



IRANIAN MEDICINAL PLANTS AS ANTIMICROBIAL AGENTS

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ABSTRACT

Resistance of human and food spoilage pathogens to antimicrobial agents and the side effects of chemical agents or preservative for human is caused for finding natural new antimicrobial agents, especially among the medicinal plants. This review introduces the methods that are used for antimicrobial evaluations and synergistic activities and the antimicrobial potential of some Iranian medicinal plants.

Keywords: medicinal plant, antimicrobial activity, method, synergy

INTRODUCTION

In recent years, the appearance of antibiotic resistant bacteria and fungi to antimicrobial agents has been an important issue for researchers. This resistance to antibiotics increases the morbidity rate in communities (**Mazel and Davies, 1999**). Because of adverse effects of chemical antibiotics and the resistant microorganisms, the scientists have interested in new sources of antimicrobial agent especially among medicinal plants. For a long time, some of plants have been medicinal or food values for humans and is used for treatment of human ailments (**Cowan, 1999**).

Essential oils and plant extracts based on ethnomedicinal uses are potential sources of new antimicrobial compounds against microbial strains. The combined use of plant extracts or essential oils and antibiotics are useful in decreasing drug resistant problems (**Mahboubi and**

Ghazian Bidgoli, 2010). There are some medicinal plant species that are used by Iranian people. Some of these plants are screened for these antimicrobial activities.

In this review, at first, we explain the methods that usually are used for antimicrobial evaluation and their synergistic activity with ordinary antibiotics, and then introduce some Iranian medicinal plants with antimicrobial activities against food spoilage and human pathogenic bacteria and fungi.

ANTIMICROBIAL EVALUATIONS

Antimicrobial evaluation by disc diffusion method

In this quantified method, the bacteria inoculate are prepared by suspending overnight colonies from Brain Heart infusion (BHI) agar in normal saline. The yeast and fungi inoculate are prepared by suspending colonies from 48 and 72 hours Sabouraud dextrose agar (SDA) cultures in RPMI 1640 medium buffered with 0.165 M Morpholine propane sulfonic acid (MOPS). This inoculate is adjusted to 0.5 McFarland (1×10^6 and 10^8 CFU/ml for fungi/yeast and bacteria, respectively) or adjust the turbidity of bacteria and fungi/yeast to 65% and 85% transmittance at 600 and 530 nm, respectively. Then, using a sterile cotton swab are cultured on cation adjusted Muller Hinton Agar for bacteria and SDA for fungi, respectively. Subsequently, sterile filter discs (6 mm in diameter) is saturated with different diluted concentrations of oil or extract that dissolves in dimethylsulfoxide (DMSO) and puts on cultured media. Antibiotic discs and disc containing pure DMSO are used as controls. The plates are incubated at 35 ± 2 °C for 24 or 48 hours for bacteria and fungi, respectively. The inhibition zone (IZ) was measured in diameter by kulis-Vernieh and recorded in millimetres (mm) \pm SD (**NCCLS, 2006**).

Antimicrobial evaluation by microbroth dilution assay

The minimum inhibitory concentration (MIC) and minimum lethal concentration (MLC) values of oil/extract are determined by micro broth dilution assay. The oil/extract is twofold serially diluted with 10% DMSO. These dilutions are prepared in a 96-well microtitre plate. MOPS buffered RPMI 1640 (fungi) (**Daboit et al., 2009**), cation adjusted Muller Hinton broth (bacteria) (**NCCLS, 2009**) are used as broth media. After shaking, 100 μ l of diluted oil/extract is added to each well of 96 microtitre plates. The adjusted microbial

suspensions with 0.5 McFarland is diluted with broth (1×10^6 CFU/ml for bacteria; 10^4 for fungi) and then 100 μ l of it is added to each well and incubated at 35 ± 2 °C. MICs are defined as the lowest concentration of oil/extract that inhibits bacteria after 24 and fungi after 48 hours. MLC values are the first well that showed no growth on specific media.

EVALUATION OF SYNERGISTIC OR ANTAGONISTIC ACTIVITY OF MEDICINAL PLANTS AND ANTIBIOTICS

Synergistic activity by disc comparison

Initially, the minimal inhibitory concentration (MIC) of desired antibiotic against clinical isolates of defined microorganism is determined using micro broth dilution assay (NCCLS, 2009). The MIC 90% for these strains is determined by statistical analysis and one fourth of its value is used as sub-inhibitory concentration in synergy assay (Betoni *et al.*, 2006). Sub-inhibitory concentration of antibiotics is added to medium plates. A plate of Mueller Hinton agar without antibiotic is used as a control. The turbidity of bacterial suspension is adjusted to 0.5 McFarland before inoculating onto the plates. The blank disks are impregnated with different concentration of the oil/extract are put on the plates containing Mueller Hinton agar plus antibiotic. The diameters (mm) of the inhibitory zones are recorded after incubation at 35 ± 2 °C/18-20 hours. The results of inhibitory zones related control media against media plus antibiotic is compared by statistical analysis.

Checkboard microtitre assay

Eight serial, two fold dilutions of oil/extract and antibiotic is prepared and used in the MIC tests. 50 μ l of each dilution of oil/extract is added to the well of 96 microtitre plates in vertical and 10 μ l of antibiotic dilutions is added in horizontal. 100 μ l of microbial suspension (10^6 CFU/ml) is added to each well and incubated at 35 ± 2 °C for 24 hours. Fractional inhibitory concentrations (FICs) are calculated as the MIC of the combination of oil/extract and antibiotic divided by the MIC of oil or antibiotic alone. The FIC index is the FIC of oil and antibiotic and interpreted as showing synergistic effect when it is < 0.5 , as indifferent when it is $> 0.5-2$ and as antagonistic when it is > 2.0 . The synergic effect is shown graphically by applying published Isobole methods (Wagner and Ulrich-Merzenich, 2009; Rosato *et al.*, 2007).

ANTIMICROBIAL ACTIVITY OF MEDICINAL PLANTS

Zataria multiflora

Z. multiflora Boiss belongs to the Labiatae family, has been used traditionally as flavoring, antiseptic, carminative, diuretic and antispasmodic agent, as well as use for treatment of premenstrual pain, chronic catharsis, asthma, jaundice, sore throat and edema. *Z. multiflora* is used in traditional Iranian folk remedies mainly for its antiseptic, antifungal, antibacterial, antiviral, analgesic and carminative properties and for women diseases. Carvacrol and thymol are the antimicrobial components of oil exhibited strong inhibitory effect against broad spectrum of microorganisms including clinical isolates of *C. albicans* (Mahboubi et al., 2008), *S. pneumonia*, *E. faecalis*, *S. agalactiae*, *S. pyogenes*, *S. sanguis*, *S. salivarius*, *S. mutans* (Mahboubi and Feizabadi, 2009), methicillin resistant *S. aureus* (MRSA), methicillin sensitive *S. aureus* (MSSA) (Mahboubi and Ghazian Bidgoli, 2010), *A. niger* and *A. flavus* (Mahboubi and Kazempour, 2009). *K. pneumonia*, *P. aeruginosa*, *B. cereus*, *E. coli* and *S. typhimurium* (Mahboubi and Kazempour, 2009) are less sensitive to *Z. multiflora* oil. *L. monocytogenes* is more resistant to it (MIC and MBC=2 and 4 µl/ml) (Mahboubi and Feizabadi, 2009).

The synergistic activity of *Z. multiflora* oil with vancomycin was shown (Mahboubi and Ghazian Bidgoli, 2009). The FIC index of *Z. multiflora* oil in combination with vancomycin against methicillin sensitive *S. aureus* (MSSA) was 0.06 and 0.125 for vancomycin. The FIC was calculated as 0.2 for oil and 0.12 for vancomycin on MRSA (Mahboubi and Ghazian Bidgoli, 2009). The methanolic extract of aerial parts of *Z. multiflora* have marked activity against clinical isolates of *Candida* sp. (Mahmoudabadi et al, 2006).

Rosemarinus officinalis

R. officinalis commonly known as rosemary is traditionally used as antispasmodic and for treatment of dysmenorrhea, respiratory disorders, nervous ailments and to stimulate growth of the hair (Zargari, 1995). 1,8-cineol, α -pinene and borneol were the main components of rosemary oil with antimicrobial activity against *S. pneumonia*, *S. agalactiae*, *S. sanguis*, *S. salivarius* and *S. mutans*. *S. mutans* and *S. pyogenes* were more sensitive to the oil (Mahboubi and Feizabadi, 2009). The oil exhibited antimicrobial activity against

C. albicans, *S. thyphimurium* and *B. subtilis*. *P. aeruginosa*, *V. cholera*, *L. monocytogenes* were more resistant to rosemary oil (Mahboubi and Kazempour, 2009).

Artemisia sp.

Artemisia genus (*Asteracea*) is one of the most important shrub plants that have 34 annual and perennial species in tropical and subtropical of Iran. Two species of *Artemisia* are *A. aucheri* and *A. sieberi* (*A. herba alba*).

A. aucheri is an aromatic plant that is traditionally used as astringent, disinfectant, anti-parasite, anti-poisoning and antiseptic. Chemical composition of its oil varies from different part of Iran. It is reported from Semnan Province, verbenone and camphor (Sefidkon *et al.*, 2002); from Khorasan Province, linalool, geranyl acetate (Farzaneh *et al.*, 2006); from Kashan, geranyl acetate, E-citral, linalool, geraniol and Z-citral (Mahboubi and Ghazian Bidgoli, 2009) as the main components.

The antimicrobial activity of *A. aucheri* essential oil with linalool and geranyl acetate was reported against *Rhizoctonia solani* (Farzaneh *et al.*, 2006) and the essential oil with geranyl acetate and citral as the main components exhibited antibacterial activity against *S. aureus*, *S. saprophyticus*, *S. pneumonia*, *Sh. flexeneri*, *A. flavus* and *C. albicans*. The essential oil had no effect on *P. aeruginosa* and Gram positive bacteria; *E. faecalis* is more resistant to essential oil. The oil showed bactericidal effect against *S. aureus* and *C. albicans* (Mahboubi and Ghazian Bidgoli, 2009).

A. sieberi Besser another species of *Artemisia* is widely distributed in desert area of Iran. *A. sieberi* essential oil from north of Iran (Tehran and Semnan) contain camphor and 1,8-cineol (Weyerstahl *et al.*, 1993; Sefidkon *et al.*, 2002). The α -thujone and β -thujone were the main components of the oil from central of Iran and exhibited some inhibitory zones against clinical isolates of *C. albicans*, so it has moderate inhibitory effect against *C. albicans* (Mahboubi *et al.*, 2008), dermatophyte fungi (Khosravi *et al.*, 2003), soil born bacteria, *Rhizoctonia solani* and had slightly antimicrobial activity against *Tiarosporrella phaseolina*, *Fusarium moniliforme* and *Fusarium solani* (Farzaneh *et al.*, 2006). Gram positive bacteria and fungi were more sensitive than Gram negative ones and among Gram positive bacilli, *L. monocytogenes* and *B. cereus* and among Gram positive cocci, *S. mutans* were more sensitive than the others (Mahboubi and Farzin, 2009).

Pelargonium graveolens

P. graveolens is a member of *Geraniaceae* family that is commercially cultivated for its essential oil. It is a traditional remedy for wounds, abscesses, fever, colic, nephritis, suppression of urine, cold, sore throat, hemorrhoids and gonorrhoea. The essential oil of *P. graveolens* and its main components, geraniol and citronellol exhibited strong antimicrobial activity against *C. albicans* (Mahboubi *et al.*, 2008), *P. aeruginosa* (Mahboubi *et al.*, 2006), *A. niger*, *A. flavus* (Shin, 2003), *Tricophyton* spp (Shin and Lim, 2004), *Penicillium chrysogenum* (Yang and Clausen, 2007), *S. aureus*, *Streptococcus pneumonia*, *Escherichia coli*, *Klebsiella pneumonia* (Mativandlela *et al.*, 2006). Geraniol inhibited the growth of *C. albicans* and *Saccharomyces cerevisiae* (Bard *et al.*, 1998). Geraniol enhances the rate of potassium leakage out of whole cell and increases *C. albicans* membrane fluidity. Synergistic interaction between *P. graveolens* essential oil and amphotericin B is reported (Rosato *et al.*, 2008).

Lavandula stoechas

Other genus of *Labiatae* family is *Lavandula* genus. *Lavandula stoechas* is an aromatic evergreen shrub that is used for its expectorant, antispasmodic, carminative, stimulant and wound healing activity (Gören *et al.*, 2002). The *L. stoechas* oil with fenchone (68.2%) and camphor (11.2%) as its main components had antifungal activity (Bouzouita *et al.*, 2005). 1,8-cineole (33.6%), linalool (16.6%), camphor (10%) and borneol (17.2%) were the main components of *L. stoechas* oil. *S. pyogenes*, *S. salivarius*, *S. mutans* and *S. pneumonia* were sensitive to the oil than that of *S. agalactiae* and *E. faecalis*. The authors concluded that the oil had moderate antimicrobial activity against *Streptococcus* sp than that of other genus of *Labiatae* family. This oil had least activity against Gram positive, Gram negative bacteria and fungi exception *C. albicans* and *A. niger* (Mahboubi and Feizabadi, 2009).

***Mentha pulegium* L.**

Mentha pulegium L. (pennyroyal) is one of the *Mentha* species commonly known as pennyroyal. The flowering aerial parts of *Mentha pulegium* L. has been traditionally used for its antiseptic for treatment of cold, sinusitis, cholera, food poisoning, bronchitis and

tuberculosis, and also as anti-flatulent, carminative, expectorant, diuretic, antitussive, menstruate. The ingredients of pennyroyal oil have shown differences in its constituents depending on the region of cultivation and there are three chemotypes of pennyroyal with the major oil components 1- pulegone; 2- piperitenone/ or piperitone; 3-isomenthone/ neoisomenthone (Topalov and Dimitrov, 1969; Cook *et al.*, 2007). Piperitone (38%), piperitenone (33%) were the main components of pennyroyal oil from south of the Iran and this oil belong to piperitone/piperitenone type. This oil exhibited a significant antimicrobial activity against *S. aureus*, *S. epidermidis*, *B. cereus*, *C. albicans* and *V. cholera*. Among Gram positive bacteria, *L. monocytogenes* was less sensitive to this oil. The yeast, *C. albicans* were more sensitive than that of *A. niger*. The oil showed bactericidal activity against *S. aureus*, *S. epidermidis*, *B. cereus* and *E. coli* and had inhibitory effect against fungi. Gram positive bacteria were more sensitive than that of gram negative ones (Mahboubi and Haghi, 2008). The antibacterial activity of pennyroyal oil against clinical isolates of *Klebsiella* sp was confirmed (Jazani *et al.*, 2009); the antibacterial effect of pennyroyal oil on *Klebsiella* sp was much higher than of *E. coli* and *S. thyphimurium* (Mahboubi and Haghi, 2008).

***Zhumeria majdae* Rech. F. & Wendelbo**

Z. majdae (Lamiacea) locally known as "Mohrekhosh" is growing in the southern parts of Iran. Its leaves have been used as a curative for stomachs, diarrhea, cold, wound healing, antiseptic and painful menstruation. Essential oil from *Z. majdae* roots and aerial parts is containing manool, o-cedrol and linalool, camphor, respectively as the major components (Javidnia *et al.*, 2003).

The aerial part essential oil showed higher antibacterial activity against *E. coli* than that of *S. aureus* (Soltani Pour *et al.*, 2004) but our study showed that aerial part essential oil had bactericidal effect against *S. aureus*, *B. cereus*. *K. pneumonia* is the most sensitive microorganisms to *Z. majdae* oil, following by *S. aureus*, *S. saprophyticus*, *V. cholera*, *B. cereus* and *S. epidermidis*. *E. coli* and *E. aerogenes* had higher MIC values than the other microorganisms. The oil showed inhibitory effect against *B. subtilis*, *P. vulgaris*, *A. flavus* and *A. niger*. The fungi were resistant to the oil than that of *C. albicans* (Mahboubi and Kazempour, 2009).

Perovskia abrotanoides

P. abrotanoides with vernacular name of "Brazambal", "Domou" and "Gevereh" is a member of *Labiatae* family. The grinded roots traditionally has been used with sesame oil as a paste for treatment of leishmaniasis (Jaafari *et al.*, 2007; Sairafianpour *et al.*, 2001). The antifungal activity of essential oil from flowers was reported against *A. flavus*, *C. albicans* and *Trichophyton mentagrophytes* (Inouye *et al.*, 2001), while it has been shown the oil had no activity against *C. albicans* and fungi (Inouye *et al.*, 2001), we exhibited that *C. albicans* and Gram positive bacteria especially *S. aureus* were sensitive to the oil and Gram negative bacteria and fungi were resistant to it. This activity was related to camphor and α -pinene. 1,8-cineol; another major components of *P. abrotanoides* essential oil had less antimicrobial activity (Mahboubi and Kazempour, 2009).

Ducrosia anethifolia

Three species of *Ducrosia* genus from *Umbelliferae* family is represented in Iran: *D. assadii* Alva, *D. flabellifolia* Boiss and *D. anethifolia* Boiss. *D. anethifolia* is traditionally used for treatment of catarrh, headache and infectious diseases. A few reports are published on antimicrobial activity of *D. anethifolia* oil (Rustaiyan *et al.*, 2006; Janssen *et al.*, 1984; Sefidkon and Javidtash, 2002). The oil with α -pinene, myrcene, limonene, decanal, dodecanol showed a remarkable antimicrobial activity against Gram positive bacteria, yeast and dermatophytes (Sefidkon and Javidtash, 2002). Pangelin is known as antimycobacterial compound from *D. anethifolia* extract (Stavri *et al.*, 2003). The oil with decanal (57.0 %) and α -pinene (6.9%) had a great potential antistaphylococcal activity against MRSA and MSSA (Mahboubi and Feizabadi, 2009).

Azilia eryngioides

A. eryngioides is a flowering endemic plant from *Umbelliferae* in Iran. There are some studies on chemical composition of its essential oil. Bornyl acetate (40.9%) was the main component of essential oil (Masoudi *et al.*, 2005) while Sefidkon and Abdoli (2004) reported α -pinene (64.5%), limonene (11.7%), bornyl acetate (6.4%) as the main components of oil (Sefidkon and Abdoli, 2004). α -pinene (63.8%) and bornyl acetate (18.9%) were the main components of *A. eryngioides* oil from our study (Mahboubi *et al.*, 2010). This oil

showed antimicrobial activity against *S. aureus*, *B. cereus*, *K. pneumonia*, *C. albicans*, *A. parasiticus* but it was less active against *E. coli* and *S. typhimurium*. The oil had the best activity against *K. pneumonia* than the other Gram negative bacteria. The oil showed inhibitory effect against filamentous fungi, *A. flavus* and *A. niger* but had activity against *E. faecalis*, *B. cereus*, *P. aeruginosa* and *C. albicans* (Mahboubi *et al.*, 2010).

Myrtus communis

Myrtus communis (myrtle) is well known in Iran and medicinally believed to have several therapeutic properties such as antioxidant, antimicrobial, antihyperglycemic, analgesic, anti genotoxic. On the basis of myrtenyl acetate, two chemotypes of myrtle oil was reported: α -pinene to myrtenyl acetate or α -pinene to 1,8-cineole (Bradesi *et al.*, 1997).

The antimicrobial activity of myrtle oil is reported against *E. coli*, *S. aureus*, *C. albicans* (Yadegarinia *et al.*, 2006), *S. typhimurium* (Bouzouita *et al.*, 2003; Sagdic *et al.*, 2003) and *Helicobacter pylori* (Deriu *et al.*, 2007). The oil had a weak antifungal activity against *Rhizoctonia solani*, *Fusarium solani* and *colletotrichum linelemuthianum* (Curini *et al.*, 2004) but it had a good antifungal activity against *C. albicans* and *Aspergillus* sp. *C. albicans* was the most sensitive to the oil than *Aspergillus* sp (Mahboubi and Ghazian Bidgoli, 2010). Synergistic activity of myrtle oil and amphotericin B is demonstrated against *C. albicans* and *A. niger* by checkboard microtitre assay (Mahboubi and Ghazian Bidgoli, 2010).

Ferula gummosa

Galbanum is one of the most important resins from roots and aerial parts of *Ferula gummosa* (Apiaceae). Galbanum is used traditionally as food flavor for treatment of some gastrointestinal disorders such as stomach pain, and as antileptic remedy for epilepsy, cholera and as wound healing remedy (Zargari, 1995).

F. gummosa oil with β -pinene (43.1%), α -pinene (5.4%) exhibited antimicrobial activity against *S. aureus*. The inhibition zone diameter ranged from 11.6-34.2 mm at 10-20 μ l of galbanum oil. The MIC, MBC values were in the ranges of 8-32 μ l/ml. The galbanum oil showed the best anti-staphylococcal activity than that of *R. officinalis* and *Foeniculum vulgare* (Mahboubi *et al.*, 2011). The antibacterial activity of 25 μ l galbanum oil with β -pinene (50.1%) and α -pinene (18.3%) by disc diffusion method was reported against *S. aureus*

ATCC 25923 (Eftekhar *et al.*, 2004). α -pinene (14.3%), β -pinene (14.1%) and sabinene (40.1%) were the main components of galbanum oil from Abedi *et al.* (2008) with the MIC value of 3.125 μ l/ml against *S. aureus* (Abedi *et al.*, 2008). α -pinene and β -pinene are bicyclic monoterpene hydrocarbon with significant antimicrobial activity against gram positive bacteria (Pichette *et al.*, 2006; Dorman and Deans, 2000). So, the antimicrobial activity of galbanum oil could be due to the pinene type hydrocarbons.

Foeniculum vulgare

Foeniculum vulgare (Apiaceae) is a well-known umbelliferous plant, commonly known as fennel. It is a perennial herb that grows all over the world and is used traditionally from ancient times as carminative, antiseptic, expectorant, digestive and diuretic agents. The seeds of fennel have been used to regulate menstruation, alleviate the symptoms of female climacteric syndrome and dysmenorrhea and increased libido (Albert-Puleo, 1980). Anethole (84-90%) are the most component of sweet fennel oil. Anethole has a chemical structure similar to dopamine. Dopamine naturally present in the body with relaxing effect on intestine. *F. vulgare* exhibited antimicrobial activity against *S. aureus* (Sadgic and Yasar, 2005; Hammer *et al.*, 1999; Mahboubi *et al.*, 2011), *E. coli* (Hammer *et al.*, 1999), *Bacillus subtilis*, *Aspergillus niger*, *Cladosporium cladosporioides* (Kown *et al.*, 2002). Also, the antimicrobial activity of fennel oil, methanolic and ethanolic extracts against microorganisms showed that the lowest MIC values of oil were for *C. albicans* (0.4% V/V), *P. putida* (0.6% V/V) and *E. coli* (0.8% V/V). The seed extracts and oil exhibit different degree of antimicrobial activities and the oil showed the better activity than two extracts. Gram positive bacteria and *C. albicans* have the same sensitivity to the fennel oil (Gulfraz *et al.*, 2008).

Oliveria decumbens

Oliveria decumbens belongs to the family of Umbeliferae. Its local names are “den”, “denak” and “moshkorak”. It is being used in traditional medicine for treating indigestion, diarrhea, abdominal pains and feverish conditions. The *O. decumbens* extracts and its essential oil has been the subject of researches. The pale yellow essential oil is rich of phenol components such as thymol, carvacrol and p-cymene. The oil from flowers exhibited a broad spectrum antimicrobial activity against bacteria and fungi (Amin *et al.*, 2005) especially against *S. aureus* (Mahboubi *et al.*, 2007), *C. albicans*, *A. niger* and *A. flavus* (Mahboubi

and Feizabadi, 2008). This oil exhibited strong antifungal activity against filamentous fungi and yeast. The gram positive bacteria are more sensitive than gram-negative bacteria. Spore forming bacteria (*Bacillus* sp.) are resistant to essential oil and the effect of oil against *Bacillus* sp. had inhibitory effect. *Pseudomonas aeruginosa* were more resistant than others. Thus, microorganisms differ in their resistance to *O. decumbens* oil, i.e. bacteria are more resistant than fungi and gram negative bacteria are more resistant than gram positive bacteria (**Mahboubi et al., 2008**). The synergistic activity of essential oil and antibiotics revealed that the oil enhances the antimicrobial activity of vancomycin (**Mahboubi et al., 2007**) and amphotericin B (**Mahboubi and Feizabadi, 2008**). The ethanolic extract of *O. decumbens* had the better antibacterial activity than the methanolic extracts. The gram positive bacteria are more sensitive to extracts than gram negative ones. Both extracts showed bactericidal activity against *S. aureus* (**Motamedi et al., 2010**).

CONCLUSION

Because of drug resistance to pathogenic microorganisms and the side effects of some antibiotics, many scientists have recently paid attention to compounds that extracted from nature especially extracts and essential oil from medicinal plants. The use of plant decoctions and other preparations to treat the ailments especially against infectious diseases has an age old history in large parts of the world. Essential oils and plant extracts have potential as antimicrobial agents. There are many literatures about the antimicrobial activity of medicinal plants. The aromatic plants have great importance for food industries, pharmaceutical companies and are used as functional ingredients in foods, drinks, toiletries and cosmetics. Among the medicinal or aromatic plants, there are many plants that have not been studied very much. The research on these plants and identifying the main effective compounds is very important issue for discovery the new antibiotics for future. The essential composition or total active compounds of plant varies in dependence on variety, growth stage, on the date of collections, climatic conditions and extraction technology. The plants from different parts of the world may be have different in their chemical compositions of essential oil or extract. Standardization and creation of some protocols for these compounds is another important issue for use in industry.

The combination of antibiotic with oil could possibility result in a reduction in the quantity of antibiotics, so the evaluation of synergistic activity or antagonistic effect of these compounds can help the problem with administration of antibiotics. We are at the beginning

of this way and we should make hard effort to discovery a new generation antibiotics from nature.

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