Chemical studies on adul tera tlon of garlic and onion oils

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-Onion and garlic are considered major vegetable crops in Egypt. Because of the importance of their essential oils in the international trading I many trials have been carried out for theiradulteration with common adulterants such as; aged oil, maize oil,ethyl alcohol and paraffin oil. Accordingly, these studies were carriedout to give sufficent information about the authenticity of such oils.Both onion and garlic oils were mixed with abovementioned adulterantsin the concentration of 10, 20 and 30%.A comparative physico-chemical analysis were carried out on the samples of both onion and garlic oils to study the effect of the aforegoing adulterants on their physico-chemical propertieS,which would help to determine the degree of authenticity of suchvolatile oil.The obtained results could be summarized as follows : Part 1: Onion volatile oil : Physical properties for fresh onion volatile oil included;specific gravity, refractive index,acid number were, 1.0965, 1.5614 and 7.27 respectively whereas, the addition of increnent amount of variousadulterants caused a proportional decrement in specific gravity. refractive index and acid number with the exception of adulterated sampleswith aged oil caused an increase in specific .;ravity and acid number.On the other hand, the solubility in ethanol of adulterated samples with aged onion volatile oil, maize oil and paraffin oil decreased when compared to the solubility of fresh onion volatileoil. On contrary the solubility of the adulterated samples with ethylalcohol did not changed. Besides, the solubility in organic solventsuch as diethyl ether, carbon tetra chloride, n-hexane, benzene andchloroform was the same since, all samples were completely soluble.U V spectra of onion volatile oil, aged onion volatile and adulterated samples with various abovernentfoned adulterants showed a maximum absorption at 278 .n m, whereas upon using the sameconcentration the absorption intensities differed proportionallyaccording to the concentration of the used adulterant.IR spectrum of onion volatile oil showed different functionalgroups. The dominant active groups were : trans double bond, C-OH stretching, propyl sulphide, CH3 (bending), active methelenegroup, carbonyl group and CH3-CH2- alkane. No new bands were detected in the I R spectra of onion volatile oil adulterated with aged onion volatile oil. whereas, the adulterated samples with maize oil caused the appearance of new band at 1740 cm-1 (C::;Q stretchingof aliphatic esters). Moreover, the adulteration with maize oil ledto broading in absorption bands at 910-980-1 (trans double bond)and 2840-3000 em-1 (-CH-stretches).Vlhen ethanol was used as adulterant, intensities of absorption bandsincreased by increasing the amount of ethanol added to onion volatileoil. whereas, samples adulterated with paraffin oil caused the appearance of four new bands at 705, 1125,1270 and 1730 em-1 which refere to alkenes, C-O in primary alcohols, C-O-C antlsymmetrlcal stretching and C=O stretching in aliphatic esters, respectively. The previous absorption bands were distinguished when commercial paraffin oil was tested alone G.L. C. of fresh onion volatile oil showed that the total peaksnumber were 23. Sexteen volatile compounds were identified whileseven compounds were unknown. The main identified components could be stated in a descending order ; methyl taurine, methyl propyl trisulphide, undecanal, dipropyl trisulphide and propyl alcohol.The G.L.C. analysis of aged onion volatile oil was the same when compared with the fresh oil. However. these components slightly decreased except propyl alcohol, propyl dlsulphide propane and methyl propyl trisulphide were increased. The G.L.C. of adulterated samples of onion volatile oil withethanol indicated that all components decreased as a result of thedilution action of ethanol with the appearance of a single peak ofethanol located directly after the solvent peak which disappeared uponwashing the adulterated samples with saturated solution of sodiumchloride followed by a subsequent drying with anhydrous sodiumsulphite.Glycerol determinations for pure onion volatile oil sampleas well as adulterated samples with maize oil indicated that glycerolcould not be detected in the pure sample of onion volatile oil whereas,glycerol increased proportionally with the increasing of maize oilused as adulterant.The qualitative determination of ethanol by iodoform testfor the pure onion volatile oil and adulterated samples indicate thatno iodoform crystal were formed for the pure onion volatile oil andadulterated samples with aged onion volatile oil, maize oil and paraffinoil. whereas, flat yellow crystals Immediately observed in samplesof onion volatile oil adulterated with ethyl alcohol.On the other hand, the volumetric and colorimetric quantitativedetermination of ethanol revealed that the volumetric method wasless sensitive when compared to colorimetric method. Also, .asexpected the ethyl alcohol content increased proportionally uponincreasing the amount of ethanol used as adulterant. Paraffin oil wasdetermined quantitatively using thin layer chromatography. Resultsobtained indicate that the paraffin oil content increased proportionallywith increasing the percent of paraffin oil in the adulterated onionvolatile oil.Part II. Garlic volatile oil : The physical properties for garlic volatile oil included specificgravity, refractive index, optical rotation and acid number were1.0770, 1.5665, 0.0 and 0.88, respectively. The addition ofincrement amount of various adulterants caused a proportionaldecrement in specific gravity, refractive index and acid numberwhereas, the adulteration with aged oil caused an increase in acidnumber. On the other hand, the solubility in ethanol of aged garlicvolatile oil and adulterated samples with. aged garlic volatile oil,maize oil and paraffin oil was less : than that of the solubilityof fresh garlic volatile oil, on contrary the solubility of theadulterated samples with ethyl alcohol had not been affected. Besidesthe solubility of garlic volatile oil samples in organic solvent suchas; diethyl ether, carbon tetra chloride, a-hexane, benzene andchloroform was the same since all samples were completely soluble.UV spectrum of garlic volatile oil, aged garlic volatile oiland adulterated samples with various adulterants showed a maximumabsorption at 278 mil. whereas, upon using the same concentrationthe absorption rate differed proportionally according to the concentrationof the used adulterant.l R spectrum of garlic volatile oil showed active groups, thedemonant active groups were: -(CH2)n-rock, trans double bond,C-O stretching in primary alcohol, alkenes, CH3-stretching andC-H stretching. No significant changes in intensities of absorptionband were observed when aged garlic volatile oil were incorporatedwith fresh garlic volatile oiL whereas, the adulterated samples withmaize oil caused the appearance of four new absorption band, at1090 cm-1 (C=O in primary alcohol), 1460 cm-1 (OH bending incarboxylic acid), 1740 em-1 (C=O stretching in aliphatic esters) and3455 E:m-1 (bonded OH) which are distinguished for maize oil.As for the use of ethanol as adulterant the intensities ofabsorption bands increased by increasing the amount of ethanol addedto the garlic volatile oil.The samples adulterated with paraffin oil caused an appearance-1 of four bands at 700, 1120, 1460 and 1725 em which refered toalkenes, C-O in primary alcohol, OH bending in carboxylic acids andC=O stretching in aliphatic esters ,respectively. The previous absorptionbands are distinguished to. the use of commercial paraffin oil.G.L.C. of fresh garlic volatile oil show that the total peaksnumber were 25. Thirteen volatile compounds were identified while12 compounds were unknowed- The main identified componentscould be stated in a descending order; diallyl thiophene, dimethylthiophene, 2-propenyl-2-propane thio-sulphonate, diallyl - trisulphideand dipropyl trisulphide.As for aged garlic volatile oil no new components appeared,whereas, all the components decreased except dimethyl thiopheneincreased.Glycerol determination for pure garlic volatile oil as wellas adulterated samples with maize oil had the same trend asmentioned before in the results of onion volatile oil.- 181 -The qualitative determination of ethanol by iodoform testfor the pure garlic volatile oil and adulterated samples indicate thatno iodoform crystals were formed for the pure garlic volatile oiland adulterated samples with aged garlic volatile oil, maize oil andparaffin oil, whereas, flate yellow crystals immediately observedin the adulterated samples with ethyl alcohol.On the other hand, the ethanol determination by volumetricand colourimetric methods had the same pattern as mentioned beforein the results of onion volatile oil.The determination of paraffin oil using TLC technique indicatedthat paraffin oil content increased proportionally with increasingthe amount of paraffin oil in adulterated samples.Conclusively, it seems that the most important determinationwhich could be used to detect adulteration of both onion as wellas garlic volatile oils are; solubility, in ethyl alcohol, specific gravity,refractive index, acid number, iodoform test and U.V. spectrum whichcould be considered as a presumptive test, whereas, quantitativedetermination of alcohol volumetrically and colourimetrically, glycerolby periodic acid oxidation, paraffin oil by T.L-C., G.L.C. and LRcouldbe considered as affirmative tests for the discovery of adulterationpractices.