

Table 1: Group 1: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil

Table (1) showed group 1: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil. The results were showed the most effective micro-organisms group. The growth was (00%, 00%, 00%, and 00%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis) after one day exposure to 100% concentration of the Curcuma longa essential oil. There was a low growth after overnight exposure were (6%, 7%, 4%, and 7%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis) individually [9-11].

The Curcuma longa essential oil 50% had lower effect on the micro-organisms, that was giving growth (3%, 4%, 3%, and 5%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis) after one day. The growth was higher after overnight (19%, 18%, 15%, and 20%) for (Clostridium sp., Shigella sp., Campylobacter jejuni, and Yersinia enterocolitis) respectively [9-11].

So that the 100% concentration of the Curcuma longa essential oil and one day exposure were more effective on the micro-organisms [1-8].

Micro-organism	Time	Curcuma longa essential oil		
		100%	50%	Mean
Streptococcus sp.	Overnight	13% (+)	41% (++)	27.0%
	One Day	4% (+)	11% (+)	7.5%
Bacillus sp.	Overnight	14% (+)	42% (++)	28.0%
	One Day	5% (+)	11% (+)	8.0%
Lactobacillus sp.	Overnight	16% (+)	43% (++)	29.5%
	One Day	7% (+)	12% (+)	9.5%
0% (-), 1-25% (+), 26-50% (++), 51-75% (+++), 76-100% (++++)				

Table 2: Group 2: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil

Table (2) showed group 2: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil. The growth was (4%, 5%, and 7%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.) after one day exposure to 100% concentration of the Curcuma longa essential oil. There was a growth after overnight exposure were (13%, 14%, and 16%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.) individually [9-11].

The Curcuma longa essential oil 50% had lower effect on the micro-organisms, that was giving growth (11%, 11%, and 12%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.) after one day. The growth was higher after overnight (41%, 42%, and 43%) for (Streptococcus sp., Bacillus sp., and Lactobacillus sp.) respectively [9-11].

Micro-organism	Time	Curcuma longa essential oil		
		100%	50%	Mean
Staphylococcus aureus	Overnight	29% (++)	61% (+++)	45.0%
	One Day	7% (+)	20% (+)	13.5%
Escherichia coli	Overnight	31% (++)	62% (+++)	46.5%
	One Day	8% (+)	21% (+)	14.5%
Salmonella sp.	Overnight	32% (++)	65% (+++)	48.5%
	One Day	10% (+)	22% (+)	16.0%
0% (-), 1-25% (+), 26-50% (++), 51-75% (+++), 76-100% (++++)				

Table 3: Group 3: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil

Table (3) showed group 3: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil. The growth was (7%, 8%, and 10%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.) after one day exposure to 100% concentration of the Curcuma longa essential oil. There was a growth after overnight exposure were (29%, 31%, and 32%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.) individually [9-11].

The Curcuma longa essential oil 50% had lower effect on the micro-organisms, that was giving growth (20%, 21%, and 22%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.) after one day. The growth was higher after overnight (61%, 62%, and 65%) for (Staphylococcus aureus, Escherichia coli, and Salmonella sp.) respectively [9-11].

Micro-organism	Time	Curcuma longa essential oil		
		100%	50%	Mean
Mucor	Overnight	8% (+)	18% (+)	13.0%
	One Day	00% (-)	2% (+)	1.0%
Alternaria sp.	Ove night	9% (+)	17% (+)	13.0%
	One Day	00% (-)	3% (+)	1.5%
Aspergillus sp.	Overnight	16% (+)	43% (++)	29.5%
	One Day	6% (+)	12% (+)	9.5%
Fusarium sp.	Overnight	14% (+)	44% (++)	29.0%
	One Day	5% (+)	14% (+)	9.5%

Candida sp.	**Overnight**	**13% (+)**	**42% (++)**	**27.5%**
	One Day	**6% (+)**	**11% (+)**	**8.5%**
0% (-), 1-25% (+), 26-50% (++), 51-75% (+++), 76-100% (++++)				

Table 4: Group 4: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil

Table (4) showed group 4: An approximate percentage of micro-organisms growth after exposure to Curcuma longa essential oil. The growth was (00%, 00%, 6%, 5% and 6%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.) after one day exposure to 100% concentration of the Curcuma longa essential oil. There was a growth after overnight exposure were (8%, 9%, 16%, 14%, and 13%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.) individually [12-19].

The Curcuma longa essential oil 50% had lower effect on the micro-organisms, that was giving growth (2%, 3%, 12%, 14%, and 11%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.) after one day. The growth was higher after overnight (18%, 17%, 43%, 44%, and 42%) for (Mucor, Alternaria sp., Aspergillus sp., Fusarium sp., and Candida sp.) respectively [12-19].

So that from the results the concentration 100% of the Curcuma longa essential oil was more effective than 50%. That was observed on the inhabitation the micro-organisms due to the chemical contents. The concentration was needing more exposure time for completely inhibit the micro-organisms [1-8].

Conclusions:

It was concluded that, through the research, the effect of the Curcuma longa essential oil was eliminating the food spoilage micro-organisms.

Recommendations:

It was recommended that, an implementing a practical system to determine the appropriate amount of the Curcuma longa essential oil for preserving food without harming the food or public health.

Acknowledgments:

Sending thanks to everyone who assisted in conducting the research.

References:

1. Gupta, B., Sharma, K., Malviya, R., & Mishra, P. (2024). Curcumin and Curcumin Derivatives for Therapeutic Applications: In Vitro and In Vivo Studies. Current Nutrition & Food Science, 20(10): 1189-1204.
2. Roney, M., Huq, M., Rullah, K., Zamri, B., & Mohd Aluwi, F. (2025). Curcumin, a bioactive compound of Turmeric (Curcuma longa) and its derivatives as α-amylase and α-glucosidase inhibitors. Cell Biochemistry and Biophysics, 83(1): 53-71.
3. Devi, S., Krishnan, R., Begum, S., Nath, D., Mohanty, A., Misra, M., & Kumar, S. (2025). Curcumin as Bioactive Agent in Active and Intelligent Food Packaging Systems: A Comprehensive Review. Comprehensive Reviews in Food Science and Food Safety, 24(4): e70228.
4. Tian, W., Liu, L., Chen, P., Yu, M., Li, M., Hua, H., & Zhao, N. (2025). Curcuma Longa (turmeric): from traditional applications to modern plant medicine research hotspots. Chinese Medicine, 20(1): 76.
5. Hegde, M., Girisa, S., BharathwajChetty, B., Vishwa, R., & Kunnumakkara, B. (2023). Curcumin formulations for better bioavailability: what we learned from clinical trials thus far? ACS Omega, 8(12): 10713-10746.
6. Odo, I. (2023). Antibacterial activities of commonly used spices; Garlic (Allium moly), Ginger (Zingier officinal), and Turmeric (Curcuma longa) extracts on bacterial isolates from spoilt tomatoes (Lycopersicum esculatum). IPHO-Journal of Advance Research in Pharmacy & Biological Science, 1(09): 01-09.
7. Touati, A., Mairi, A., Ibrahim, A., & Idres, T. (2025). Essential Oils for Biofilm Control: Mechanisms, Synergies, and Translational Challenges in the Era of Antimicrobial Resistance. Antibiotics, 14(5): 503.
8. Ru, Q., Huang, Y., Jin, Z., Yu, D., Fu, Z., Tian, J., & Luo, J. (2025). Antifungal Activity and Inhibitory Mechanism of Essential Oil from Fresh and Fallen Leaves of Cinnamomum camphora (L.) Presl against Zearalenone-Producing Fusarium graminearum. LWT, 118331.
9. Tandirogang, N., Anitasari, S., Arung, T., Paramita, S., & Shen, K. (2022). Evaluations of antibacterial properties of Zingiber purpureum essential oil against 13 different Gram-positive and Gram-negative bacteria. The Indonesian Biomedical Journal, 14(3): 303-8.
10. Shariati, A., Noei, M., Askarinia, M., Khoshbayan, A., Farahani, A., & Chegini, Z. (2024). Inhibitory effect of natural compounds on quorum sensing system in Pseudomonas aeruginosa: a helpful promise for managing biofilm community. Frontiers in Pharmacology, 15: 1350391.
11. Kirmani, F., Saddiqe, Z., Saleem, S., Ali, F., & Haq, F. (2024). Phytochemical investigation and antibacterial activity of Curcuma longa against multi-drug resistant bacteria. South African Journal of Botany, 164: 137-145.
12. Noshirvani, N. (2024). Essential oils as natural food preservatives: special emphasis on antimicrobial and antioxidant activities. Journal of Food Quality, 2024(1): 5807281.
13. Suwal, N., Bashyal, S., Paudyal, P., Khanal, P., Suwal, N., Dhaubanjar, S., & Paudel, R. (2025). Comparative Assessment of Antibiofilm and Antioxidant Activities Between Curcuma long a silver nano Particles and Ethanolic Extract of Curcuma longa. Next Research, 100447.
14. Ratna, R., Anjani, G., Afifah, N., Ayustaningwarno, F., & Rustanti, N. (2025). Antibacterial Potential of Curcuma Mangga Kombucha: The Effect of Fermentation Duration on Activity Against Escherichia coli and Salmonella typhi. Medical Laboratory Technology Journal, 11(1): 34-44.
15. Bushra, R., Saeed, F., Ahmed, Z., Naeem, S., Ishaq, J., & Saleem, Y. (2025). Curbing anti-microbial resistance of synthetic medicinal agents using herbal drug alternatives: current trends and future insights. Prospects in Pharmaceutical Sciences, 23(2): 50-66.
16. Cui, T., Li, B. Y., Liu, F., & Xiong, L. (2024). Research progress on sesquiterpenoids of Curcumae Rhizoma and their pharmacological effects. Biomolecules, 14(4): 387.
17. Chen, C., Long, I., Zhang, F., Chen, Q., Chen, C., Yu, X., ... & Long, Z. (2018). Antifungal activity, main active components and mechanism of Curcuma longa extract against Fusarium graminearum. PloS one, 13(3): e0194284.
18. Cruz, A., Sánchez-Hernández, E., Teixeira, A., Martín-Ramos, P., Cunha, A., & Oliveira, R. (2024). Antifungal and antioomycete activities of a Curcuma longa L. hydroethanolic extract rich in bisabolene sesquiterpenoids. Horticulturae, 10(2): 124.
19. Kayiran, D., Bolgen, G., Akgül, E., Kadiroglu, P., Cengiz, N., Cevikelli, T., & Ozogul, F. (2025). Chemical composition, characterization, and antimicrobial properties of Thymbra

spicata essential oil-based nanoemulsions and its application on curd cheese. Frontiers in Nutrition, 12: 1615832.

20. Elkiran, O., & Telhuner, O. (2025). Chemical Profiles and Antimicrobial Activities of Essential Oil from Different Plant Parts of Fennel (Foeniculum vulgare Mill.). Food Science & Nutrition, 13(5): e70307.
21. Kadeřábková, N., Mahmood, J., & Mavridou, A. (2024). Antibiotic susceptibility testing using minimum inhibitory concentration (MIC) assays. npj Antimicrobials and Resistance, 2(1): 37.
22. Facibeni, A. (2023). Silver nanoparticles: synthesis, properties, and applications. Jenny Stanford Publishing.
23. Kiviaho, K., Anttonen, M., Alfthan, H., & Itkonen, O. (2025). Reliable quantification of fecal elastase-1: A study on sample stability, IDK ELISA and IDK Extract® device. Clinica Chimica Acta, 120541.

DOI:10.31579/2766-2314/178