

## ANTIMICROBIAL ACTIVITY OF ESSENTIAL OIL OF *ALLIUM CEPA*

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Article Received on  
27 Nov. 2017,

Revised on 17 Dec. 2017,  
Accepted on 07 Jan. 2018

DOI: 10.20959/wjpr20182-10415

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### ABSTRACT

Essential oil extraction from the stalk, fresh bulb and mature bulb of *allium cepa* was carried out through hydro-distillation using Linkersson apparatus. Antifungal activity of all the essential oil was carried out against *aspergillus niger*, *aspergillus oryzae*, *fusarium oxysporium*, *aspergillus ficuum* and *penicillium* while antibacterial activity was carried out against *staphylococcus aureus*, *bacillus subtilis*, *escherichia coli*, *salmonella typhimurium* and *enterobacter aerogenes*. The results revealed that mature bulb essential oil have maximum zone of inhibition against *staphylococcus aureus* (12.6 mm), *bacillus subtilis* (12.7 mm), *escherichia coli* (11.2 mm), *salmonella typhimurium* (3.6 mm) and *enterobacter aerogenes* (11.9 mm) while zone of inhibition of mature bulb essential oil against the fungal strain were *aspergillus niger* (13.6 mm), *aspergillus oryzae* (11.0 mm), *fusarium oxysporium* (12.1 mm), *aspergillus ficuum* (12.5 mm) and *penicillium* (12.8 mm) were respectively. Zone of inhibition of fresh bulb and fresh green stalk of essential oil of *allium cepa* were less as compared to mature bulb essential oil. The antibacterial and antifungal activity of mature bulb was high due to more concentration of chemical constituents.

**KEYWORDS:** Antioxidant, Fresh bulb, *Alium Cepa L*, Hydro-distillation, Essential oil.

### INTRODUCTION

Onion (*allium cepa L.*) belongs to the family *amaryllidaceae*, having more than 700 species found all over the world.<sup>[1]</sup> Onion is one of the oldest known vegetable, indispensable and important vegetable item which is used throughout the year. It is cultivated in all parts of the world and it's all parts like bulb, stalk, seed are used in a valuable way.<sup>[2-4]</sup> Total volume of crop produced is 86.34 million tons from the 1.64 million hectares. Pakistan is an agricultural

country where it is cultivated on 143.7 thousand hectares and produces about 1892 thousand tons during 2010-11.<sup>[5]</sup>

*Allium cepa* has been used both as a food and a medicine. Chemical compounds derived from the bulb of *allium cepa* have exerted anti-inflammatory and antihistamine effects in vitro and in animal models.<sup>[2,6]</sup> Its antibacterial, antiparasitic, and antifungal and antiparasitic, activities have been studied.<sup>[7-9]</sup> Onion past was studied against the gram positive and gram negative bacteria by Kirilov et al, in 2014 and found that white variety gave highest inhibition.<sup>[10]</sup> Lachrymatory effect of *allium cepa* is well known from ancient times. Crushing of *allium cepa* bulb leads to release of trans-(+)-S-(1-propenyl)-L-cystein sulfoxide which is hydrolyzed by the enzyme aliinase stored in the cell vacuoles. Enzymatic reaction produces (Z)-propanethial-S-oxide which causes tear.<sup>[11]</sup> Aroma of the *allium cepa* is due to alkylthiosulphonates which are released on freshly cut bulb, while propyl and propenyl sulfides are responsible for cooked onion. Dimethylthiophenes is found in fried *allium cepa* bulb. Precursor on the *allium cepa* are S-methyl and S-propyl-L-cysteine sulfoxide which are biosynthesized from valine and cysteine.<sup>[10]</sup> More than ninety percent soluble organic-bound sulfur in the *allium cepa* is found in  $\gamma$ -glutamylcysteine peptide not hydrolyzed by aliinase.  $\gamma$ -Glutamylcysteine peptide serve as storage reserve and are important for seed germination. Sulfur rich *allium cepa* compounds metabolized in the human liver microsomes are being substrates for FMO and CYPs.<sup>[12,13]</sup> Recent studies revealed that diallyl disulfide and dipropyl disulfide lowering the blood glucose and lipid levels in human and in animals.<sup>[14]</sup>

The current study was designed to investigate the antibacterial and antifungal activity of the essential oil of fresh green bulb, mature bulb and stalk of *allium cepa*.

## MATERIALS AND METHODS

Mature bulb, fresh green bulb and green stalk of *allium cepa* were collected from the local area nearby Lahore and cut into small pieces. These materials were used for the extraction of essential oil.

### Extraction of essential oil

Mature bulb, fresh green bulb and green stalk of *allium cepa* 1Kg (each) were subjected to hydro-distillation by using Linkersson apparatus for 12 hrs.<sup>[15]</sup> The steam distillate of each part was extracted twice with petroleum ether (2×150 ml). The organic layer was dried over anhydrous sodium sulfate, which on removal of solvent afforded pale colored oil. Dried oil

was stored in an air tight amber colored bottle at 4°C in refrigerator for antibacterial and antifungal studies.

### **Antibacterial and antifungal activity**

The agar disc diffusion method was employed for the determination of antibacterial and antifungal activity of essential oil of mature bulb, fresh green bulb and fresh green stalk of *allium cepa*. Various food borne pathogens including bacteria, staphylococcus aureus, bacillus subtilis, escherichia coli, salmonella typhimurium and enterobacter aerogenes, and various fungi aspergillus niger, aspergillus oryzae, fusarium oxysporium, aspergillus ficuum and penicillium. Standard culture media CM 139, CM271, CM145, CM69, CM7 and CM201 were employed and fungal culture were maintained at 25°C while bacterial culture were maintained at 37°C. Sterile and dried 4mm paper discs (Difco) were impregnated with filtered sterilized (0.45 mm Millipore filter) extracted essential oil and placed on freshly seeded microbial lawns (4 discs in each plate) with a control. All experiments were conducted in triplicate. The petri plates were incubated at their respective temperature and zone of inhibition thus against tested microorganisms were measured in millimeters after a period of 24 hours.<sup>[16,17]</sup>

### **RESULTS AND DISCUSSION**

The essential oil of mature bulb, fresh green bulb and green stalk of *allium cepa* was extracted through hydro-distillation and subsequent separation by diethyl ether followed by drying with sodium sulfate anhydrous. The antibacterial activity of the essential oils of mature bulb, fresh green bulb and fresh green stalk of *allium cepa* are shown in the table 1, while their antifungal activity is shown in the table 2. Maximum zone of inhibition was given by the essential oil of mature bulb in both the cases; antibacterial and antifungal. Followed by fresh green bulb and then fresh green stalk. As it has been confirmed that *allium cepa* essential oil contain of all three parts contains maximum concentration of sulfide compounds but their concentration vary from part to part.<sup>[18]</sup> The difference in their antibacterial and antifungal activity also depends upon the concentration of chemical components.<sup>[19,20]</sup> So, the mature bulb gave highest zone of inhibition as compared to other two parts due to maximum concentration of chemical components.

**Table 1: Antibacterial activity of essential oil of mature bulb, fresh green bulb and fresh green stalk of *Allium cepa*.**

Test Organisms	Colony Morphology	Incubation Temp. °C	Culture Media (Oxoid)	Inhibition Zone (mm) After 24 h. Fresh green stalk	Inhibition Zone (mm) After 24 h. Mature bulb	Inhibition Zone (mm) After 24 h. fresh bulb
Staphylococcus aureus	Gram + cocci	37°C	CM145	9.0	12.6	11.2
Bacillus subtilis	Gram + rods	37°C	CM271	10.1	12.7	12.6
Escherichia coli	Gram - rods	37°C	CM69	10.0	11.2	10.5
Salmonella Typhimurium	Gram - rods	37°C	CM201	2.0	3.6	3.1
Enterobacter aerogenes	Gram - rods	37°C	CM7	9.9	11.9	11.4

**Table 2: Antifungal activity of essential oil of mature bulb, fresh green bulb and fresh green stalk of *Allium cepa*.**

Test Organisms	Incubation Temp (°C)	Culture Media (Oxoid)	Inhibition Zone (mm) After 24h Fresh green stalk	Inhibition Zone (mm) After 24h, Mature bulb	Inhibition Zone (mm) After 24h Fresh bulb
Aspergillus niger	25°C	CM139	11.0	13.6	13.3
Aspergillus oryzae	25°C	CM139	8.1	11.0	10.5
Fusarium oxysporium	25°C	CM139	9.0	12.1	11.7
Aspergillus ficuum	25°C	CM139	7.8	12.5	11.9
Penicillium	25°C	CM139	8.0	12.8	12.0

The essential oil of mature bulb, fresh green bulb and fresh green stalk of *allium cepa* has potential antibacterial and antifungal activity. The advantage of this essential oil is that it contains sulfur compounds, though these oil have acrid smell, but it may be used for skin preparations and hair oil preparations.<sup>[21]</sup> Further study is needed to confirm its efficacy.

## CONCLUSION

Essential oils of mature, fresh green bulb and fresh green stalk of *allium cepa* was extracted through hydro-distillation using Linkersson apparatus. Antibacterial and antifungal activities of all the essential oils were carried out by disc diffusion method against fungul strains (aspergillus niger, aspergillus oryzae, fusarium oxysporium, aspergillus ficuum and penicillium) and bacterial strains (staphylococcus aureus, bacillus subtilis, escherichia coli, salmonella typhimurium and enterobacter aerogenes). The results revealed that mature bulb essential oil have maximum zone of inhibition against staphylococcus aureus (12.6 mm), bacillus subtilis

(12.7 mm), *Escherichia coli* (11.2 mm), *Salmonella typhimurium* (3.6 mm) and *Enterobacter aerogenes* (11.9 mm) while zone of inhibition of mature bulb essential oil against the fungal strain were *Aspergillus niger* (13.6 mm), *Aspergillus oryzae* (11.0 mm), *Fusarium oxysporium* (12.1 mm), *Aspergillus ficuum* (12.5 mm) and *Penicillium* (12.8 mm) were respectively. Zone of inhibition of fresh bulb and fresh green stalk of essential oil of *Allium cepa* were less in both antibacterial and antifungal activity. The antibacterial and antifungal activity of mature bulb was high due to more concentration of chemical constituents.

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