

# Abstract

## Background

With the rising demand of microbiologically and chemically safe food products, conventional chemical preservatives are gradually fading away from the interests of both researchers and consumers. Thus, natural products are considered as promising substitution, especially botanical volatile organic compounds (VOCs) with bio-compatibility, accessibility and practicability, which are found versatile in defending both foodborne pathogens and spoilage organisms.

## Scope and approach

This article aims to comprehensively review the biosynthesis and antimicrobial mechanism of VOCs, collects and selects current and potential application of VOCs in food pathogen control from both applied and basic research. Antimicrobial mechanisms of VOCs are divided into direct and indirect effects combined with summarization of potential VOCs candidates as antimicrobials. Biosynthesis and rate-limited steps of VOCs in plants are systematically summarized in this review, furnishing a guideline for synthetic biology of VOC production. Challenges involving side-effects, microbial detoxification, toxicity, and acquisition of VOCs with possible solutions are elaborated.

## Key findings and conclusions

Conceptual distinction is conducted between VOCs and essential oils (EOs), where synergetic and antagonistic effects of every single VOC component in EOs require more investigations. Synthetic biology enables large-scale production of VOCs instead of traditional extraction technique, however, detailed VOC biosynthesis pathway should be deciphered. Versatile applied platforms including modified atmosphere package, emulsion and coating are solutions for solving challenges impairing VOC practical application. Applied concentration and type of VOC directly influence on the safety and efficiency. Thus, strict regulation and safety assessment are demanded due to potential toxicity.