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ANTIMICROBIAL ACTIVITY OF SOME BIOACTIVE PLANT MATERIALS

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Abstract— **The natural medical plant play important role in human health care development. In India about 70 percent of rulal population are depend on traditional Ayurvedic medicines. So, natural medicine plant or traditional medicine is a best alternative of modern medicine. India is top of the producer of medicinal plants. There are currently about 250,000 registered medical plants are in India** (Pandey, Rastogi, and Rawat 2013)**. Nowadays, medical plants play a dominant role in antimicrobial textiles. The compounds like alkaloids, flavanoids, glycosides, resins, phenolic compounds, fales and oils present in the medicinal plants are responsible for antimicrobial activity. These natural compounds derived from the plants are non-toxic and eco-friendly nature. Gram negative and gram positive bacteria are unhealthy and cause disease when it spread into human body. Although most bacteria are harmless some are pathogenic which cause disease in humans. In this paper some natural bio active materials like, Citrus lemon, Garlic, Baeckea frutescens, Neem and Eclipta Alba, used for antimicrobial activity are discussed.**

Keywords— **Antimicrobial activity, herbal, bioactive compounds, medicinal plants, cotton fabric, citrus lemon, garlic, Neem.**

I. INTRODUCTION

Various natural bioactive materials are available in world wide. Each material has its own properties. Some bioactive materials has very good antimicrobial properties (Pandey, Rastogi, and Rawat 2013). In this article, the compounds present and responsible for antimicrobial properties and the application of bioactive materials, Citrus lemon, Garlic, Baeckea frutescens, Neem and Eclipta Alba, on cotton fabric are described**.**

A. Antimicrobial activity of Citrus Lemon

Lemon used in house as medicine for many medical issues and it is from Rutacease family. The lemon having the alkaloids and it has the power to cure cancer (Kadhim Hindi and Ghani Chabuck 2013). So it used to prepare the anticancer activities. The lemon has the potential of antimicrobial activity of the extracts of all the parts of the plants (Kawaii et al. 2000). The lemon has citrus flavonoids in addition to the alkaloids. This citrus flavonoids have the wide spectrum of biological activity (Burt 2004; Ortuño et al. 2006). Flavonoids act as the antioxidants and inhibit cell proliferation (Duthie Garrya and Crozier Alan n.d.). The plant has Flavonoids in the form of glycosylated, and the important factor for determining the bioavailability is their sugar moiety. To minimize the central nervous system disorder, the extracts of bitter orange of various parts, peel, flowers, and leaves are used (De Moraes Pultrini, Almeida Galindo, and Costa 2006). The peel of *Citrus* fruits is a rich source of flavonoid glycosides and volatile oils (Shahanaz sultana et al. 2007). The bioactive compounds, polyphenols, the important vitamin C to cure the vitamin C deficiency also present in the fiber of citrus fruit (Dhanavade et al. 2011). The literature shows that the compounds, essential oils, corydaline and protopine alkaloids, acyclic sesquiterpenes, polyacetylene, lactons, pseudohypericin and hypericin present in citrus lemon are effective in wide range of bacteria. The other compounds, the alcohols, terpenes, aldehydes and ester are also contribute the overall antimicrobial acitivity (Keleş et al. 2001).

Maruti J. Dhanavade et al, used lemon peel for antimicrobial properties. The peels of lemon were separated and dried under sunshades. Dried peels converted into fine powder by crushing in an electric blender. The solvents, ethanol, methanol and acetone are used for extraction of lemon peel. The microorganism used for this antimicrobial activity are *Pseudomonasaeruginosa*, *Salmonella typhimurium*, and *Micrococcus aureus*. The result shows that the lemon peel exhibits good antimicrobial activity (Dhanavade et al. 2011). The essential oils present in the lemon exhibits to inhibit the growth of the microorganisms, moulds P, A. niger chrysogenum, A. flavus and P. verrucosum (Viuda-Martos et al. 2008). Giuseppe *et al*., (2007) have reported the presence of limonoids in *Citrus* species have the antimicrobial properties (Gattuso et al. 2007). Limonoids exhibits good antifungal and antimicrobial properties obtained in *C. limon.*

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The Citrus fruit lemon, orange and grape fruit are used as the natural antimicrobial agents for food products (Corbo et al. 2008). There are several *Citrus (C.)* species, of these *C. limon* (lemon), *C. limetta* (sweet lemon), *C. aurantium* (bitter orange, *C. paradise* (grape fruit)), and *C. jambhiri* (Rough lemon) showed antimicrobial properties (Waidulla N Al-Ani, Siba M Al-Haliem, and Nahla O Tawfik 2010).

Syed Qutaba Bin. Tariq et al (2017), used 100% pure bleached cotton fabric with plain weave construction. The mass per unit weight of the cotton fabric was around 120gsm. The fabric was applied with waste fruit material. Lemon and orange peel were used for extraction. Before extraction, the peels were dried in shade and made into powder. The powders were used to extract the core ingredients from the peel. The extracts of lemon and orange peel are applied on cotton fabric by exhaust method. He used sodium bi carbonate as binder and it improves the durability of the finishing. The lemon and orange fruit waste extracts increases the antimicrobial activity (Qutaba et al. 2017).

Padma S. Vankar et al., used lemon leaves (Citrus limon) as biomaterial for production of nanocomposites to produce the antimicrobial textiles. Lemon extracts act as a reducing agent and silver nano particles act as a core material. The bio synthesis of silver nano composites using the bioactive material, lemon extracts increases the efficiency of the antimicrobial properties (Vankar and Shukla 2012).

B. Antimicrobial activity of Garlic (Allium Satinum)

Garlic (Allium satimm) is a member of the Lilliaceae family. The other materials comes under this family are onions, leeks and chives. The garlic has the bioactive properties like, antimicrobial, antilipidemic, antioxidant, detoxification, anticoagulant, anticarcinogen, antihypertensive properties (Rees et al. 1993). The other medicinal properties of garlic is also reported in many articles and these medicinal properties is mainly due to the presence of sulphides in the oil of garlic(Tsao and Yin 2001).

The main constituents of garlic is Diallyl monosulphide and diallyl disulphide, is responsible for the medicinal properties of the garlic (Tsao and Yin 2001). It has been reported 54.5% of total sulphides were present in the garlic oil. Out of which, diallyl tri sulphades and diallyl tetra sulphades accounted around 26 %, responsible for medicinal properties (Tsao and Yin 2001). In folk medicine, the Allium satiwm L. is used to cure many diseases. The garlic has various bioactive compounds like alliin, allicin, alliinase, diallylsulphide, S-allycystein, and allymethyltrisulphide. The presence of allicin and tiosulphonates attribures to inhibit the growth of bactericidal activity (Adetumbi, Javor, and Lau 1986; Ishikawa et al. 1996; Luigina Cellini et al. 1996; Shashikanth, Basappa, and Murthy 1984).

Garlic exhibits the good antimicrobial activity against the most Susceptible bacteria include S.aureus (Huddleson I.F et al. 1944), E.coli.(Jezpwa L, Rafinski T.J, and Wrocinski T 1966), and so many (V. . Sharma et al. 1977). Antifungal activity of garlic also good against the dermatophytes (Amer, Taha, and Tosson 1980), Cryptococcus sp (Fromtling R and Bulmer G.S. 1978). Antonio Marques et al, studied the effect of thermal variation on antimicrobial activity against the microbes S. enterica of garlic and he reported that the garlic has good antimicrobial properties at low temperatures. He also reported that the Oregano has strong antimicrobial properties than garlic (Marques et al. 2008). Susumu Yoshida et al., studied the antimicrobial activity of the Ajoene derived from garlic. The report exhibits strongest antimicrobial properties were obtained by Ajoene, a derived product of garlic (Yoshida et al. 1987).

C. Antimicrobial activity of Baeckea Frutescens

Myrtaceae is the family and Myrtoideae is the sub family of the medicinal plant Baeckea frutescens L. The plant has been used as an traditional medicine in South East Asia and the essential oil present in the plant contribute to the medicinal use (Razmavar et al. 2014). The small tree, Baeckea frutescens L. found in Hong Kong, South China and Australia. The plant is also called as "Cucur Atap." in malay. The leaves are very small and narrow and look like as needle and it is about 6–15 mm long. The leaves produces resinous aromatic fragrance when it is crushed. In china, to treat the fever, tea is made from the extracts of these leaves (S. Mardisiswojo and H. Rajakmangunsudarso 1985). In Indonesia, it has been used as the traditional folk medicine (S. Mardisiswojo and H. Rajakmangunsudarso 1985). For colic diseases, these leaves are burned and the smoke is given the sufferers (Razmavar et al. 2014).

The oil made from these leaves used for aroma therapy and is used to cure mental clarity and mental distress by inhale of the smoke of these leaves (Setzer et al. 2004). For massaging and to release pain from body, the oil made from these leaves are used (Setzer et al. 2004). The presence of phenolic compounds and flavonoids in Baeckea frutescens L. is revealed by Phytochemical method. The alkaloids are known to prepare analgesics, antimalarial and stimulantsand to control the tumor growth, the flavonoids are used (J.A.Dukeand and E.S.Ayensu 1985). Razmavar et al., in 2014, used the extracts of Baeckea frutescens L. to analyse the antimicrobial activity and it shows good antimicrobial activity angainst the Staphylococcus aureus microbes (Razmavar et al. 2014). Khoirun Nisa et al., isolated three new compounds of acylphloroglucinols, baeckenones along with the known compounds. The isolated compounds exhibits moderate antimicrobial activity (Nisa et al. 2016).

Baeckea frutescens extracts were prepared by drying the parts of the plant at around 60^{O}C in shade. The dried leaves are crushed and made into powder by grinding. The coarse particles were removed by sieving. Then the dried powder were used to extraction. Various solvents were used including, methanol, ethanol and aqueous solvents. The extracts were filtered in Whatman filter paper and the extracts after filtration were used for antimicrobial testing (Razmavar et al. 2014).

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D. Antimicrobial activity of Neem

Azadirachta indica A (Neem) is a tree from the family of Meliaceae is wide spread in all over India. It is widely used to cure insect bites for its excellent pesticide activity. It is used to cure over 400 insect bites (Bina S. Siddiqui et al. 2004; Bina Shaheen Siddiqui et al. 2003). The plant has also has the pharmacological activities, such as anti-malaria, anti-inflammatory, anti-fertility and antimicrobial (Dai et al. 1999; Subapriya and Nagini 2005). Tetranortriterpenoid is the active component of neem and it is abundant in the seeds of neem and it is present in leaves at smaller quantities. The neem has also salanin, nimboline, nimbin, azadiractol and Azadirachtin compounds. Over 300 components were isolated from neem (Dai et al. 1999; V. Sharma et al. 2003; Silva, Crotti, and Cunha 2007). Azadirachtin is the main component of neem for its biological activity (Alves et al. 2009).

The studies of antimicrobial activities on Neem showed good against the most pathogenic microbes. The leaves and seeds exhibits good antimicrobial activity against the microbes *Escherichia coli* and *Staphylococcus aureus.* Whereas, it is very poor against the microbes *S. paratyphi, Bacillus subtillis, Candida albicans* and *S. desynteriae* (Alhmad & Beg, 2001). The Neem extracts were excellent against the most pathogenic fungi, *Epidermophyton, Trichophyton,* and *Microsporum,*((Alves et al. 2009). The aqueous extracts of neem leaf has the excellent antiseptic properties to cure wounds, swellings, soothes and used in skin problems (Raut, Sawant, and Jamge 2014).

N.A. Ibrahim et al., used neem oil in reactive print to impart antimicrobial activity on cotton and viscose fabrics. The print was exposed in alkaline condition to fix the reactive dye. The inclusion of bioactive compound, neem oil increases the antimicrobial activity against the pathogenic microbes E. coli and S. aureus. The antimicrobial activity is not affected by the type of reactive dye. The print with reactive dye look darker in shade when it is applied over the neem oil. The durability of antimicrobial activity of the finishing is confirmed after the 15 washes (Ibrahim, Eid, and El-Zairy 2011).

M joshi et al., used a natural bioactive agent, Neem to finish the polyester cotton blended fabric for its improvement in antimicrobial activity. He used glyoxal/glycol as crosslinking agent to improve the durability of the finishing. The aqueous extracts were prepared as per the standard procedure and applied on polyester and cotton blended fabric along with the crosslinking agent, glyoxal/glycol and Citric acid as catalyst in padding mangle by pad dry cure method. The padded fabric is dried at 60^{O}C and cured at 150^{O}C in curing chamber. The research identify that the increase in catalyst increase the crease recovery angle of the finished fabric. This may be the presence of citric acid act as a binder to increase the crease recovery angle. The increase the concentration of extract increase the antimicrobial activity. The durability performance was increased by the increase of crosslinking agents (Joshi, Ali, and Rajendran 2007).

K. Vaideki et al., used RF plasma treatment before the application of Neem extracts on cotton fabric to study the effect of RF plasma on antimicrobial activity. The plasma treatment increase the absorbency of azadirachtin compounds that increase the antimicrobial activity(Vaideki et al. 2008). Aparajita Verma at al., used neam leaves to synthesis of silver nanoparticles. The finished silver nano particles prepared from neem leaves produces the excellent antimicrobial activity (Verma and Mehata 2016).

E. Antimicrobial activity of Eclipta Alba

Asteraceae family of Eclipta alba also called as Bhringraja in local, a herbaceous medicinal plant known for its biological activities. In India, hepatitis are treated by Eclipta alba (Singh et al. 2001), it is also used to reduce the hair loss (Datta et al. 2009), anti venom for snake bite, and viral infections (Diogo et al. 2009). In Ayurveda, hepato related diseases like liver restore and other issues related to liver like liver ailments as well as hepatitis has been treated with Eclipta alba (Singh et al. 1993). Anti-HCV activities were cured using the Eclipta alba extract and the isolated compounds. It is used as a cholagogue and anti-blocking, jaundice and gall bladder (Orning et al., 1980). It is also has the power to enhance the memory and anti aging (Manvar et al. 2012). Wedelolactone and dimethyl wedelolactone compound were isolated from the Eclipta alba and used to blood thinning agent (Franca, Bertoni, and Pereira 1995; Wagner et al. 1986).

Khushwinder Kaur et al., used the methanolic extracts of false daisy to finish the cotton fabric for antimicrobial activity by direct and micro encapsulated methods. The methanolic extracts of false daisy were prepared by drying the leaves in shade and crushed into powder using mixer grinder. Then the powder were used for extraction in Soxhlet apparatus and methanol used as the solvent. The prepared methanol extracts were applied on cotton fabric in pad dry cure method with cross linking agent and micro encapsulation methods. The antimicrobial activity of the false daisy showed good in reduction of microbial growth in both direct method and micro encapsulated methods. The microencapsulated method showed good antimicrobial activity even after some washes (KAUR, BAINS, and GREWAL 2016).

II. CONCLUSION

Natural bioactive plant material is the alternative materials for synthetic non ecofriendly materials. These synthetic antimicrobial materials create lot of issues like non eco-friendly, cause side effects and so many. Whereas, the natural bioactive materials are ecofriendly, no side effects and available abundantly. In this paper, the antimicrobial activity of the various bioactive materials like Citrus lemon, Garlic, Baeckea frutescens, Neem and Eclipta Alba were described. Also the compounds which are present in the bioactive

materials responsible for the antimicrobial are also listed. The extraction method and application of bioactive materials on textile materials are also enlisted.

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