Chemical and antimicrobial studies of monoterpene: Citral

Amna A. Saddiq a * Suzan A. Khayat b

a Microbiology Department, King Abdul Aziz University, Faculty of Science, Saudi Arabia
b Chemistry Department, King AbdulAziz University, Faculty of Science, Saudi Arabia

ABSTRACT

6-7 Citral-epoxide derivative (a mixture of E and Z isomers with respect to the C2 – C7 double bond) could be react with DNA base producing a major adduct. The mixture of epoxides was condensed with 2 mol of cysteine to give the adduct through condensation between aldehyde and amino groups. Antifungal and anti-bacterial activity of the adduct was tested on citral and epoxide mixture. ABSTRACT

1. INTRODUCTION

Cymbopogon citratus (DC) (Ganeshine) is an herb worldwide known as lemongrass. The tea made from its leaves is popularly used as antimicrobial, analgesic, anti-inflammatory, antipyretic, diuretic and sedative [1]. The volatile oil obtained from fresh leaves of this plant is widely used in industries and in traditional medicine for various purposes [2]. Citral is the major component of lemongrass oil which was extracted from its leaves, present at levels of, approximately, 65-85%. Citral (3,7-dimethyl-2-octenal) geranyl, gerani- lactate and nerol [2]. A number of dietary monoterpenses was shown to act effectively in chemoprevention and chemotherapy of different cancers in animal models, at cellular level, and in human clinical trials [3]. Unnatural terpenes are capable of trapping activated oxygen species in vivo to give intermediate epoxides which can alkylate DNAs, proteins, and other biomolecules [4].

Keywords: MRSA. (MRSA) and fungi comparing by citral. The epoxides against the growth of bacteria methicillin resistant have good antimicrobial activity. Citral epoxide shows high activ-

2. MATERIALS AND METHODS

2.1. Lemongrass leaves: Scientific name: Cymbopogon citratus (C. citratus). Citral (1) was isolated by extraction of C. citratus, which was collected from Maddinah city (Saudi Arabia). Citral epoxide can be pre-

pared in last [13].

2.2. Test organisms

2.2.1. Fungi pathogenic: Penicillium italicum and Rhizopus stolonifer were obtained by the compilation of the Center for mi-

crobes (Miren), Faculty of Agriculture, Ain Shams University – Egypt. It was cultured on sabourad dextrose agar (Oxoid CM 41) at 27 °C.

2.2.2. Bacterial pathogenic: Bacillus cereus and Escherichia coli (MRSA) from Laboratory of Jeddah king Fahd Hospital in Saudi Arabia, was cultured on Mueller Hinton media (Oxoid CM 41) at 37 °C.

2.3. Standard antibiotic discs: Penicillin G (100 units), Ampicillin (100 mg), Gentamycin (30 µg), Tetracycline (30 µg), Nitrofurantoin (100 µg) and Vancomycin (30 µg).

2.4. The methods:

2.4.1. Alkylation of epoxide citral 2a with cysteine[12]. Mixture of epoxide citral 2a & 2b (0.00 µgm, 0.37 mol) and (0.22 gm, 1.0 mol) of cysteine (1 mole equivalent) were added to a mixture of ethyl alcohol (2 

Table 1: Diameter of inhibition zone of the lemongrass oil against Staphylo-

2.4.2. Citral-cytosine adduct [3]. Colorless semisolid, 6.67 ± 0.28**

Table 2: Effect of Various Concentrations of Citral and Citral epoxide on the Radial Growth of Penicillium italicum and Rhizopus stolonifer Grown on Solid Media (mm disc; Mean of Replicates ± SE).

Table 3: Effect of Various Concentrations of Citral and Citral epoxide on the growth rates of Staphylococcus aureus after 24h.

Table 4: Antibacterial activity data of Citral, Citral epoxide and some known antibiotics.

Ampicillin

Nitrofurantoin

Antibiotic

Staphylococcus aureus (MRSA)

No. 1.

REFERENCES

1. Carnesecchi, S., Schneider, Y., Ceraline, J., Duranton, B., Gosse, F., Seller, N., and Raul, F. (2001). Geraniol, a component of the monoterpene citral, was tested for in vitro antimicrobial activity by the agar-well diffusion method [24]. The antibacterial and antifungal activities of lemongrass oil on both mammalian (MRIISA) and fungi (Pathalcol and R. stolonifer) (Table 1).

2.4.3. Biological activity of citral and citral epoxide: Citral and its epoxide were tested against the fungal species R. stolonifer, and the bacterial species S. aureus.

2.4.4. Antifungal activities: Diffusion method was used to eval-

uate the antimicrobial activity of the tested compounds [25]. The di-

ameter of the fungal growth were measured after 2, 4 and 6 days (Table 2).

2.5. Data analysis:

Analysis of data was carried out by student’s t-test for comparing the means of experimental and control groups [28].

3. RESULTS

Ciral, (1a, 2a, (Z)-3,7-dimethyl-oct-2-en-6-dienal) (1a,1a) is a monoterpene aldehyde which is the major component of lemon grass oil extracted from C. citratus belonging to Gramineae [14 – 16] as a mixture of (2E)- and (2Z)-isomer at a ratio of 3:2, respectively. Thermal oxidation of citral using m-chloroperoxybenzoic acid (mCPBA) in chloroform at room temperature or photochemical oxidation with hydrogen peroxide using a sodium lamp, we obtained a mixture of (E) and (Z) epoxides 2a & 2b in ca. 60% yield (in the ratio of 60:40 of E:Z configuration). No other products were observed [13] (Scheme 1).

Figure 1. Chemical structure of the citral.

Figure 2. Effect of Citral epoxide on radial growth of fungus grown on the solid media (a) control (b) Penicil-

Figure 3. Effect of lemongrass leaves oil (a) Citral (b) Citral epoxide (c) on the radial growth of P. italicum grown on the solid medium (control).

Antibiotic

Staphylococcus aureus (MRSA)

No. 1.

REFERENCES


monoterpenes..J. Nutr., 129:775.


