OIL TECHNOLOGISTS' ASSOCIATION OF INDIA

MARCH 2016 - AUGUST 2016

EASTERN REGION

FOR LIMITED CIRCULATION

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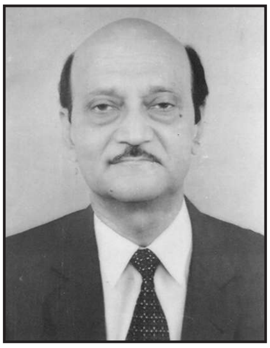
From the Editor's Desk



There is continuous change in the dietary guidelines/pattern of fat consumption. The latest being the Therapeutic uses of "Ketogenic Diets" published in the Journal "Inform", February 2016 and the article is authored by Catherine Watkins.

The salient points which has been stressed upon are @The high fat, adequate -protein and very low carbohydrate way of eating known as the Ketogenic diet(KD) has been used for almost 100 years to treat epilepsy. @The therapeutic effects of K.Ds have been investigated in a number of disease and disorders, including Diabetes, Obesity, Cancer, cardiovascular diseases ,and neurological conditions such as Alzheimer's and Parkinson's disease @ The article provides an overview of where the research stands. We will just have a look at the Macronutrient ranges and total grams for ketogenic diets. Macronutrient ranges and total grams for ketogenic diets :

Macronutrient	**% of calories**	**Total grams***
Dietary fat	70-85%	178 gms
Protein	15-20%	75gms
Carbohydrate	5-10%	25gms

** Based on 2000 Calories/day with 80% Fat,15% Protein,5% Carbohydrate

"Clearly, the biochemistry of KDs is much more complicated than the bare bones description suggests. The focus of this article however ,is on the research regarding therapeutic uses of KDs and not on the cellular mechanism at play." the article states.

The idea behind bringing this article in the Knowledge our members /readers is to provide them with the information regarding the latest research on Fats &Oils and where we are leading to in the context of our traditional pattern of Fat consumption.

A food for thought for all of you.

S. K. ROY
Editor

Ack. / Courtsy
Inform, February, 2016, Vol 27(2), Catherine

Down the Memory Lane

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Ref. No. MMC/Misc/2001 *Date* Sept. 15. 2001

Shri S. K. Roy,
President
Oil Technologists' Association of India (Eastern Zone)
5C, Tarak Mitra Lane, Calcutta 700 026

Dear Shir Roy,

Thank you for asking me to inaugurate the short course on Detection of Adulteration in Edible Oils and Fats, in the Chemical Technology Department of Calcutta University on 29.9.2001 at 10 a.m. I shall be happy to do so.

With regards,

Yours sincerely,

(M. M. Chakrabarty)

Flashback

Prof. D. K. Bhattacharyya, Mr. T. K. Mitra, S. K. Roy, Dr. S. Ghosh in a OTAI function

PHYTOCHEMICALS IN HUMAN NUTRITION AND HEALTH

Prof. Utpal Raychaudhuri, Jayeeta Bardhan, Prof. Runu Chakraborty

Department of Food Technology and Biochemical Engineering, Jadavpur University

WHAT ARE PHYTOCHEMICALS ?

Naturally occurring and biologically active plant compounds that provide health benefits. Nonnutrient plant chemicals that contain protective,disease-preventing compounds Pronounced "fight-o-chemicals," phytochemicals fight to protect health.

HOW DO PHYTOCHEMICALS WORK ?

Some Possible Actions :

Antioxidant – Phytochemicals with antioxidant activity: allyl sulfides (onions, leeks, garlic), carotenoids (fruits, carrots), flavonoids (fruits, vegetables), polyphenols (tea, grapes).

Hormonal action – Isoflavones, found in soy, imitate human estrogens and help to reduce menopausal symptoms and osteoporosis.

Stimulation of enzymes – Indoles, which are found in cabbages, stimulate enzymes that make the estrogen less effective and could reduce the risk for breast cancer. Other phytochemicals, are protease inhibitors (soy and beans), terpenes (citrus fruits and cherries).

Interference with DNA replication – Saponins found in beans interfere with the replication of cell DNA, thereby preventing the multiplication of cancer cells. Capsaicin, found in hot peppers, protects DNA from carcinogens.

Anti-bacterial effect – The phytochemical allicin from garlic has anti-bacterial properties.

Physical action – Some phytochemicals bind physically to cell walls thereby preventing the adhesion of pathogens to human cell walls. Proanthocyanidins are responsible for the anti-adhesion properties of cranberry. Consumption of cranberries will reduce the risk of urinary tract infections and will improve dental health.

PHYTOCHEMICALS AND NUTRITION

1) **Nutrition Concept :** Essentiality to Optimality.
2) **Essentiality :** Avoidance of deficiency diseases using target dietary intakes for the various human groups such as the RNIs (Reference Nutrient Intakes).
3) **Optimality :** Enhanced nutrition linked to prevention of chronic diseases Macronutrients: Balance of the main energy providers like fat, protein and carbohydrate ie, dietary guidelines for healthy eating.

4) **Optimal Nutrition of Micronutrients :** Antioxidant nutrients in reducing adverse impact of toxic free radicals on health.
5) **Accessory factors of antioxidant nutrients :** Phytochemicals/Plant materials having complex bioactive constituents.
6) **Applying Phytotherapy for disease conditions :** Important to consider the influences on the group of cells showing dysfunction or pathology.
7) Cell dysfunction is due to number of stressors when the cell lacks any one of the forty or more nutrients which are required for its function.
8) The Biothermodynamic status of human body (internal environment & energy of the body fluids consistent with the optimal function of the body's cells) and the capacity of the Receptor Activity of the Phytochemicals may trigger responses to the target function of the surrounding tissues to promote blood flow and hence to ameliorate the situation.

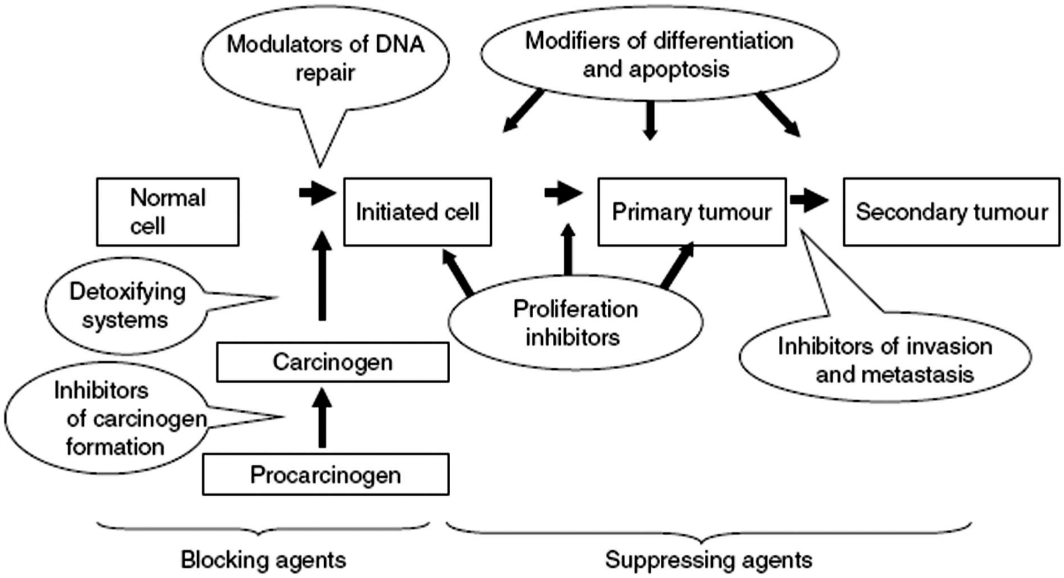
PHYTOCHEMICALS AND HEALTH

Phytochemicals could provide health benefits as :

1) Substrates for biochemical reactions;
2) cofactors of enzymatic reactions;
3) inhibitors of enzymatic reactions;
4) Absorbents/sequestrants that bind to and eliminate undesirable constituents in the intestine;
5) Ligands that agonize or antagonize cell surface or intracellular receptors;
(6) Scavengers of reactive or toxic chemicals;
7) Compounds that enhance the absorption and or stability of essential nutrients;
8) Selective growth factors for beneficial gastrointestinal bacteria;
9) Fermentation substrates for beneficial oral, gastric or intestinal bacteria; and
10) Selective inhibitors of deleterious intestinal bacteria.

PHYTOCHEMICALS : ANTICANCER EFFECT

Many of these phytochemicals exert anti-carcinogenic effects in animal models of cancer, and much progress has been made in defining their many biological activities at the molecular level. Such mechanisms include the detoxification and enhanced excretion of carcinogens, the suppression of inflammatory processes such as cyclooxygenase expression, inhibition of mitosis and the induction of apoptosis at various stages in the progression and promotion of cancer.



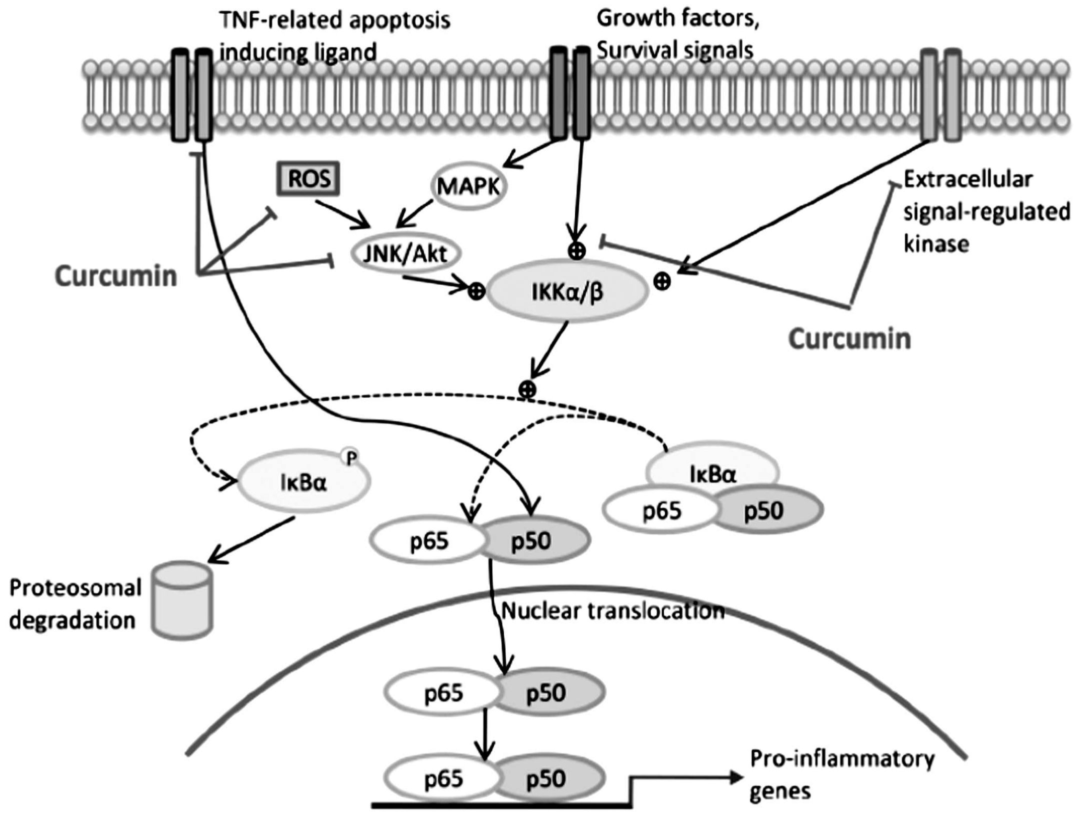
Family of Phytochemicals

1. **Cruciferous Vegetables :** Broccoli, Cauliflower, Cabbage, Dark Leafy Greens.
   Phytochemicals Found : Organosulfur and Glucosinolates
2. **Tomatoes and Watermelons**
   Phytochemical Found : Lycopene
3. **Onions, Garlic, Scallions, Chives**
   Phytochemicals Found : Allium compounds
4. **Grapes, Strawberries, Cranberries, Nuts, Blackberries, Raspberries**
   Phytochemicals Found : Ellagic Acid
5. **Citrus Fruits**
   Phytochemicals Found : Monoterpenes
6. **Soybeans**
   Phytochemicals Found : Isoflavones and Saponins.

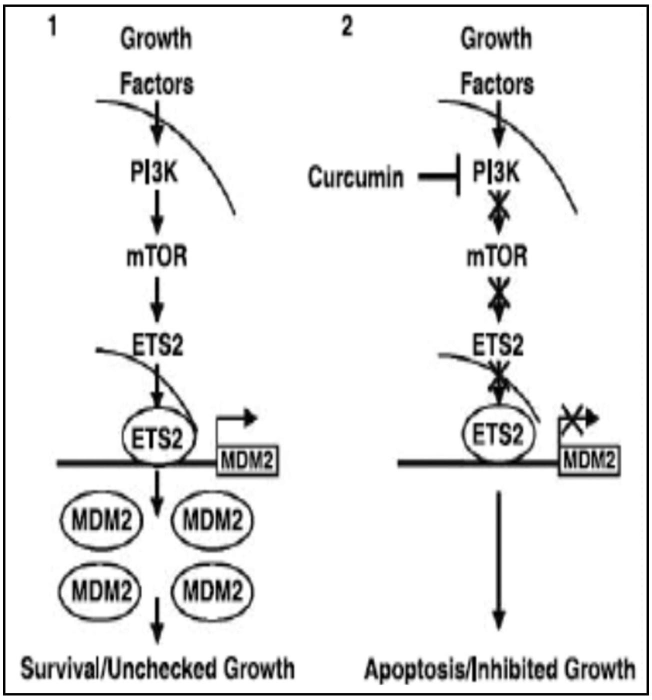
Curcumin

Potentials of curcumin are :

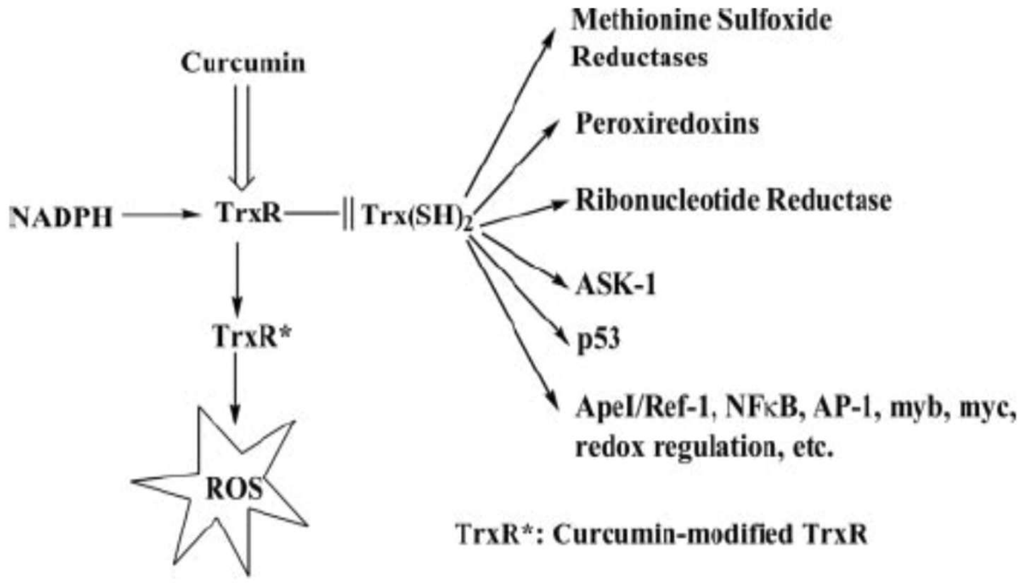
- Antioxidant
- Anticancer
- Antiviral
- Antibacterial
- Antifunga



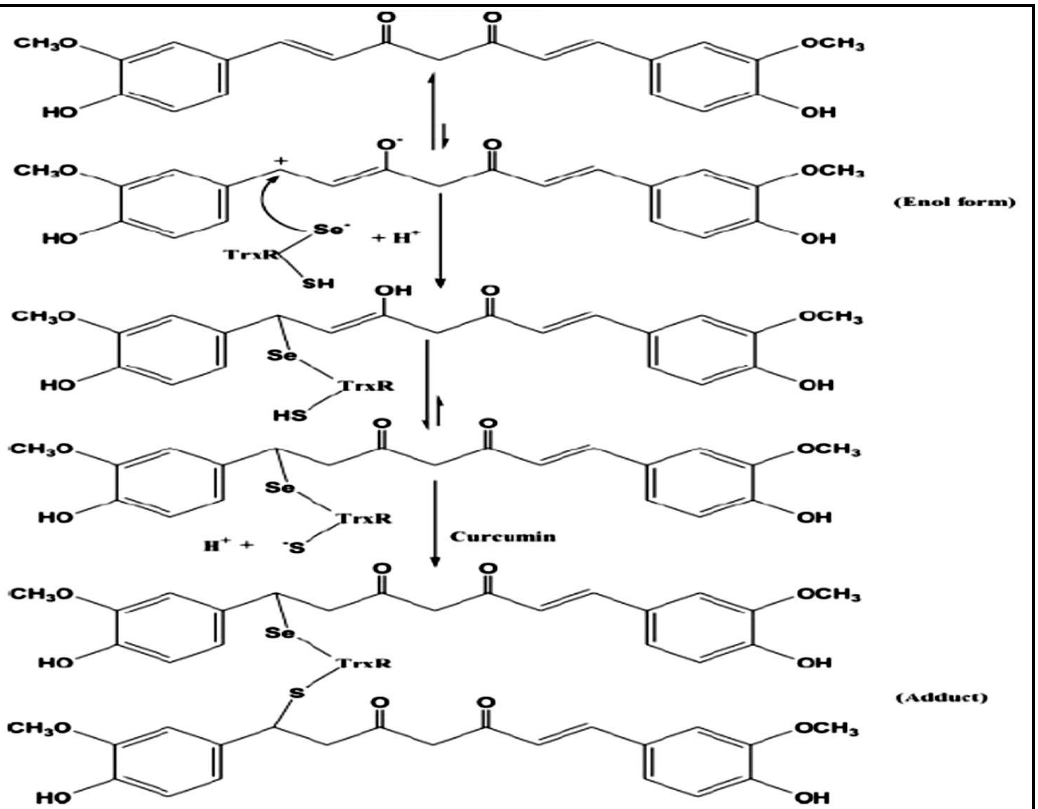
Curcumin inhibits inducible NF-?B activation and suppresses cancer cell proliferation



CURCUMIN DOWNREGULATES ONCOPROTEINMDM2 AT THE TRANSCRIPTIONAL LEVEL



SCHEME 1. **Cascade effects after modification of TrxR by curcumin.** *AP-1*, activator protein 1.



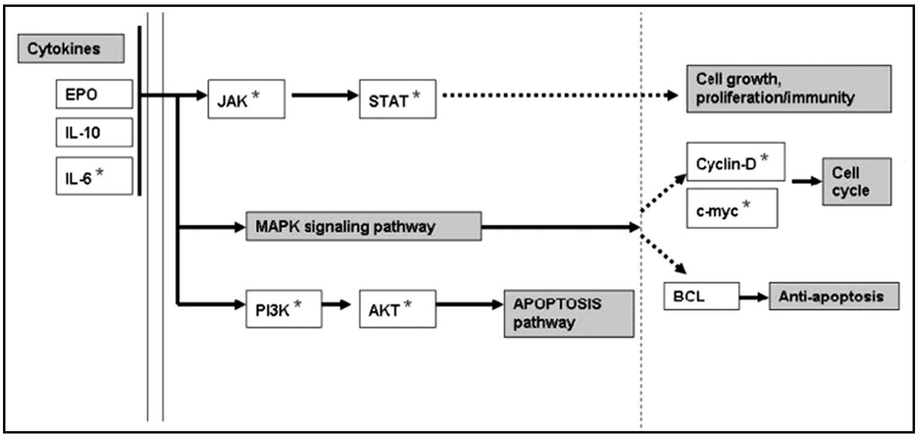
SCHEME 2. **Proposed mechanism of inhibition of TrxR by curcumin.**

Curcumin covalently modify Trx R, thereby inactivating it, causing the signaling cascades ultimately inducing apoptosis

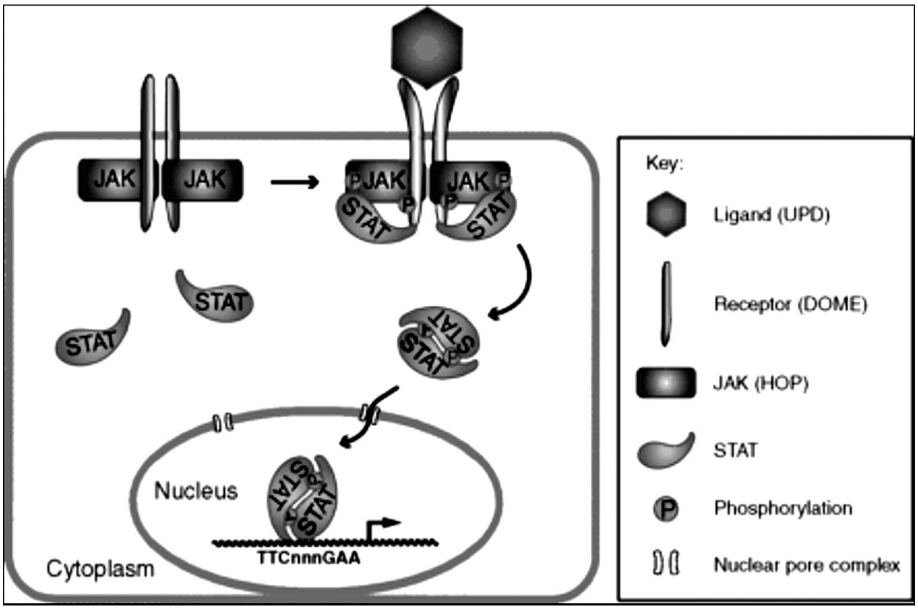
ASWAGANDHA

Withania Somnifera

- Antitumor
- Antistress
- Immunomodulatory
- Anti inflammatory
- Antibacterial



Ashwagandha extract regulates the genes important in cell proliferation, regulation of apoptosis and immunomodulation

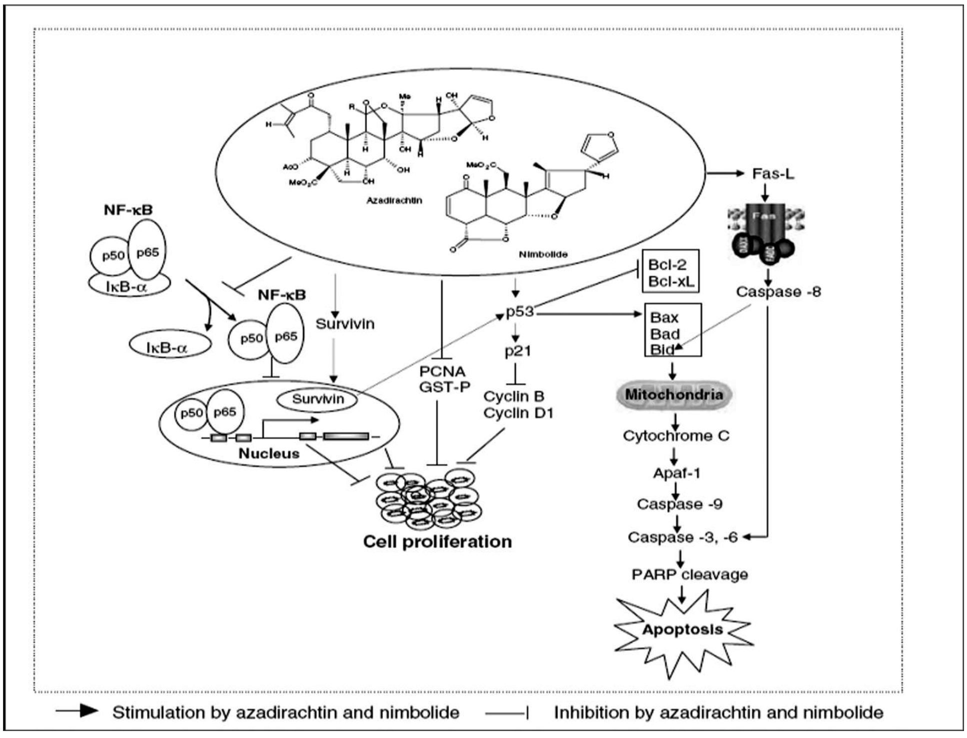


Aswagandha Downregulates the Expression of Stat 2 thereby Modulating Cell Proliferation and Immunity

NEEM

Azadirachta Indica

- Immunomodulatory
- Anti-inflammatory
- Antihyperglycaemic
- Antiulcer
- Antimalarial
- Antifungal
- Antibacterial
- Antiviral
- Antioxidant
- Antimutagenic
- Anticarcinogenic



Inhibition of Ikß degradation and nuclear translocation of p50-p65 NFkß heterodimers cause cell cycle arrest

Upregulation of death receptor Fas and its ligand Fas-L results in activation of caspase 8 and caspase 3 and apoptotic induction

Increase in the Bax-Bcl-2 ratio, release of cytochrome C,formation of apoptosome complex ans caspase activation ultimately transduce apoptosis.

CONCLUSION

1) Identification of a plant/crop with biological activity
2) Identification and characterization of the active principles of the plant
3) Variation in the content of the active principles
4) Examination of the biological activity and the efficacy of a natural product or its active components

    In vitro experiments
    Animal Experiments
    Human experiments

5) Toxicity of natural products of active principles :

   There are three characteristics of a product, which must be examined in relation to toxicity :

   i) Increased doses of the product or active principle above the ususal or recommended amounts.
   ii) Effects of compounds other than the active principles above the ususal or recommended amounts.
   iii) Chemicals used in the purification or treatment of the product to isolate the active principle.

   Adverse effects can occur due to the direct effects on the human body of compounds in three groups above.

6) Alternatively compounds may interfere with other nutrients taken into the body in a Variety of ways :

   i) Destruction of nutrients
   ii) Reducing availability of nutrients
   iii) Interfering with digestion
   iv) Interfering with utilization of nutrients
   v) Decreasing food intake

7) Assessment of natural products for use in human health and medicine.

Effects of Refining Process on Sunflower Oil Minor Components : A Review

Alicia Ayerdi Gotor and Larbi Rhazi

Abstract : Sunflower oil is well known because of its diversity of fatty acids profiles which allow different uses (food: dressing salads, margarines; nonfood: agrofuel, lubricants). Besides, crude oil contains high amounts of desirable minor components (tocopherols, phytosterols, polyphenols, phospholipids...) that present important nutritional features with a positive impact on human health. The different steps of the refining process have as main objective to remove contaminants and other compounds that could hamper the continuity of the process or alter oil during storage. An indirect consequence of this treatment used to preserve food safety is that micronutriments of interest are also partially eliminated reducing the nutritional quality of the oil. This review describes in the first part the chemical composition of sunflower oil focusing on desirable and undesirable components. In the second part the refining process is detailed following the losses of micronutriments at each step of the process and the elimination of unwanted compounds.

Keywords : Sunflower oil / minor components / tocopherols / sterols / refining

1. Introduction

Sunflower (Helianthus annuus L.) seeds have been object of research to study its nutritional characteristics because of its fatty acids and minor components composition. Sunflower oil represented almost 13% of the total oilseeds consumed in the world with near 9.5 Millions of tons in 2011 (FAO, 2015) being the 4th more consumed oil. Sunflower oil has an interesting composition in fatty acids (Tab. 1) on its regular formwith high content in linoleic acid (Regular SO) but also with the other four variants in fatty acids composition: High Oleic Sunflower Oil (HOSO),Mid Oleic Sunflower Oil (MOSO), High Steraric High Oleic Sunflower Oil (HSHOSO) and High Palmitic High Oleic Sunflower Oil (HPHOSO). These four other compositions are interesting for different usages like: biodiesel (Del Gatto et al., 2015), lubricant (Al Mahmud et al., 2013) or its ability to replace hydrogenated fats (Salas et al., 2014). Its oil also contains an important unsaponifiable fraction mainly composed of tocopherols (Vitamin E) and phytosterols, but that also has polyphenols and carotenoids.

Table 1. Fatty acid composition (%) of regular sunflower compared to high oleic, mid oleic and high stearic sunflower.

Fatty acid	Regular SO	HOSO	MOSO	HSHOSO	HPHOSO
C16:0	5.0-7.6	2.6-5.0	4.0-5.5	6	29
C18:0	2.3-4.0	2-4.0	3.0.5.0	21	1.7
C20:0	0.1-0.5	0.2-0.5	0.2-0.4	0.2	/
C22:0	0.3-1.5	0.5-1.6	0.6-1.1	0.4	/
C24:0	ND-0.5	ND-0.5	0.3-0.4	ND	/
C18:1	14.0-39.4	75.0-90.7	43.1-71.8	69	53-57
C18:2	48.3-74.0	2.1-17.0	18.7-45.3	4	2.1-4.3

Data from Fernández-Moya *et al.*, 2006; Ghazani and Marangoni, 2013; Gunstone, 2011; Marmesat *et al.*, 2008; O'Brien, 2009; ND = Non Detectable; SO = Sunflower Oil; HOSO: High Oleic Sunflower Oil, MOSO = Mid Oleic Sunflower Oil; HSHOSO = High Stearic High Oleic Sunflower Oil; HPHOSO = High Palmitic High Oleic Sunflower Oil.

Table 2. Tocopherol contents and composition of several contrasted sunflower oils (mg/kg oil).

	α-toco	β-toco	γ-toco	δ-toco	Total toco
Regular SO	153-957	ND-45	ND-34	ND-7	176.9-1872
HOSO	400-1090	10-35	3-30	ND-17	450-1120
MOSO	488-668	19-52	2-19	ND-2	509-741
HPHOSO-α	826	/	/	/	/
HPHOSO-γ	/	/	808	/	/
IAST-4	4 (%)	3 (%)	34 (%)	58 (%)	/
IAST-5	30(%)	0.77(%)	/	/	/
T2100	/	/	19.97 (%)	/	/

Data from Ayerdi Gotor *et al.*, 2007, 2014; Gunstone, 2011; Marmesat *et al.*, 2008; Velasco *et al.*, 2002, 2004; ND = Non Detectable; SO = Sunflower Oil; HOSO: High Oleic Sunflower Oil, MOSO = Mid Oleic Sunflower Oil; HPHOSO = High Palmitic High Oleic Sunflower Oil.

1.1 Minor components with a nutritional interest

1.1.1 Tocopherols

Tocopherols, also known as Vitamin E, are well known antioxidants molecules naturally found in vegetal oils. There are four forms α-, β-, γ- and δ-tocopherol. γ-tocopherol has showed the highest in vitro antioxidant activity followed by δ-tocopherol (Kamal-Eldin and Appelqvist, 1996; Seppanen *et al.*, 2010). Whereas α-tocopherol presents the highest *in vivo* activity (Traber and Atkinson, 2007) and it exists daily recommended intakes of up to 16 mg/d (Institute of Medicine, 2011). Sunflower oil contains a considerable amount of tocopherols but is the oil having the highest amount in α-tocopherol (Gunstone, 2011). This content can vary within genotypes (Ayerdi Gotor *et al.*, 2006; Velasco *et al.*, 2002) and environmental conditions during cultivation (Ayerdi Gotor *et al.*, 2006, 2015). The tocopherols composition could also be modified (Velasco *et al.*, 2004) (Tab. 2) but is not linked with the composition of fatty acids (Ayerdi Gotor *et al.*, 2014).

1.1.2 Phytosterols

Phytosterols, also known as plant sterols, are a family sof compounds which have been studied largely because of their property to reduce the level of cholesterol in blood, but also because of the reduction of the incidence of some cancers (Kritchevsky, 2002). The American National Cholesterol Education Program (Expert panel on detection evaluation and treatment of high blood cholesterol in adults 2001) recommended a daily intake of 2 g of phytosterol to reduce the low density lipoproteins (LDL cholesterol) in blood. The development of food with added phytosterol has led to regulations on the labeling of these products to avoid an excessive consumption (European Commission, 2013) and a maximum intake of 3 g/day it has been suggested (European Food Safety Authority, 2008). Sunflower oil has a high content in phytosterols (Gunstone, 2011; Vlahakis and Hazebroek, 2000) (Tab. 3) being β-sitosterol the main sterol. Phytosterol content is mainly affected by environmental conditions during plant growth (Ayerdi Gotor *et al.*, 2015) and genetics (Aguirre et al., 2014; Fernandez-Cuesta et al., 2011) but there is no effect of the modification of the fatty acids profile (Ayerdi Gotor *et al.*, 2014).

1.1.3 Others terpenoids

Together with the phytosterols, there are two other terpenoids in sunflower oil, the squalene also a triterpenoid, as the sterols, and the family of carotenoids that are tetraterpenoids. Rao et al. (1998) concluded that the squalene reduces the risk of colon cancer and the serum cholesterol level. Few studies have focused in the variability of squalene in sunflower oil, Merah et al. (2012) reported a variation from 10 to 202 mg/kg on a collection of inbred lines. Otherwise, sunflower oil it is not particularly rich in carotenoids with only 1–1.5 ppm of carotenoids (Gunstone, 2011). The major carotenoids in sunflower oil are xantophylls which reach up to 81% of the total (Rade *et al.*, 2004).

Table 3. Phytosterols contents and composition of several contrasted sunflower oils (mg/100 g oil).

	Campesterol	Stigmasterol	β-sitosterol	Δ^5-Avenasterol	Δ^7-Stigmasterol	Total phytosterol
Regular SO	15.6-65.0	14.4-65.0	120.0-350.0	ND-34.5	15.6-120	125-765
HOSO	8.5-67.6	7.7-67.6	71.4-364.0	2.6-358.8	11.1-124.8	170-520
MOSO	9.1-9.6(%)	9.0-9.3(%)	56.0-58.0(%)	4.8-5.3(%)	6.5-24(%)	–
IASP-18	–	–	–	–	–	1370

Data from Aguirre *et al.*, 2007, 2014; Gunstone, 2011; ND = Non Detected; SO = Sunflower Oil; HOSO: High Oleic Sunflower Oil, MOSO = Mid Oleic Sunflower Oil.

1.1.4 Phenolic acids

Phenolic acids have largely been studied because of their antioxidants and neuroprotectives properties (Stevenson and Hurst, 2007). Sunflower oil presents two major polyphenols, namely, vanilic acid with 6.9 μg/100 g oil and caffeic acid with 4.9 μg/100 g oil. Moreover, there are also small amounts (each one around 1.5 μg/100 g) of p-hydroxybenzoic, pcoumaric, ferulic and sinapic acid (Siger et al., 2008).

1.1.5 Coenzymes Q9 and Q10

Coenzymes are isoprenoid chains with 6 to 10 isoprenoid units (number indicated after the Q letter) attached to substituted benzoquinone moiety (Pravast *et al.*, 2010). Few studies have evaluated the content on coenzyme Q9 (CoQ9) and CoQ10 in oils. Rodriguez-Acuna et al. (2008) developed a new method by HPLC MS/MS. They found that sunflower oil had mainly CoQ9 with 101.3 mg/kg and only 8.7 mg/kg of CoQ10 in refined oil whereas other studies showed higher amounts of CoQ10 up to 15 mg/kg in crude oil (Pregnolato *et al.*, 1994). These coenzymes are interesting because they have antioxidant and anti-inflammatory activities (Yang *et al.*, 2015).

1.2 Other constituents with undesirable functions

1.2.1 Phospholipids

Crude sunflower oil presents high content of phospholipids, which are the major constituents of the biological membranes. The main families of phospholipids found in sunflower oil are phosphatidylcolines, phosphatidylethanolamides, phosphatidylinositols and phosphatidic acids (Gupta, 2002). Sunflowers has mainly hydratable phospholips (Zufarov et al., 2008) but also non hydratable phospholipids, which content could vary in function of the activity of the D phospholipase who is able to convert hydratable onto non hydratable phospholipids in presence of water (Haraldsson, 1983). These molecules have unfavorable effects during the refining process as they can saturate bleaching earths (Taylor, 1993) or induce browning during deodorization (Zamora et al., 2004). This affects the flavor, odor and appearance of the oil, they have, therefore, to be removed during the refining process at the degumming stage (Verleyen, Sosinska *et al.*, 2002). However, polyphenols have a role during oil storage increasing the oxidation stability (Poiana *et al.*, 2009) and could have beneficial effects on human health (Kullenberg *et al.*, 2012).

1.2.2 Free fatty acids

The presence of free fatty acids (FFA) in oils may promote oxidation (Frega *et al.*, 1999). The presence of high levelsof free fatty acids, or free acidity, is due to wet harvest conditions which promote the action of lipases generating these molecules, as well as moist grains during storage (Beratlief and Iliescu, 1997). In sunflower oil FFA varied from 1.19 to 1.35% (w/w) in regular sunflower oil (Kreps *et al.*, 2014), from 0.76 to 1.13% in HOHPSO (Marmesat *et al.*, 2008) and can reach up to 4% in HOSO (Moschner and Biskupek-Korell, 2006). FFA are neutralized during the refining process in order to reduce their undesirable effects as undesirable flavor.

1.2.3 Colorants

The two most common pigments present in vegetable oils are carotenoids and chlorophylls. Few studies have evaluated the content of those two families of molecules in sunflower oils as they are present in small quantities and they are eliminated during the refining process (at the bleaching step). Topkafa *et al.* (2013) found that chlorophyll varied from 403 to 1021 ppb in four crude sunflower oils and β-carotene varied from 1692 to 2803 ppm. The refining process reduces the chlorophylls content up to 96% and 80% the β-carotene content (Kreps *et al.*, 2014).

1.2.4 Wax

Sunflower seeds contain around 0.9% of waxes (Carelli *et al.*, 2002) that are present in the hulls. Only a part of the total wax content is eliminated during the winterization step of the refining process, only the small wax chains with less than 42 carbons are found in the final product (Carelli *et al.*, 2002). Sunflower has mainly C40 and C41 waxes in cold pressed oil (26.8 and 30.2 mg/kg) for a total of 205 mg/kg, whereas in pressed oil C44 was the most abundant (20.3 mg/kg) followed by C41, C46 and C40 for a total of 409 mg/kg (Brevedan *et al.*, 2000), in both cases oil has a wax diversity from C36 to C48.

1.2.5 Trace metals

Trace metals can act as pro-oxidants wherefore the refining process should diminish their content. In sunflower crude oil we can found Iron at 8.37mg/kg, cupper at 3.41mg/kg, calcium at 95.34 mg/kg andmagnesium at 1505.04 mg/kg (Lamas *et al.*, 2014), and traces

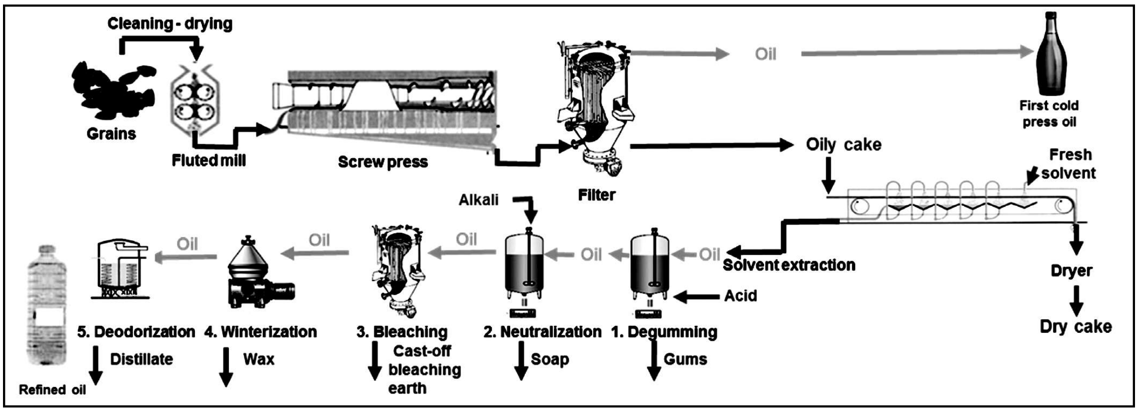


Fig. 1. Extracting and refining steps of sunflower oil.

of other heavy metals as cobalt, cadmium, chrome, lead; nickel or zink (Pehlivana *et al.*, 2008). Preserving oil minor components during the refining process is a major issue in world nutrition. In the present review we focus on the resistance of these minor components at each step of the refining process.

2 Sunflower oil refining

Sunflower oil mechanical extraction is the first step to obtain crude oil, after filtration cold press oil is obtained. On the other hand the residual oily cake is going to be submitted to a solvent extraction and after five successive stages refined oil is obtained. Figure 1 represents schematically the main steps of sunflower oil extraction and refining. There are five main stages where there is a potential leak of minor components : Degumming, neutralization, bleaching; winterization and deodorization. In industries we can find several adaptations of this simplified schema. When the degumming step or the neutralization step are absent they are called physical or solvent refining respectively.

2.1 Refined vs. crude oil

The purpose of refining sunflower oil is to convert the crude oil, which has a high acidity level and/or organoleptic defects, to make it suitable for human consumption. The refining is also aimed at removing contaminants as pesticides and process solvents. Therefore, several refining processing steps are used to remove all undesirable molecules (Fig. 1). Nevertheless, valuable minor components are destroyed and or eliminated with by-products. Generally, several studies have discussed the influence of refining process on the reduction of some minor components present in olive, soybean and rapeseed oil. However, few reports have investigated the effect of each refining step on the total and individual content of each bioactive minor component.

Few studies have evaluated the content of polyphenol and coenzymes in refined oils and none of them have studied the impact of the refining process on all minor components in sunflower oil. The global impact of the refining process observed in different oil matrix was a reduction in these families ofmolecules. In sunflower oil, we observed a reduction of the total phenolic content from19.23 to 1.82mg of gallic acid equivalent / 10g of oil (Kostadinovic-Velickovska and Mitrev, 2013). In rapeseed oil (Kraljić *et al.*, 2015), the loss of polyphenolic compounds was of 63% during the neutralization, 16% during the bleaching and was of 67% during the deodorization step.

In chemical refining process, total tocopherol content gradually declined during overall of process. The reduction in total tocopherols content ranged from 14 to 34% with an average loss of about 27% (Alpaslan *et al.*, 2001; Ergönül and Köseoǧlu, 2014; Karaali, 1985; Talal *et al.*, 2013; Tasan and Demirci, 2005). Ergönül and Köseoǧlu (2014) showed the lowest diminution as they found that the level of total tocopherols decreased from 737 mg/kg in crude sunflower oil to 633.8 mg/kg in refined sunflower oil. The highest decline was reported by Tasan and Demirci (2005).

Physical refining process induced a higher reduction of the total tocopherol content compared to chemical refining process. Total tocopherols losses during the physical process varied from 24.6 to 54.8% with an average loss of 41% (Alpaslan *et al.*, 2001; Kreps *et al.*, 2014; Tasan and Demirci, 2005). Differences in the amount reduction depend on the nature of sunflower cultivars (i.e.: HOSO or regular SO) and the severity of the process conditions such as temperature and steam flow.

Phytosterol content and composition changes during the hole refining process were evaluated by Verleyen, Forcades *et al.* (2002) who found that the process modified the phytosterol composition by increasing the esterified sterols passing from 28.6% in bleached oil to 40% in the refined oil (after the deodorization) of the total sterol content. Karaali (1985) determined in chemically refined sunflower oil a decrease of 60.3% on total phytosterols, with the highest loss during the physical neutralization step.

The level of squalene was found to decrease continuously during all refining steps (Nergiz and Celikkale, 2011). Total average reduction for sunflower seed oil samples during refining process was 32.9%. The level was about 13.8 mg/100 g in crude sunflower oil and about 9.2 mg/100 g in refined sunflower oil.

2.2 Degumming

The main objective of the degumming step is to remove phospholipids (Segers and van de Sande, 1990) as they lead to a dark oil color and promote off-flavors in processed oils. The degumming could be made with water when oil contains hydratable phospholipids or with a previous treatment with an acid like phosphoric or citric acid when oil contains nonhydratable phospholipids (Segers and van de Sande, 1990; Zufarov *et al.,* 2008). Both treatments convert hydratable and nonhydratable forms into hydrated gums. The water degumming process permits to remove about 83% of total phospholipids from solvent extracted sunflower oil (Brevedan et al., 2000). During the refining process metals are removed, acid degumming reduces the content of calcium and magnesium of 88 and 90% (Zufarov et al., 2008), and the iron content is reduced from 4.4 to 3.3 ppm (Karaali, 1985). FFA content is reduced up to 82% passing from 1.24 to 0.23% (w/w) in a combined degummingneutralization step (TOP, also called total degumming process) (Kreps *et al.*, 2014). But it decreased only 20% from 1.03 to 0.83 (% g oleic acid) in a classic degumming step (Karaali, 1985). Chlorophylls are reduced from 5.62 to 4.63 (mg/kg pheophytin a) in HOSO and from 4.32 to 3.56 in regular SO in acid degumming (Kreps *et al.*, 2014).

In addition, the degumming step could be done using enzymatic treatment (Carelli *et al.,* 2002; Lamas et al., 2014). Phospholipid content is reduced up to 97.8%while phosphorus content is decreased up 99.4% (Lamas *et al.*, 2014). About 81.2% and 93% of the calcium and magnesium content respectively, is removed from the crude sunflower oil during enzymatic degumming (Lamas *et al.,* 2014).

This degumming step also affects the content of desirable molecules, tocopherol content is reduced between 6.6 to 8.4% of the total content in regular SO and HOSO respectively (Kreps *et al.,* 2014) but there is no modification in the composition (Tab. 4). These reductions are in agreement with other reported losses (Tasan and Demirci, 2005). These authors found losses of 6% in total tocopherol content during degumming stage of the physical refining process. Karaali (1985) showed a lower reduction in the total tocopherol content, in about 4%. Karaali (1985) also studied the effect of chemical degumming step on sterol content in sunflower oil and found a decrease of 22.4% in total sterol content with equivalent results on individual sterols, except for △7-Avenasterol which increased its relative content 50%.

Reduction in minor components contents during degumming stage could be attributed to acid catalyzed hydrolysis (Verleyen *et al.*, 2001). No data of the content of these components in the produced gum have been reported. Therefore, losses could not be attributed to liquid-solid partitioning of minor components into the gum.

2.3 Neutralization

Oil alkali neutralization is also known as deacidification. It is an important step in the edible oil refining process and aims to remove FFA in oil. It neutralizes free fatty acids in the oil using caustic soda and potash, also decomposes pigments, it eliminates phosphorus compounds, trace metals, proteins and oxidizing materials. Alkali treatment converts the acids into soaps (Hendrix, 1990). These soaps are easily removed by decantation or by centrifugation. This step is only used in the chemical refining process.

Few investigations have discussed the effect of oil neutralization step on minor constituents of refined sunflower oil. Four to 16% losses in total tocopherol level were observed between crude and neutralized oil. Alpasan *et al.* (2001) analyzed total and individual tocopherol contents of sunflower oil, processed either by chemical refining or physical refining methods. About 4.7% of loss in total tocopherol content occurred during chemical neutralization (Tab. 4). They reported a significant decrease of all tocopherols but 63% of the reduction was due to α-tocopherol. Higher elimination of the total tocopherol content has been obtained during chemical neutralization step (Karaali, 1985; Naz *et al.*, 2011). Karaali (1985) showed a significant loss of 11.8% while Naz *et al.* (2011) presented losses of 16% in the total sunflower tocopherol content. More recently, Talal *et al.* (2013) showed a significant decrease in the level of total tocopherols content in sunflower oil during the degumming and alkali neutralizing step. Results of their study indicated a loss of about 10% in total tocopherol amount.

Table 4. Losses (%) of minor components during each step pf the refining process.

Processing stages	Total Tocopherols	Total Polyphenols	Squalene	Phytosterols
Chemical refining process				
Degumming	4	22.4	ND*	ND
Neutralization	3.9-14.7	29.3	ND	ND
Bleaching	5.85-7.9	ND	ND	ND
Winterization	0.6-4.6	5.2	ND	ND
Deodorization	3.6-15.7	3.4	ND	ND
Total loss	14-34	60.3	ND	90.5%
Physical refining process				
Degumming	6-8.4	ND	6.9	ND
Bleaching	3.5-15.8	ND	5.3	ND
Winterization	0.8-5.8	ND	4	ND
Deodorization	20.2-25.7	ND	16.9	ND
Total loss	24.6-54.8	ND	33.1	ND

*ND = Not available data. Data from: (Alpaslan et al., 2001; Ergönül and Köseoǧlu, 2014; Karaali, 1985; Kreps *et al.*, 2014; Nergiz and Çelikkale, 2011; Talal *et al.*, 2013; Tasan and Demirci, 2005; Verleyen, Forcades *et al.*, 2002).

The reduction in the total tocopherol content during the oil neutralization is in agreement with the results of several reported studies on vegetable oils, according to which caustic soda treatment affected the tocopherol level of oils (Ferrari *et al.*, 1996; Karaali, 1985; Tasan and Demirci, 2005). The decline of tocopherols may be due to the fact that tocopherols are unstable in the presence of long contact time with air and alkali and are oxidized to tocoquinones (Tasan and Demirci, 2005).

In addition, chemical treatment do not have similar impact on individual tocopherol content since a loss of α-, β-, γ- and δ-tocopherols of 3, 26, 24, 16%, respectively, was observed (Alpaslan *et al.*, 2001).

A significant decline in the total sterol content in vegetable oil has been reported during the chemical neutralization step (Gutfinger and Letan, 1974), which is attributed to a liquid.liquid partitioning of phytosterols into the soapstock (Serani and Piacenti, 1992). Neutralization process caused in oils 29.3% losses of total sterols. Results of Ruiz-Mendez *et al.* (2011) confirm that an important quantity of removed sterols is found in soapstocks obtained from sunflower oil. Authors demonstrated the influence of alkali concentration and temperature used during neutralization on the total sterol content.

A significant reduction of the total polyphenol content which represents a loss of near 25% of the initial content during this neutralization step was found by Karaali (1985).

Nergiz and Çelikkale (2011) have evaluated the effect of the refining steps on the squalene content of some vegetable oils and found significant reduction in the squalene content after the neutralization/physical refining step. The reduction during this stage of refining was found to be 7% as compared to crude sunflower oil.

2.4 Bleaching

This third step of the oil refining process has as main objective to remove coloring pigments from carotenoids, chlorophylls, and related compounds that catalyze the oxidation of the oil by reacting with light, by using bleaching earths that can be acid activated or coupled with activated carbon to increase the adsorption power and diminish the quantities used (Anderson, 2005; Topkafa *et al.*, 2013). Bleaching earth are also adsorbing residual soaps, phospholipids and other polar lipids (Anderson 2005). Although bleaching generally improves crude oil quality with respect to color, initial and aged flavor, along with oxidative stability, this refining step also has other effects. Some of them are desirable; others are undesirable as the isomerization of the triglycerides (Anderson, 2005). FFA content do not vary significantly during this step in sunflower oil (Kreps *et al.*, 2014) but this step could lead to an increase in FFA in other oils. Chlorophylls are eliminated up to 96% in both HOSO and regular SO where the bleaching conditions were: temperature 90ºC, 0.59% w/w bleaching clay (TAIKO, type : Classic 1G, Malaysia) with mechanical stirring was used at vacuum 13 x 10^3 Pa for 30 min (Kreps *et al.*, 2014) and carotenoids around 77% of the initial value (Rade *et al.*, 2004). The decreases in total tocopherol contents due to bleaching step have been largely studied (Alpaslan *et al.*, 2001; Ergonul and Koseo.glu 2014; Kreps *et al.*, 2014; Tasan and Demirci, 2005). The average reduction is approximately 8% (Alpaslan *et al.*, 2001; Kreps *et al.*, 2014; Tasan and Demirci, 2005). Tasan and Demirci (2005) showed declines of 7.2 and 7.6% in total tocopherol contents for chemical and physical refining process respectively but there is no indication of the bleaching conditions used. Alpaslan reported the lowest percentage of losses during physical process but also the bleaching conditions were no described. Ergönül and Köseoğlu, 2014 (90ºC, 20 min, 1% of activated earth w/w) showed 6% losses. Kreps *et al.* (2014) reported losses of 14.9% in HOSO and 15.8% in regular sunflower oil during this refining step without change in the composition of tocopherol isomers. Naz *et al.* (2011) reported the highest losses of 38.2% of the total tocopherol content (with unspecified bleaching conditions). These reductions during the process of bleaching are due to the complexation of tocopherols with molecules of bleaching clay. The alkalinity and acidity of bleaching clay may damage tocopherol molecules. It has been demonstrated that acid activated bleaching clay can catalyze tocopherol esterification. The acid can also play a role in protonation of tocopherol to produce oxonium ions (McMurry, 2004; Taylor, 2005).

No study has evaluated the impact of bleaching stage on the sunflower's sterols. In other oils total sterol content was slightly reduced in cotton seed oil (8.7% according to El-Mallah *et al.* (2011). In other study authors observed a reduction of 1.3, 8 and 18.5% in corn, soybean and rapeseed respectively in the total sterol content (Ferrari et al., 1996). A deeper analysis on sterol evolution during the refining process was conducted by Verleyen, Sosinska et al. (2002). They showed a differentiated behavior depending on the oil matrix for the evolution of esterified and free sterols. Corn oil presented an increase of up to 3% of free sterols and a decrease of 5% of esterified sterols. In palm oil they observed no difference on esterified sterols and a decrease of 16% on free sterols.

Last, 6% of the squalene content is lost during this bleaching step (Nergiz and Çelikkale, 2011).

2.5 Winterization

Winterizationalso called dewaxing has as main objective to eliminate long chain waxes (with carbon number higher than C42) (Brevedan et al., 2000) and saturated triglycerides by reducing the oil's temperature to 6.8ºC and eliminating the solid particles, for instance, by filtration (Ruiz Mendez *et al.*, 2013).Winterization is the step that reduces the least the minor compounds and particularly tocopherols. In sunflower oil, the reduction in total tocopherol content range from 0.6 to 5.8% with an average of about 2.4% and a variation coefficient between studies of about 76%. These variations are due to the refining process used and the nature of sunflower. Kreps *et al.* (2014) found a loss of 5.8% in HOSO and of 2.9% in regular SO during the process of winterization. In that study, authors explained the decline of tocopherols in winterized oil by interactions between detergent and tocopherols and their removal with waxes.

The winterization has no impact on chlorophylls and reduces18% of the content of β-carotene in both regular and HOSO (Kreps *et al.*, 2014). Karaali (1985) found that the total sterol content diminish in 5.2% that came from an equivalent reduction of each individual sterol except campesterol, its content was reduced 11% and △7 avenasterol which increased nearly 35%.

Nergiz and Celikkale (2011) investigated the changes in the amount of squalene in different vegetable oils during the refining process and found that the smallest reduction of squalene was caused during the winterization. The average reduction was found to be 4%.

2.6 Deodorization

In the edible oil processing, deodorization is the final key step used to remove the off flavors generated during the previous refining steps as oxidation products such as : hydroperoxides, aldehydes, ketones and epoxides, and pulling out volatile components as FFA or contaminants (Akterian, 2009). At the end of this stage, the taste, odor, flavor, color and stability of the oil is improved. During deodorization oil is subjected to high temperatures, to a stripping stream and pressure for a given duration aimed to the optimization of the elimination of undesirable substances, but preserving minor components (leaving at least 80% of them) and reducing the creation of trans fatty acids or oxidation products (Martinčič *et al.*, 2008).

Changes in the content of total tocopherols during this stage are tightly related to the conditions of oil treatment. Physical refining process causes the highest decline. Therefore, losses in total tocopherols content range from 3.7 to 15.7% during chemical refining process (Alpaslan *et al.*, 2001; Ergönül and Köseoǧlu, 2014; Karaali, 1985; Talal *et al.*, 2013; Tasan and Demirci, 2005) while the reported values of reductions during physical refining process are between 21.2% and 25.7% (Alpaslan *et al.*, 2001; Kreps *et al.*, 2014; Tasan and Demirci, 2005). According to these reports, the deodorization stage is the highest reducing stage for tocopherols. The percentages of losses due to this step range from 26.2% (Ergönül and Köseoǧlu, 2014) to 86.3% (Alpaslan *et al.*, 2001) with an average of about 48.6%. In order to decrease the effect of this step on minor components, studies have been done to optimize deodorization conditions. To reduce the losses and preserve up to 90% of the total tocopherol and phytosterol content, Martinčič *et al.* (2008) found in HOSO that the conditions during this deodorization step should be: temperature under

235ºC, with a pressure of 3 mbar and a sparge steam between 2.25 and 1%. Reducing the temperature during the process reduces the losses, but increases the FFA content and reduces the organoleptic value of the oil. During the deodorization step in the oil there is formation of steradienes, that are the dehydrated form of sterols caused by high temperatures and acid conditions (in physical refining) (Verleyen, Szulczewska *et al.*, 2002) reducing the content of free sterol. In sunflower oil Karaali (1985) observed a reduction of 3.4% of total sterol content with higher losses of campesterol and stigmasterol (12% and 15% respectively) and just 3% in β-sitosterol, relatively △5-avenasterol and △7-stigmasterol increased their content to 9 and 7% respectively. Squalene is lost up to 7% in the deodorization process (Nergiz and Celikkale, 2011).

Carotenoids suffer a supplementary reduction of between 8% and 28% of the initial content during this step, reaching a final content equivalent to 15.20% of the initial value in regular SO and 25% in HOSO (Kreps *et al.*, 2014; Rade *et al.*, 2004). Chlophylls are slightly reduced during this step (Kreps *et al.*, 2014) to a minimal value of 0.18.0.21mg/kg pheophytin a (regular and HOSO respectively) that represented 4% of the initial value on crude sunflower oil which represented a supplementary elimination of 15% during this step.

Deodorization step also influence the content of squalene in sunflower oil (Nergiz and Çelikkale, 2011). The last report showed that most of the losses of squalene (17%) occurred during this refining step.

Decline of minor components in deodorized oil is in part due to removal of these molecules during injection of heated steam. Therefore, valuable minor components such as tocopherols, tocotrienols, phytosterols, squalene and hydrocarbons are stripped. Then, they are found in the deodorizer distillate which is the most important by-product of edible oil refining. Naz *et al.* (2011) studied the chemical characterization of sunflower oil deodorizer distillates and found significant amounts of sterols, squalene and tocopherols. They showed that total sterols in deodorized distillate sunflower were present at the concentration of 13.9.14.2% and total tocopherols and hydrocarbons were estimated at average percentages of 6.5 and 16.5, respectively.

3 Conclusions

During the refining process sunflower oil loses considerableamounts of minor components that have interestingnutritional and health related characteristics. Several studies have been done to reduce the loss of micronutriments and preserve final oil quality and nutritional characteristics, for example by using pre heating with microwave (Veldsink *et al.*, 1999; Zacchi and Eggers, 2008) which increases the final tocopherol and polyphenols content; or, modifying the temperatures during the deodorization step (Martinčič *et al.,* 2008) that reduces the losses of phytosterols and tocopherols. However losses persist, but the residual products of this refining process are partially recovered to be used in other industries like cosmetic industry (tocopherols and phytosterols), gums in the form of lecithin is included in several food products instead of soybean lecithin. Challenges are : (i) to find cultivars with high levels in these minor components, as in the case of sterols (Velasco *et al.,* 2014), (ii) To evaluate the possibility and developing new commercial varieties with these new traits continuing efforts already done (Ayerdi Gotor *et al.,* 2008), (iii) To evaluate the impact at each step of the refining process of minor nutriments like coenzymes or β-carotene, (iv) To find the optimal refining conditions at each step, to preserve the maximum of all these nutriments. The last goal of this essential research is to increase the amount of the mentioned minor components after the refining process which has an important repercussion in the nutritional and economical value of the obtained oil.

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Cite this article as: Alicia Ayerdi Gotor, Larbi Rhazi. Effects of refining process on sunflower oil minor components: a review. OCL 2016, 23(2) D207.

PARLIAMENT NEWS

Lok Sabha Unstarred Question No. 1511 - Answered on 3rd May 2016

GM MUSTARD

Dr. K. Gopal

Will the Minister of Environment, Forests and Climate Change be pleased to state :

(a) whether it is true that the Government is considering to make public all the data pertaining to the safety of Genetically Modified (GM) mustard, sans proprietary intellectual property data;

(b) if so, the details thereof; and

(c) if not, the reasons therefor?

Answer

Minister of State (Independent Charge) for Environment, Forest and Climate Change (Shri Prakash Javadekar)

(a) & (b) The Genetic Engineering Appraisal Committee (GEAC) in its meeting held on 5.2.2016 has inter alia decided that :

* The revised dossier in respect of transgenic mustard received from the Applicant would be considered by the Sub-Committee and a Biosafety Risk Assessment and Risk Management (RARM) report would be prepared for consideration of teh GEAC and

* Subsequent to the above review, the biosafety dossier/RARM report excluding confidential information will be put in the public domain for comments.

(c) Does not aries.

Rajya Sabha Unstarred Question No. 664 - Answered on 29th April 2016

Development of low Erucic Acid Varieties of Mustard

Shrimati Renuka Chowdhury

Will the Minister of Agriculture and Farmers Welfare be pleased to state :

(a) whether ICAR has developed a low erucic acid variety of mustard, if so, the details thereof; and

(b) the steps taken by Government to make it available to farmers for large scale commercial cultivation at the earliest?

Answer

Minister of State in the Ministry of Agriculture and Farmers Welfare
(Dr. Sanjeev Kumar Balyan)

(a) The all India Coordinated Research Project on Rapeseed-Mustard (AICRPRM) of Indian Council of Agricultural Research (ICAR) has developed eight low erucic acid varieties of Indian mustard namely Pusa Karishma, Pusa Mustard 21, RLC-2, Pusa Mustard 29 and Pusa Mustard 30.

(b) About 2300 kg breeder seed of these improved varieties was provided to various public and private seed producing agencies during the last five years ending 2014-15, in order to make available their quality seed to the farmers for large scale cultivation.

Besides, Pusa Mustard 30 variety has been licensed to three seed companies such as M/s Malwa Enterprises, Punjab; M/s Arpan Seeds Pvt. Ltd., Rajasthan and Ajeet Seeds, Aurangabad for its multiplication and distribution among the farmers.

Lok Sabha Unstarred Question No. 2749 - Answered on 10th May 2016

TARGET FOR OILSEED PRODUCTION

Shri K Parasuraman

Will the Minister of Agriculture and Farmers Welfare be pleased to state

(a) whether the Government has fixed target to enhance production of vegetable oil sources by 2.48 million tonnes by the end of the 12th Plan period;

(b) If so, the details thereof; and

(c) the action taken by the Government to achieve the target?

Answer

Minister of state in the ministry of Agriculture and Farmers Welfare
Shri Mohanbhai Kundariya

(a) & (b) Government has fixed target to enhance production of vegetable oil sources oilseeds, oil plam and tree borne oilseeds (TBOs) by 2.45 million tonnes by the end of 12th Plan period (7.06 million tonnes to 9.51 million tonnes.

(c) In order to achieve the target, National Mission on Oilseeds and Oil Plam (NMOOP) is under implementation from April 2014 in the country. the Mission comprises three Mini Missions namely MM I - Oilseeds, MM II - Oil Palm and MM III - TBOs. Mission provides financial assistance for production and distribution of seeds/planting materials, seed minikits, plant, protection euipments, bio-pesticides / bio-fertilizers, micronutrients, improved farm implements, irrigation tools, water saving devices, demonstrations, farmers and entension workers training etc and cost of maintenance / intercropping for oil palm and TBOs.

Lok Sabha Unstarred Ouestion No. 2567 - Answered on 10th May, 2016

Production of Edible Oil

Shri R. P. Marutharajaa

Will the Minister of Consumer Affairs, Food and Public be pleased to state :

(a) whether the production of edible oils has been affected because of the damage to the oilseeds crops;

(b) if so, the estimated production of edible oils in the country and the projected shortfall during the current year;

(c) whether steps have been taken by the Government to meet the demand of edible oils in the country; and;

(d) if so, the details thereof?

Answer

Minister of Consumer Affairs, Food & Public Distribution (Shri Ram Vilas Paswan)

(a) Yes Madam.

(b) Estimated production and projected shortfall of edible oils for current oil year 2015-16 (Nov.-Oct.) is tabled below :

Estimated production of Oilseeds in current oil year 2015-16 (Nov.-Oct)*	Estimated production of edible oil in current oil year 2015-16 (Nov.-Oct)	Projected shortfall of edible oil in current oil year 2015-16 (Nov.-Oct)
263.39	95.39	155.00

*Based on 2nd Advance Estimate (declared by Ministry of Agriculture on 15.02.2016)

(c) & (d) : To meet the demand of edible oils in the country, the import of edible oils has been allowed under Open General License (OGL) and import duty on edible oils is reviewed from time to time. Export of edible oils has been banned since 17.03.2008 with some exceptions. Further in order to increase production of oilseeds and hence edible oils, a National Mission on Oilseeds and Oil Palm (NMOOP) is being implemented in country since year 2014-15 by Department of Agriculture, Cooperation & Farmers Welfare. NMOOP comprise of three Mini-Mission (MM) viz MM - I (Oilseeds), MM - II (Oil Palm) and MM - III (Tree Borne Oils). Under the mission, assistance is being provided to farmers for various components/interventions to increase oilseeds production.

Rajya Sabha Unstarred Question No. 1942 - Answered on 11th May, 2016

IMPORTS OF OIL SEEDS

Shri Narendra Kumar Swain :

Will the Minister of Commerce and Industry be pleased to state :

(a) whether Government has any plan to import oil seeds to meet country's demand;

(b) if so; the details thereof; and

(c) the likely impact of such imports on domestic market in the country?

Answer

The Minister of State in The Minister of Commerce and Industry (Independent Charge)

(Smt. Nirmala Sitharaman)

(a) At present, the import policy for oilseeds is 'free' subject to adherence to the policy conditions and payment of import duty at prevalent rates. As of now, the Government does not have any plans to import oilseeds on Government account.

(b & C) Does not arise in view of (a) above.

Loksabha Starred Question No. 228 - Answered on 10.05.2016

IMPORT PRICE OF PULSES AND OILSEEDS

Shri Ponguleti Srinivasa Reddy

Will the Minister of Consumer Affairs, Food and Public Distribution be pleased to state :

(a) whether the production/availability of pulses and oilseeds in the country has been affected due to the cheaper imports on account of independent nature of the trade policy on Minimum Support Price (MSP) and if so, the details thereof;

(b) whether the Ministry has approached the Department of Commerce for making changes in the trade policy to ensure that prices of imported pulses and oilseeds are not lower than the MSP; and

(c) if so, the details thereof and the response of the Department of Commerce thereof?

Answer

The Minister of Consumer Affairs, Food and Public Distribution
(Shri Ram Vilas Paswan)

(a) to (c) A Statement is laid on the Table of the House.

Statement Reffered in Reply to Parts (a) to (c) of Lok Sabha Starred Question No. *228 for 10.05.2016 Regarding Import Price of Pulses and Oil Seeds

(a) As our domestic production of pulses is lower than the demand, the deficit is largely met through imports. To ensure availability of pulses at reasonable prices, import of pulses is allowed at zero duty and export is banned except for Kabuli chana and up to 10,000 MT per annum of organic pulses & Lentils. In the case of oilseeds, import attracts a basic customs duty of 30% and imports are also marginal. Production and productivity of pulses and oilseeds in India remains low as these crops are mainly grown on marginal lands in rainfed areas and by small and marginal farmers.

(b) & (c) : No, Madam. As per the Economic Survey, 2015-16, India has adopted a trade policy vis-a-vis agricultural commodities, which is responsive to the changing domestic situation of crop production, demand, supply and most importantly retail prices. The Basic Customs Duty (BCD) of agricultural products is, therefore, subject to frequent revisions, including their reductions of removals depending on the domestic conditions, to protect farmers and agriculture linked industries.

Rajya Sabha Unstarred Question No. 1637 - Answered on 9th May 2016

POTENTIAL YIELD OF GM MUSTARD

Shrimati W Wansuk Syiem

Will the Minister of Environment, Forest and Climate Change be pleased to state :

(a) whether initial studies establish that GM Mustard has the potential of increase yield between 20 to 30 percent which is significant enough for commercial cultivation of any crop;

(b) whether a consortium of six farmer bodies has demanded commercialization of GM mustard corp, saying it would increase farmers' income in the country by more than Rs. 1,000 crore and also help extract edible oil which is presently imported in huge quantities; and

(c) whether the petition from farmer bodies makes out that GM technology can successfully co-exist with conventional hybrid as well as organic farming systems?

Answer

Minister of State (Independent Charge) for Environment, Forest and Climate Change (Shri Prakash Javadekar)

(a) Yes, Sir. Genetically Engineered Mustard Technology, to facilitate production of hybrids with superior performance, has been developed by Centre for Genetic Manipulation of Crop Plants. University of Delhi. The Centre has conducted Biosafety Research Level-I & II trials at three locations each in the mustard growing states. The field trial date indicate that the yield increase could be upto 30% with the new technology.

(b) Yes, Sir. Farmer organizations have sent representations to various authorities in the government for expediting the approval of genetically engineered mustard for cultivations by farmers.

(c) No, Sir.

Lok Sabha Unstarred Question No. 451 - Answered on the 26th April, 2016

NATIONAL OILSEEDS AND OIL PLAM MISSION

Shri Prataprao Jadhav:

Shri Chandrakant Khaire:

Will the Minister of Agriculture and Farmers Welfare be pleased to state:

(a) whether the National Mission on Oilseeds and Oil Palm is under implementation in a number of States;

(b) if so, the details thereof along with the amount of funds allocated and utilized for this mission during the last three years, Statewise;

(c) whether any review has been made regarding the proper implementation of this Mission;

(d) if so, the details and the outcome thereof: and

(e) if not, the reasons therefor?

Answer

Minister of State in The Ministry of Agriculture and Farmers Welfare
(Shri Mohanbhai Kundariya)

(a) & (b) : The National Mission on Oilseeds and Oil Palm (NMOOP) is being implemented in the country since 2014-15 in 27 States. The State-wise and year-wise funds allocated (central share) and released under NMOOP during 2014-15 and 2015-16 is annexed.

(c) to (e) : At National level, Executive Committee (EC) headed by Minister of Agriculture, Standing Committee (SC) headed by Secretary (AC&FW) and Mission Monitoring Committee (MMC) under the Chairmanship of the Joint Secretary (oil seeds) review and monitor Implementation of the Mission. Representatives of States/Agencies are invited to the meetings of these committees to discuss various issues relating to implementation of NMOOP. State Level Standing Committee headed by Agriculture Production Commissioner/Principal Secretary of the State reviews the progress of implementation in the States.

Further, National Level Monitoring Teams have been constituted for monitoring of the Mission activities at field level and providing necessary feedback for effective implementation and improvement. Several meetings/workshop/video conference/seminars/melas are also organized to create mass awareness and obtaining feedback. Based on discussions and deliberations held with various stakeholders in committee meetings and at other fora, several revision / modifications have been made in the operational guidelines on NMOOP for its smooth and effective implementation.

Annexure

Information in Respect of Lok Sabha USQ No. 451 for 26.04.2016

State - Wise Allocation and Released Funds (Cectral Share) under National Mission on Oilseeds and Oil Palm (NMOOP) During 2014-15 & 2015-16

(Rs. in Lakhs)

Sl. No.	Name of the States	2014-15		2015-16	
		Allocation	Release	Allocation	Release
1.	Andhra Pradesh	5136.00	1798.00	5262.92	3957.00
2.	Bihar	231.00	154.29	239.50	169.75
3.	Chhattisgarh	534.16	319.50	768.71	318.86
4.	Gujarat	3665.00	1401.14	1648.26	646.94
5.	Haryana	692.00	242.00	1023.66	831.47
6.	Jammu & Kashmir	134.96	101.22	158.01	0.00
7.	Jharkhand	238.00	118.77	438.81	0.00
8.	Karnataka	2245.00	2021.85	2156.85	1335.81
9.	Kerala	69.00	41.41	21.13	2.00
10.	Madhya Pradesh	7507.00	4505.78	4339.43	2614.64
11.	Maharashtra	4544.00	3408.10	1999.19	1982.86
12.	Orissa	1581.53	925.61	785.28	557.64
13.	Punjab	115.00	40.00	49.90	0.00
14.	Rajasthan	5085.00	4784.86	4912.19	3491.10
15.	Tamil Nadu	1059.00	842.58	888.11	806.06
16.	Telangana	1091.00	619.07	981.31	967.65
17.	Uttar Pradesh	1400.00	1172.85	1888.29	1319.20
18.	Uttarakhand	0.00	0.00	89.89	70.18
19.	West Bengal	958.12	602.97	1300.00	984.85
20.	Arunachal Pradesh	408.01	204.01	361.07	218.09
21.	Assam	1771.92	885.95	1624.10	886.53
22.	Manipur	264.64	198.48	133.20	66.60
23.	Meghalaya	125.86	62.93	0.00	0.00
24.	Mizoram	891.14	668.36	1270.08	507.33
25.	Nagaland	454.63	454.64	250.16	120.36
26.	Sikkim	69.02	69.02	52.16	30.12
27.	Tripura	512.44	512.44	404.16	261.98
	Total	**40783.43**	**26155.83**	**33046.34**	**22146.99**

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A REVIEW

*The book entitled **"A treatise on Analysis of Food, Fats and Oils"** is an example of unique competence and contribution of the authors, S. K. Roy, N. K. Pramanik and A. R. Sen.*

The book is the first of its kind in India. It covers the traditional and modern analytical methods for the characterization and quality of fats, oils as well as other food items.

The authors are well reputed and qualified and they have applied their collective wisdom and expertise in including and presenting more appropriately and meticulously the analytical methods.

The book can also be viewed as a rarer type as it deals with the statutory and industrial aspects of fats, oils and their products, and pollution control in vegetable oil industry.

In fact these aspects are of extreme use and importance to those concerned with these issues.

The book is already well received by the readers and users in the academic and industiral circles throughout India because of the highly relevent and beneffICIAL methodologies and basic-cum technological information. The book will be recognised in due course of time as one of the top quality analytical books in the area of food, fats and oils.

Prof. D. K. Bhattacharyya
21-6-2003

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BOOK REVIEW

A book entitled “Perfumery Materials, Production and Applications” has been authored by an very eminent Professor (Dr) D. K. Bhattacharyya, Emeritus Fellow (AICTE), Adjunct Professor Bengal Engineering and Science University, former President, O.T.A.I and a Scientist of National and International repute.

The book speaks for itself about his mastery and competence in the discipline of “Perfumery Materials”.

“The book demonstrates the scopes of certain specific reactions and raw materials in producing new synthetics. The enormous scopes of biotechnology involving bio-conversion processes’, with isolated enzymes and by fermentation biotechnology involving selective microorganisms has been indicated in making synthetics. The applications of natural aromatic oils in aromatherapy, food, cosmetics/toiletries, imitation perfumery and allied sector have been included.

Standardisation and evaluation of natural aromatic (essential oils and incidence of their adulteration have been elaborated in order to ascetain their quality and authenticity for sustaining the business in the industry” says Prof (Dr) R.N. Mukherjee, Former, Professor and Head, Deptt of Chemical Engg, University of Jadavpur. The book will fulfill a long felt want in the discipline of Essential Oils and will cater to the various categories of Scholars, Scientists and Technologists. The book has already been well appreciated in India and abroad, though published by the Stadium Press L.L.C., USA.

Those interested to procure a copy of this Valued book on Essential Oils may contact Professor D. K. Bhattacharyya at Phone No (033) 2461 9662.

(S. K. Roy)
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