

## Review

# Organic Acids in Food Preservation: Exploring Synergies, Molecular Insights, and Sustainable Applications

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**Abstract:** Food safety is a critical global health concern, as the consumption of unsafe food can lead to various acute and chronic diseases. While various preservation methods are employed to prevent food spoilage, it remains a significant issue for the food industry, resulting not only in food waste but also significant economic losses for manufacturers and consumers alike. Furthermore, there is growing consumer concern regarding food quality and safety, leading to the rejection of chemical additives due to their associated health risks. Organic acids, naturally occurring compounds of plants and animals, and produced by various beneficial microorganisms, play an important role in enhancing food flavor, preserving nutritional quality, and extending the shelf life of food products. Recognized for their antimicrobial potential, organic acids are commonly utilized as food preservatives, thus contributing to food safety. This review focuses on organic acids as natural preservatives within the food industry. It delves into their chemical structures, mode of action in cells, the types commonly used in preservation along with their general properties, and their antimicrobial activity against bacteria, yeasts, and fungi. These insights are drawn from the published literature, providing comprehensive understanding of the role organic acids play in ensuring food safety and maintaining food quality.

**Keywords:** organic acids; natural preservatives; antimicrobial; sustainable food preservation; sustainable ingredient



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## 1. Introduction

The preservation of food is a paramount concern for the food industry and consumers worldwide. Microbiological deterioration stands as one of the leading causes of food quality and safety loss, posing a significant challenge to the food industry. Various types of method are used to maintain preservation of food such as thermal processing, drying, freezing, refrigeration, irradiation, fermentation, modified atmosphere packaging, and the addition of antimicrobial agents, such as salts or other chemical or biological preservatives [1].

One of the most effective approaches to combat this deterioration is using natural antimicrobial agents, such as organic acids. Organic acids are chemical compounds found in a variety of natural foods such as fruits, vegetables, and fermented food products such as vinegar, among others. They play a crucial role in preserving foods by inhibiting the growth of unwanted microorganisms such as bacteria, fungi, and yeasts. The antimicrobial capability of organic acids has been recognized and utilized for centuries in traditional food preservation techniques such as fermentation and acidification [2].

The utilization of organic acids as antimicrobial agents in food preservation has gained increasing interest due to their proven effectiveness, as well as consumer demand for natural

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