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SCREENING OF SEED OILS FROM FOUR SPECIES OF GENUS *IPOMOEA*

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ABSTRACT

Background: India depends upon world market to fulfill their industrial and domestic demand of oil, account huge foreign exchange. Since agriculture in India depend upon monsoon, causes uncertainty. In last few decades, there is rapid increase in demand of oil and their oleo chemicals in industries like plasticizers, lubricants, pharmaceuticals, organic pesticides, agro products etc.

Aim: The aim of this study is to explore non-traditional oil sources in order to establish them for various purposes.

Methodology: Seeds from four plant species of genus *Ipomoea* (*I. indica, I. nil, I. pestigridis* and *I. quamoclit*) belonging to convolvulaceae family were subjected to various analytical technique to evaluate their physico-chemical properties. Fatty acid methyl esters (FAMEs) were analyzed using chromatographic and spectroscopic techniques to evaluate their fatty acid compositions.

Results: The results show that the oil yields from the seeds varied from 7.84% to 14.71%. Linoleic and oleic acids were found major fatty acids in all four seed oils. They show high iodine and saponification values. The all four seed oil show high content of polyunsaturated fatty acids (PUFAs) and P/S index more than 1.

Conclusion: Fair oil%, high saponification value and P/S index more than 1, indicated us to use these parameters to establish them as alternate oil sources for various domestic and industrial applications.

Key Words: Genus *Ipomoea*, fatty acid compositions, polyunsaturated fatty acids (PUFAs), Oleo chemicals, P/S index

INTRODUCTION

Genus *Ipomoea* belongs to convolvulaceae; morning glory family, prominently found in southern, mid-western and western India. Ipomoea is the largest genus of convolvulaceae family; consist over 500 species world wide of which about 60 species are native to India. There are some familiar and economically important examples of this genus; such as *Ipomoea batatas* (sweet potato), *Ipomoea aquatica* (water spinach), *Ipomoea carnea* (mahananda) etc. All four Ipomoea species (*I. indica, I. nil, I. pestigridis* and *I. quamoclit*) are climber, common in tropical and sub tropical region.

Ipomoea indica (blue morning glory) is a herbaceous twining vine. The plant has laxative property and root paste applied to backaches and sore muscles as a poultice (1). *Ipomoea nil* is commonly known as Japanese morning glory, seed show hepatoprotective activity (2). The dried seeds are used in anti-inflammatory, Inflammations, Constipation, Dyspepsia, carminative, depurative, Purgative, Vermifuge, Bronchitis, Fever, Skin diseases, Scabies etc. and also used as purgative (3,4). *Ipomoea pestigridis* (Tigers foot morning glory) leaves extract is administered orally for treatment of intestinal worms (5). Roots are proved beneficial for women in urinary retention, constipation and gynecological disorder and also useful in purgative (3,6). Whole plant along with bread is eaten for healing wounds (7). *Ipomoea quamoclit* (Cyperus vine) seed is helpful in laxative (8), crushed root with sugar administered orally to cure passing of semen with urine (9). Its leaves are beneficial in ulcer, chest pain (10) and along with stem are helpful in fever, diabetes (11). Hydro-alcoholic extract of its aerial parts show significant radical scavenger activity (11,12).

Plant oils are important biomolecules, mostly are in the form of triglycerides (13), they are good sources of usual and unusual fatty acids. In past few decades, production and utilization of oils and fats have grown in size and diversity. Use of Oleo-chemicals have also grown in size in verity of industries such as surfactants, plasticizers, lubricants, pharmaceuticals, soap, detergents, organic pesticides etc. The majority of world oil production depends on few plant species such as

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soybean, palm, rapeseed, sunflower, ground nut, olive etc. In order to meet the necessary demand of oils and because of different geographical and climatic conditions many plant species have been domesticated and cultivated for centuries for vegetal, medicinal and industrial applications. In our research, we have studied seed oils of genus *Ipomoea* to evaluate their potential applications for various purposes.

MATERIAL AND METHOD

Sample collection and *trans*-estrification

Seeds of four species (*I. indica, I. nil, I. pestigridis* and *I. quamoclit*) were collected at maturity from arid and semi arid region of western Rajasthan (India). The whole seeds were used for the analyses, were freeze-dried and ground to powder using mortar and analyzed immediately. Oil extraction was performed from grounded seeds of four species with light petroleum ether (40-60°C) using soxhlet extraction technique. The solvent was removed completely under vacuum using rotary evaporator. The analytical values of seeds and seed oils were determined according to American Oil Chemist Society (AOCS) methods (14). Methyl esters of oils were prepared using *trans*-esterification technique (15).

Analyses of Fatty Acid Methyl Esters

IR spectrums of Fatty Acid Methyl Esters (FAMEs) were recorded using Perkin Elmer RX-I FTIR on KBr cell. The UV-Vis. Spectrum was performed on Perkin Elmer Lambda 15 UV/Vis spectrophotometer. FAMEs were analyzed in Thermo scientific TSQ 8000 Gas Chromatograph- mass spectrophotometer. A capillary column of polysilphenylene-siloxane (BPX 70 TM; length: 25 m; internal diameter: 0.22 mm; thickness of film: 0.25 µm) was used. Helium was the carrier gas at a flow rate of 1 ml/min. The injector temperature was 250 °C and detector temperature was 260 °C. The oven starting temperature was 80 °C and increased to 200 °C at rate of 8 °C/min, held for 10 min. then increased to 250 °C at rate of 10 °C/min, held for 10 min.

RESULTS

Seed oils of four species from *Ipomoea* genus were evaluated. They are liquid at room temperature and free from any sediment. The analytical values of seeds and seed oils are given in table I.

The oil content of the seeds was 10.39% for *I. indica*, 7.84% for *I. nil*, 14.71% for *I. pestigridis* and 10.37% for *I. quamoclit*. The protein content in the seeds was varied 13.11% (*I. quamoclit*) to 23.89% (*I. pestigridis*). The seed oil of *I. quamoclit* showed highest saponification value (207.41) and the seed oil of *I. indica* showed highest iodine value (134.29). The iodine values obtained by experimental procedures are in well agreement with fatty acid composition of seed oils. The IR and UV-Vis spectra of FAME exhibited no absorption band for the presence of any *trans* unsaturation and conjugation respectively. The oils were examined by GC-MS analysis to the fatty acid content. Fatty acid and their cumulative compositions of seed oils are given in table II.

Linoleic acid (ω-6, essential fatty acid) was found to be most abundant fatty acid in *I. indica* (38.72%), *I. pestigridis* (37.69%), *I. nil* (33.50%) and *I. quamoclit* (29.65%). The second most abundant fatty acid in *I. indica, I. nil, I. pestrigridis* and *I. quamoclit* was oleic acid (ω-9, non essential fatty acid) with 23.43%, 23.10%, 25.73% and 20.73% to the total fatty acid respectively. The amount of linolenic acid (ω-3, essential fatty acid) in the seed oils of *I. indica, I. nil, I. pestrigridis* and *I. quamoclit* was 13.47%, 9.56%, 9.47% and 13.54% respectively. Amoung SFAs stearic was the most abundant fatty acid in *I. indica* and *I. quamoclit* followed by palmitic acid while vice- versa for *I. nil* and *I. pestrigridis*. These seed oil were also found to contain lauric, myristic and other acids in trace amount. The seed oil of *I. quamoclit* was found to contain highest SFAs (36.07%) followed by *I. nil* (33.77%), *I. pestigridis* (27.06%), and *I. indica* (24.39%). In case of PUFAs, the seed oil of I. *indica* showed highest PUFAs (52.19%) followed by *I. pestigridis* (47.16%), *I. quamoclit* (43.19%) and *I. nil* (43.06%) and on the basis of PUFAs content all of them categorized as semi-drying oils. The P/S ratio of *I. indica* seed oil was found to be 2.139 followed by *I. pestigridis* (1.743), *I. nil* (1.1275) and *I. quamoclit* (1.197).

DISCUSSION

Since all four seed which were investigated categorized as semi-drying oils on the basis of PUFAs content and contain P/S ratio more than 1, good for paints-varnishes and Oleo chemical industries (16). Except *I. nil* the other three seed oils showed high saponification values, could be used in soap industries (17,18). The relative amount of SFAs and UFAs in oil is an important parameter for human nutrition and other industrial applications. Since SFAs are desirable for stability of oil (16,19) but became undesirable for human consumption because of the tendency to increase the concentration of low density lipoprotein (LDL)-cholesterol, plasmatic cholesterol and affect the ratio of LDH to HDH (high density lipoprotein) cholesterols level, result into promoting of clotting, vascular smooth proliferation and causes obesity (20-22). Linolenic and linoleic acids (PUFAs) increase the HDL-cholesterol and decrease the LDL-cholesterol while oleic acid (monounsaturated fatty acids; MUFAs) decreases LDL- cholesterol and triacylglicerols blood levels but does not effect HDL-cholesterol level, makes oleic acid more ef-

fective in the prevention of heart diseases (21-23). However PUFAs are important to maintain the adequate ratio of LDL and HDL-cholesterol. So for oils, ratio of PUFAs and SFAs (P/S index) has great importance and should be greater than 1 to consider them suitable for human consumption (24). It was established in studies that P/S relation influences the level of nutrient metabolization in the body and as it increases showed lesser deposition of lipids (23).

CONCLUSION

The present study envisage that on accounting high P/S index (more than 1), appreciable amount of oleic acid, adequate content of SFAs and absence of any *trans* unsaturation and conjugation, the seed oil of all four plant species could be suitable for human consumption. However, not much study on of the seed and seed oil of *I. indica* has been reported so far whether exhibit poisonous property or not. So the seed oil could be more suitable at industrial scale and oleo chemical industries and needs further investigations to establish as a source for edible purpose. Since the medicinal values of seeds of other three plant species have been reported (2-3,6-7), make them a convenient alternate source for human consumption at low scale (domestic level) and because of moderate protein content it could be proved a local animal feedstock as protein source. The by-product of the seeds after oil extraction could also be useful as bio-mass for various applications. Apart from these parameters there are many other parameters likewise presence of any component in seed oil of *I. nil, I. pestigridis* and *I. quamoclit* that could be toxic on consuming at high concentration, their stability at high temperature and resistance against oxidation process should also to be taken in account before establishing as potential source for edible purpose, need further investigations. The result obtained from our study suggested that the above data could be used as base parameter to develop *I. indica, I. nil, I. pestigridis* and *I. quamoclit* for domestic and commercial purpose with a sustainable and sustainable manner in southern, mid-western and western region of India.

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Table 1: Analytical values of seeds and seed oils

	I. indica	*I. nil*	*I. pestigridis*	*I. quamoclit*
Oil %	10.39	7.84	14.71	10.37
Protein %	19.83	17.31	23.89	13.11
Moisture %	1.57	2.47	1.91	1.27
Unsaponifible matter %	1.09	1.83	2.79	1.11
Saponification value	199.63	187.81	197.02	207.41
Iodine value	134.29	121.33	109.54	116.69
Refractive index	1.4743	1.4769	1.4761	1.4807

Table 2: Fatty acid and their cumulative compositions of seed oils

Fatty acids	*I. indica*	*I. nil*	*I. pestigridis*	*I. quamoclit*
Lauric acid (12:0)	2.39	2.83	-	2.47
Myristic acid (14:0)	1.75	2.31	2.83	-
Palmitic acid (16:0)	8.54	13.47	10.59	15.11
Stearic acid (18:0)	10.09	11.39	9.57	16.69
Oleic acid (18:1)	23.41	23.16	25.73	20.73
Linoleic acid (18:2)	38.72	33.50	37.69	29.65
Linolenic acid (18:3)	13.47	9.56	9.47	13.54
Arachidic acid (20:0)	0.83	3.77	4.07	1.80
Behenic acid (22:0)	0.79	-	-	-
ΣSFAs (S)	24.39	33.77	27.06	36.07
ΣUFAs (U)	75.53	66.22	72.89	63.92
ΣPUFAs (P)	52.14	43.06	47.16	43.19
P/S index	2.138	1.275	1.743	1.197

SFAs= saturated fatty acids; UFAs= unsaturated fatty acids; PUFAs= polyunsaturated fatty acids