



Determination and Comparison of the Extractives Chemical Compounds in Wood and Bark of Planted Eldar Pine Tree by GC-MS Methods

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Eldar pine tree is one of the species that planted in city parks, garden and forests region of Tehran and another city of Iran. In this study, three trees from species of planted elder pine tree were randomly cut down in planted forest region of Tehran city. Then from each tree were separated three disks. At first wood flour and then extractive measured by TAPPI standards. The results showed that the average of extractives in wood and bark of planted elder pine tree were 3.6 and 17 %, respectively. Then wood flour was washed by acetone and extractives residue was added BSTFA reactor and samples kept in Ben Mary Bath in 70 °C for 1 h and were analyzed by GC/MS. For the identification of compounds were used GC diagram which shows abundance and retention time of each compound, and calculation of quartz index and Adams table. So that, specified 56 compounds in wood and 43 compounds were in bark of planted elder pine tree. That 1-phenanthrenecarboxylic acid, rosin acids, γ -sitosterol, 9-octadecanoic acid, *n*-hexadecanoic acid, octadecanoic acid, 9,12-octadecanoic acid, dodecan, tetradecan, styrene and hexadecan were as 11 common compounds in wood and bark of planted elder pine tree so much and these compounds are very important in durability and its consumption.

Key Words: Elder pine tree, Retention time, BSTFA, GC-MS.

INTRODUCTION

Eldar pine tree is one of the species that planted in city parks, garden and forests region of Tehran and another city of Iran. Eldar pine tree imported to Iran from Tiflis (Georgia) about 800 years ago. The eldar pine can very effective in ever-green and beautiful of city region. The leaves and bark of this species are important in ions adsorption of air pollutions¹⁻⁴. Eldar pine is soft wood with certain heartwood and gum ducts. The growth-ring boundary is certain. The tracheids walls are thick in end of growth-ring. The rays have across-tracheid and sometimes with gum duct. Identification extractives chemical compounds in wood and bark of planted eldar pine tree by GC-MS methods is important for best applications. Hosseini⁵ reported that exhaustive ethanol-toluene of the bark and heartwood of *Juglans regia* afforded pale red-coloured extractives 10 and 12 % yields, respectively. Detailed chemical evaluation of these extracts using GC/MS revealed the major components in the bark and heartwood extractives to be the 3,7-dioxa-2,8-disilanonane, 2,2,8,8-tetramethyl (25.17 %), while the major heartwood extractives constituent was benzoic acid, 3,4,5-tri-(hydroxyl)/gallic acid (44.57 %). The same components of the bark and the heartwood also contained amounts of the gallic acid, 3,7-dioxa-2,8-disilanonane, 2,2,8,8-tetramethyl and

d-glucose, 2,3,4,5,6-pentakis-*o*-(hydroxyl). The most toxic components in the heartwood, were juglone (5.15 %) and 2,7-dimethylphenantheren (5.81 %). Gupta *et al.*⁶ reported that walnut has been related to the presence of phenolic compounds such as flavenoides, naphthoquinones and hydrolyzable tannins. The wood and the bark of black walnut have not been found to contain tannins^{2,7}. However, the wood contains appreciable amounts of gallic acid as well as ellagic acid, glucose and a dark violet polymer. Vaysi⁸ by using GC/MS reported that extractive variation of cypress tree decrease in the longitudinal direction. The average of extractives in natural and planted cypress tree are 7.52 and 2.57 %, respectively. There are specified 14 compounds in natural and 12 compounds in planted cypress tree. That isophyllocladene, 9-octadecenamido, cinnamaldehyde-2-hexyle, bourbonanone and 1 h-naphtho-[2,3-c]pyran-3-acetic acid there were in either species so much and these compounds are very important in durability. Vaysi⁹ reported that 58 compounds definite in newsprint. Benzaldehyde (32.56 %), silan, trimethyl (12.65 %), bis-(2-ethylhexyl) phthalate (6.98 %), γ -sitosterol (4.84 %), *n*-hexadecanoic acid (4.56 %), bibenzyl (3.82 %) were the most compounds and the dodecanoic acid (0.14 %), decan (0.18 %), xylene (0.19 %), 1-methyl-4-phenylmethyl benzene (0.2 %) were lowest

TABLE-2
ANALYSIS OF IMPORTANT EXTRACTIVES CHEMICAL
COMPOUNDS IN BARK OF ELДАР PINE BY GC-MS METHODS

Chemical Component in bark of planted Eldar pine	Retention time (min)	Area (%)	KI
Styrene	6.794	1.07	853
Cyclohexanone	6.962	0.82	862
Decane	10.636	0.99	992
1-Hexanol	11.833	1.58	1029
Dodecane	17.131	3.81	1200
Tetradecane	22.648	2.91	1401
Hexadecane	27.500	2.05	1601
4-Ethoxymethyl-2-methoxyphenol	29.111	0.83	1673
<i>n</i> -Hexadecane	35.321	7.75	1976
9,12-Octadecanoic acid	38.438	1.55	2145
9-Octadecanoic acid	38.55	7	2155
Benzamine	40.185	0.53	2246
Eicosanoic acid	42.320	2.39	2371
Dioxyquinone A dimethyl	42.954	2.58	24.09
Rosin acids	43.025	1.7	2413
1-Phenanthrerecarboxylic acid	43.71	11.57	2460
2,7-Dihydroxy-3,4,6-trimethoxy	44.292	3.41	2499
Abietic acid	44.681	2.78	2525
γ -Sitosterol	44.739	5.6	2529
1,2-Benzenedicarboxylic acid	45.159	4.8	2556
Octadecanoic acid	45.552	15.87	2782
3-Cyclohexane	50.011	1.09	50.01

wood, were juglone (5.15 %) and 2,7-dimethylphenantheren (5.81 %). Vaysi¹² reported that 13 compounds was in Kiwi residues. That hexenol, isopropyl butyrate, 1,2-benzenedicarboxylic acid, 2-methoxy pyrazine, dihydro eudesmol there were in Kiwi residues so much and these compounds are very important in durability.

Conclusion

Eldar pine tree is one of the species that planted in city parks, garden and forests region of Tehran and another city of Iran. The leaves and bark of this species are important in ions adsorption of air pollutions and it can very effective in ever-green and beautiful of city region. Eldar pine is soft wood with certain heartwood and gum ducts. The growth-ring boundary is certain. The aim of this study was identification and comparison of extractives chemical compounds in wood and bark of planted eldar pine tree by GC-MS Methods. Some extractives compounds have been proposed or considered as initiators or the main cause of yellowing in high-yield and wood applications. The results of this study showed that the average of extractives in wood and bark of planted eldar pine tree were 3.6 and 17 % respectively. The results showed that

56 compounds were in wood of elder pine, that 1-phenanthrerecarboxylic acid (31.77 %), rosin acids (27.12 %), pimanic acid (2.61 %), γ -sitosterol (1.01 %), α -pinene (0.09 %) were important components. There were 43 compounds in bark of elder pine that octadecanoic acid (15.87 %), 1-phenanthrerecarboxylic acid (11.17 %), rosin acids (1.7 %), abietic acid (0.78 %), γ -sitosterol (5.6 %) were important components. The result showed that 1-phenanthrerecarboxylic acid, rosin acids, γ -sitosterol, 9-octadecanoic acid, *n*-Hexadecanoic acid, octadecanoic acid, 9,12-octadecanoic acid, dodecan, tetradecan, styrene and hexadecan were as 11 common compounds in wood and bark of planted eldar pine tree, too. These compounds are very important in durability and consumption its. Vaysi⁹ reported that 58 compounds were defined in newsprint. Benzaldehyde (32.56 %), trimethyl silane (12.65 %), bis-(2-ethylhexyl)phthalate (6.98 %), γ -sitosterol (4.84 %), *n*-hexadecanoic acid (4.56 %), dibenzyl (3.82 %) were the most compounds and the dodecanoic acid (0.14 %), decane (0.18 %), xylene (0.19 %), 1-methyl-4-phenylmethyl benzene (0.2 %) were the lowest compounds respectively, too. These compounds are very important in yellowing and brightness stability of newsprint. Vaysi⁸ reported that extractive variation decrease in the longitudinal direction of cypress tree. The average of extractives in natural and planted cypress tree are 7.52 and 2.57 %, respectively. There are specified 14 compounds in natural and 12 compounds in planted cypress tree. That isophyllocladene, 9-octadecenamamide, 2-hexyl cinnamaldehyde, bourbonanone and 1H-naphtho[2,3-c]pyran-3-acetic acid. Gupta *et al.*⁶ reported that walnut has been related to the presence of phenolic compounds such as flavonoides, naphthoquinones and hydrolyzable tannins. The wood and the bark of black walnut have not been found to contain tannins. However, the wood contains appreciable amounts of gallic acid as well as ellagic acid, glucose and a dark violet polymer.

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