SUMMARY

The present study entitled, “Efficacy of Natural Antioxidants of Plant Origin on Shelf Life of Edible Oils” was carried out in laboratories of Departments of Food Technology, Guru Jambheshwar University of Science and Technology, Hisar and Department of Food Science and Technology, Choudhary Devlal University, Sirsa. The results of the study are summarized and concluded as under:

1. Four different fruit peel samples were analyzed (pomegranate, sweet orange, papaya and mango) for antioxidant assay. Peel of three different varieties of mango (dushehari, chausa and fazli) was analyzed. It was found that β-carotene was highest in Pomegranate i.e. 3.59mg/100g, total carotenoid was also highest in pomegranate i.e. 5.82mg/100g, RSA% was highest in pomegranate i.e. 66.45% and ascorbic acid was found highest in lemon i.e. 65.26%. The RSA% was found highest in pomegranate, so we can conclude that from this study that pomegranate peel extract can be used as source of natural antioxidants for various purposes. Also it is found that citrus fruits (lemon and mosambi (sweet orange) can also be used in different food commodity for prevention of oxidation upto a good extent because of high ascorbic acid which is used as natural antioxidants.

2. Total carotenoid content in pomegranate, lemon and sweet orange were measured as 5.82, 0.5 and 3.41mg/100g. Pomegranate (5.82mg/100g) had highest TCC content as compared to lemon (0.5mg/100g). β-carotene content of pomegranate, lemon and mosambi were measured as 3.59, 0.008 and 0.001mg/100g. Pomegranate had highest β-carotene content (3.59mg/100g) but the lemon and sweet orange had very less amount of b-carotene. RSA% was measured as 66.45%, 27.31% and 33.22%. In case of RSA% pomegranate also has highest (66.45%) RSA%. Ascorbic acid of pomegranate, lemon and sweet orange were measured as 3.11, 65.26 and 46.11mg/100g. In case of ascorbic acid pomegranate had lowest ascorbic acid (3.11mg/100g) content and lemon had highest (65.26mg/100g), while sweet orange had (46.11mg/100g) ascorbic acid. The highest TCC was reported in the chausa variety (6.09 mg/100g) followed by
dushehari (5.12 mg/100g) and fazli (4.8 mg/100g). Papaya peel also showed the high amount of TCC (6.42 mg/100g) as compared to chausa variety. In case of B-carotene, chausa had the highest (4.72mg/100g) amount of β-carotene as followed by dushehari (4.19mg/100g) and fazli had (3.97mg/100g). Papaya peel had the high amount of β-carotene (5.10mg/100g) as compared to varieties of mango peel. The percentage of radical scavenging activity was highest (18.10%) in chausa mango peel followed by dushehari (17.32%) and fazli (17.02%). Papaya peel showed very high percentage (95%) of RSA (%) as compared to variety of mangoes peel. But in case of ascorbic acid fazli had the highest (42.07mg/100g) ascorbic acid content followed by chausa (35.17mg/100g) and dushehari (20.21 mg/100g). In comparison of papaya and mangoes peel, papaya had the highest (57.22mg/100g) amount of ascorbic acid. Results obtained for RSA of different peels were highest for papaya, followed by pomegranate, sweet orange, mango (chausa), mango (dushehari) and lowest for mango (fazli). The fruit peels of papaya, pomegranate and sweet orange and mango (chausa) were used for further studies.

3. The pomegranate peel extracts exhibited proton-donating ability by DPPH assay. PPE exhibited proton-donating ability by DPPH assay, demonstrated high free radical scavenging activity (66.45%). The samples of soybean oil, sunflower oil, olive oil and mustard oil were used to determine the antioxidant capacity of pomegranate peels. Antioxidant activity was determined by calculating the FFA and peroxide values of oils with and without any synthetic antioxidant and also after the addition of pomegranate peels. At room temperature, oils in which no antioxidants has been added showed FFA value of 0.030 on zero day which goes on increasing with time and readings were observed and recorded after regular interval of time. 0.2% FFA value is considered as critical FFA value above which any oil is regarded as oxidized and not fit for consumption. On 120th day, FFA value comes out to be above 0.247% which implies that the oils had become oxidized. Similarly observations were made by adding synthetic antioxidants i.e. BHA and BHT at a concentration of 200ppm. After addition
of BHA we observed that the oil showed a value of approx. 0.03% FFA on 0 day and on 120th day it became around 0.302% this indicates that BHA is an effective antioxidant for soybean oil, whereas BHT showed good results. The oil remained un-oxidized even on 180th day and showed FFA value of 0.073%.(approx.). BHT was found more effective in retarding rancidity than BHA. Thereafter, pomegranate peel extract was added at different concentrations i.e. 800ppm, 1600ppm and 2400ppm. This addition showed decrease in pattern in FFA value of all of the oils and the best result were obtained at 1600ppm concentration of pomegranate peel extract. All the results and observations show that pomegranate peel contains a large amount of antioxidants and can be used in edible oils for their antioxidant activity. It was also observed that pomegranate peel has antioxidant activity equivalent to BHT at a concentration of 1600 ppm. The pomegranate peel extract added at 1600 ppm and at 2400 ppm level showed almost same results so it can be concluded that PPE at 1600 ppm can be used instead of synthetic antioxidants in edible oils.

4. The extracts of peels of papaya, mango and sweet orange also exhibited proton-donating ability by DPPH assay. Like in case of pomegranate peel, the samples of soybean oil, sunflower oil, olive oil and mustard oil were used to determine the antioxidant capacity of papaya, mango and sweet orange peels. Antioxidant activity was determined by calculating the FFA and peroxide values of oils with and without any synthetic antioxidant and also after the addition of fruit peels. Similar pattern was observed in the case of all the fruit peels in the values of free fatty acid and peroxide value as observed in pomegranate peel extract. Similarly observations were made by adding synthetic antioxidants i.e. BHA and BHT at a concentration of 200ppm. When fruit peel extract were added at different concentrations i.e. 800ppm, 1600ppm and 2400ppm, the addition showed that in papaya peel and mango peel extracts 2400 ppm level showed best results whereas in sweet orange
,1600 ppm level given the best results. All the results and observations show that pomegranate peel followed by sweet orange, papaya and mango peel contains a large amount of antioxidants and can be used in edible oils for their antioxidant activity. The use of fruit peel extracts in mustard oil resulted in showing good shelf life in terms of free fatty acid value and peroxide value. Olive oil was found most prone to oxidative changes followed by sunflower and soybean oil. All the results clearly explains the efficiency of natural antioxidants from fruit wastes in retardation of rancidity of edible oils.

RECOMMENDATIONS OF THE STUDY:

1. The extraction should be done under dim light conditions.
2. The extracts should be stored in amber colored vessels away from light and in refrigerated conditions.
3. The contact of air with extracted antioxidants must be avoided.
4. The incorporation of antioxidants in any system must be concentration specific and should be done with expertise.

RECOMMENDATIONS FOR FUTURE RESEARCH:

The excessive use of synthetic antioxidants in food has been denounced the world over because of their hazardous properties. This has led to focus on the use of antioxidants obtained from natural resources. Natural antioxidants are being acclaimed globally for their numerous benefits to human health. They have been found to have anti-carcinogenic, anti-mutagenic and anti–inflammatory properties. Despite of enormous health benefits, the use of natural antioxidants has remained somewhat subdued primarily because of their instability to light, heat and other food processing regimes. There has been a very scanty and unorganized research and development activity in the area of natural antioxidants and that too antioxidants from waste of agro-industries. In the light of the results of the present study the following recommendations are made:
1. The extraction of pure natural antioxidants for being able to be used in foods has been a very demanding and taxing task, so future research needs to be guided in direction of evolving extraction and purification technologies that are cost effective and efficient.

2. The biggest challenge facing the scientific community is the instability of the natural pigments under various processing conditions. Future research should be more confined towards stability towards extreme processing condition.

3. There is also an urgent requirement to explore more residual sources for natural antioxidant extraction.

4. The acceptability of natural antioxidants by industries is a major concern and wide research should be done in this area.

5. The incorporation of natural antioxidants in micro emulsion forms and nanoparticle forms should be tried and techniques for their stability must be developed.

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