Sunflower Oil Production, Quality and Applications

PROCEEEDINGS OF INTERNATONAL CONFERENCE ON SUNFLOWER OIL PRODUCTION, QUALITY AND APPLICATIONS

SEPTEMBER 2-5, 2018

EDIRNE, TURKEY

INTERNATONAL CONFERENCE ON SUNFLOWER OIL PRODUCTION, QUALITY AND APPLICATIONS

5 SEPTEMBER, 2018,

EDIRNE, TURKEY

In

Trakya University Balkan Congress Center,

Edirne, Turkey

Organized by

Trakya University

International Sunflower Oil Association

WELCOME NOTE

We would like to welcome you to the Sunflower Seed Oil Production, Quality and Applications Conference organized by the International Sunflower Oil Association and Trakya University. The aim of the conference is to provide a venue for highlighting latest scientific and technological developments in sunflower seed oil production, utilization and quality. The conference will also give an opportunity to the scientists to present their research results expanding the current knowledge in the field and the industry personnel to introduce new products which may be interest to the global sunflower seed oil community. We hope that this conference will facilitate a lively dialog between the scientific community and the industry.

The program will commence with a plenary session on sunflower oil markets, economics, policies and regulations governing sunflower seed oil trade. The afternoon session will focus on the technical aspects of sunflower seed oil production and applications.

In an effort to eliminate waste and protect the environment, we trried to minimize the use of paper. The abstract book is published in an electronic format and delivered in flash memory sticks which will be distributed during the conference. The posters presentations are also prepared electronically and will be exhibited on electronic poster panels.

Edirne is a beatiful, lovely and historic city at the edge of Europe. We are thrilled to host you all in Edirne and hope that you will take this opportunity to visit others parts of Turkey and enjoy your time.

We would like to thank you for joining to this conference. We extend our special thanks and gratitude to our sponsors and collaborators for supporting this event.

We wish you a nice stay in Edirne, Turkey.

Prof Dr Nurhan TURGUT DUNFORD Prof Dr Yalcin KAYA

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Prof Dr Yalcin KAYA Prof Dr Nurhan TURGUT DUNFORD

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CONFERENCE PROGRAM

September 5th, 2018

Registration 8:00-9:00 am

9:00-12:00 **Plenary Session**
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09:00: 09:30 Welcome
09:30-10:00 Turkish Oil Seed Industry, ***Tahir BUYUKHELVACIGIL, BYSD President***
10:00-10:30 Sunflower Oil Related policies and regulations in Turkey,
Prof. Dr. Aziz TEKIN, YABITED President
10:30-11:00 ***Coffee Break***
11:00-11:30 Modern Margarine: Turkish Margarine Industry,
Ebru AKDAG, MÜMSAD General Coordinator,
11:30-12:00 World Sunflower Oil Market Outlook, ***Dr. Xue BING XU, ISOA President***
12:00-12:30 Trends and opportunities of high oleic sunflowers in the healthy consumption,
Anton ILIEV, Syngenta, Spain
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Prof. Dr. Nurhan TURGUT DUNFORD, Oklahoma State University
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Dr. Ir. Jan DE KOCK, Desmet Ballestra Group, Zaventem, Belgium
14:10-14:30 Eco Friendly Technology for Sunflower Oil Refinery,
Dr. Javed HUSAIN, Muez Hest, India
14:30-14:50 Enzymatic Extraction of Sunflower Oil,
Asst. Prof. Dr. Derya KAHVECI KARINCAOĞLU, Yeditepe Univ., Turkey
14:50-15:10 Innovative Enzyme Applications in Oils & Fats Processing,
Dr. Ali R Esteghlalian, Novozymes
15:10-15.30 Dry Tribo-electrostatic Protein Enrichment of Sunflower Seed Meal,
Mr. Kyle Flynn, ST Equipment & Technology, USA
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16:20-16:40 Precise Refining and Quality Control of Sunflower Oil
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16:40-17:00 Genetic modification of sunflower (*Helianthus annuus* L.) for high oleic acids contents, ***Prof. Dr. Saeed RAUF, Pakistan***
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17.30 Closing Ceremony

EMERGING SUNFLOWER SEED OIL APPLICATIONS

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Robert M. Kerr Food and Agricultural Products Center

Abstract

Traditionally sunflower seed oil is preferred for food applications due to its bland flavor, pleasant mouth feel, favorable fatty acid profile and good oxidative stability. In US, sunflower seed oil is a premium oil for deep fat frying of snack foods. Food industry also blends sunflower oil with other vegetable oils to optimize flavor, cost and oxidative stability required for specific applications. There are a number of emerging applications of sunflower seed oil as well. Renewable fuels, renewable polymers, coatings, edible films, skincare products, oleogels, coco butter equivalents, spheresomes as natural emulsions, lubricating oil additive are some of the examples for relatively new sunflower seed oil applications. Most of the renewable fuel research focuses on biodiesel production using either homogeneous or heterogeneous catalysis for production of alkyl esters of sunflower seed oil fatty acids through transesterification using alcohols. There is also interest in catalytic cracking of used sunflower seed oil for producing renewable fuels. Bio-based hyperbranched polyol with high primary hydroxyl functionalities can be prepared from sunflower seed oil. The sunflower oil-based polyols are highly tunable to generate polyurethane thermoplastic with a broad range of cross-linking densities due to the high hydroxyl group functionality. Sunflower seed oil has been used to form uniform adherent films on iron via a simple single-step thermal treatment process without any initiator/mediator/catalyst use. Coatings that can be prepared by simple thermal treatment of sunflower seed oil on metal surfaces open a venue for many applications requiring a barrier against moisture and acids for use in chemical and corrosion protection. Ozonated sunflower seed oil is commercially available and used for wound disinfection and accelerate healing process. This presentation will highlight chemical and technological fundamentals of the above mentioned applications in detail.

SUNFLOWER OIL RELATED POLICIES AND REGULATIONS IN TURKEY

Aziz Tekin

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Abstract

Sunflower oil has a great importance for Turkey since it is the main seed oil in terms of production and consumption. Legislations are issued by Ministry of Agriculture and Forestry after harmonizing them to EU legislation and/or Codex Alimentarius. Turkey applies Codex Standards for Named Vegetable Oils (Codex Stan 210-1999) for all vegetable based oils including sunflower oils, because EU does not have this regulation. The Ministry prepares regulations after deep discussions acording to scientific data and needs of industry in established sub-commissions that consist of all stakeholders of the subject. Final decision is given by National Food Codex Commission.

Turkey had some problems in application of the regulations for sunflower oils due to oleic acid problem for regular sunflower oil. Some scientific data showed that oleic acid ratios of sunflower seeds cultivated in Southern Turkey were higher than the standard values for regular one. The standard was then modified by combining the fatty acid and sterol distributions of regular and mid-oleic acid types. Like Turkey, big producers such as Argentina and some other southern countries have decleared same problem for sunflower oil. Therefore, this issue has been discussed in CCFO meeting for about 10 years and Turkey is possibly going to make regulations for sunflower oils in the standard when the commission gets a decision.

PRECISE REFINING AND QUALITY CONTROL OF SUNFLOWER OIL

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Abstract

Sunflower is an important edible oilseed crop, which is widely consumed as cooking oil or salad dressing in more than 70 countries. Crude sunflower oil contains a complex of minor components. Undesirable minor components such as free fatty acid (FFAs), phospholipids, and pigments can have negative effects on the physicochemical properties, sensory characteristics, and stability of the oil. Most of these undesirable components can be eliminated during the process of refining. However, some bioactive components such as tocopherols and phytosterols can also be reduced due to the chemical reagents and/or high temperature used in refining. Tocopherols, which belong to the vitamin E family, exhibit anti-oxidation, anti-tumor and hypocholesterolemic potentials. They are considered as natural antioxidants in food and biological systems. Phytosterols have ability to decrease cholesterol absorption in humans, consequently reducing serum cholesterol levels, and potentially lowering the risk of cardiovascular diseases. Considering the importance of refining on the safety and quality of refined sunflower oils, we investigated the changes of bioactive components and undesirable components in sunflower oils at different steps of refining. In addition, changes in physicochemical properties such as color, acid value (AV) and peroxide value (PV) were evaluated at each step during refining. Such studies could provide comprehensive information during the refining process of sunflower oil, and tried to maintain the maximal amounts of bioactive components and minimalize undesirable components in sunflower oils by using precise refining.

GENETIC DIVERSITY ANALYSIS OF TUNISIAN ACCESSIONS OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) USING SSR MARKERS

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Abstract

In the present study, 15 pairs of SSR primers were used for the assessment of molecular variability among 33 sunflower (*Helianthus annuus L.*) accessions, including 26 are collected in Tunisia and 7 are introduced from different countries. Ten pairs of SSR primers retained in this study generated clair polymorphic bands. The total number of alleles amplified by the 10 polymorphic primers was 29 with an average of 2.9 alleles per locus. The results showed that the percentage of total polymorphism was 86.21% and varied from 50 to 100. Polymorphism information content (PIC) values range from 0.38 for the 0RS 598 primer to 0.75 for the ha4136 primer with an average of 0.50. The UPGMA dendrogram clustered all the accessions into four distinct groups. The 33 sunflower accessions showed high genetic diversity and were structured independently of their geographical origin. These data may serve as a foundation for the development of sunflower breeding programs.

Keywords: Sunflower, Genetic Diversity, UPGMA, Origin, Sunflower Breeding

INNOVATIVE ENZYME APPLICATIONS IN OILS & FATS PROCESSING

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Abstract

Biotechnology has enabled the cost effective production of a variety of enzymes that improve processes and final products for a number of industrial producers. In this presentation, an overview of enzyme discovery and product development from screening of microorganisms in nature to final products will be provided. In the oils and fats industry, enzymes are now a standard processing aid in a number of production processes, this presentation will discuss how:

- lipases have been and are currently used for specialty fats products, like CBE and infant milk replacers,

-lipases are used in the production of margarine and shortenings enabling production without the formation of trans-fatty acids,

-phospholipases remove phospholipids from oils ensuring high processing yields and improved process economy in vegetable oil refining,

-lipases are aimed to revolutionize the biodiesel industry, and

-cellulases will improve production yield in palm oil processing.

INDUSTRIAL PRODUCTION OF FOOD GRADE SUNFLOWER LECITHIN

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Abstract

Lecithin (E322) is still a widely used additive in a lot of food applications (margarine, chocolate…). Lecithin is a quite complex mixture that contains mostly phospholipids, oil and quite a lot of other minor (polar) components. The phospholipids are the most important part of the lecithin, since they can act as an emulsifier, as a viscosity reducing agent etc…, due to their amphiphilic nature.

Traditionally, most of the lecithin used in food applications was (and still is) produced from crude soybean oil in the soybean extraction plants. The production process typically consists of water degumming of the crude oil, followed by drying of the wet gums to produce the dry lecithin. Finally, a standardisation step can be added to produce a consistent product with standardized acetone insoluble content (AI) of around 60 to 62w%.

In recent years, there has been an increased interest to produce lecithin from alternative raw materials (mainly sunflower oil and rapeseed oil), due to the discussion about the use of lecithin originating from genetically modified soybeans in foodstuffs.

Sunflower lecithin is now widely accepted as a good alternative for soybean lecithin in the market. However, the production of a sunflower lecithin of high quality often requires additional purifications steps before the water degumming step (filtration of the crude oil, centrifugation of the crude oil or the miscella…). These additional steps are very crucial to obtain a lecithin low in toluene (hexane) insoluble (TI). According to the E322 regulation the toluene insoluble content needs to be less than 0.3w%, but should preferably even much lower (>0.1 w%).

In the presentation a short introduction will be given about the composition of different lecithins from vegetable origin (soybean, rapeseed, sunflower lecithin) and the differences to be considered when producing lecithin from these different oil seeds.

Then a practical overview will be given of the processing steps that should be implemented (mostly in the sunflower extraction plant) to be able to produce a sunflower lecithin of high food grade quality.

ENZYME ASSISTED AQUEOUS EXTRACTION OF SUNFLOWER OIL

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Abstract

Solvent extraction method is the most commonly used method for the extraction of oil from oilseed. For this extraction method, hexane is preferred as the solvent. There are several research studies to identify an alternative to solvent extraction method due to the toxicity and flammability of hexane. Also this method leads to some negative effects on quality of oil like rancidity and off-flavor. Recently, aqueous enzymatic extraction is going interest as one of the oil extraction method. In this study, it was aimed that to improve the quality of oil and reduce oil loss by aqueous enzymatic process with four different enzymes: Protease (Alcalase 2.4L FG), Pectinase (Pectinex Ultra SP-L), Viscozyme L, and Cellulase (Celluclast 1.5L). The yield and the oxidative stability of obtained oils were compared with aqueous process without enzyme and oil to obtained soxhlet method. As a conclusion, the highest yield was achieved with solvent extraction method (98.3% of the total content oil in the seed) , followed by protease assisted aqueous extraction (52.2% of the total content oil in the seed). Additionally, the lowest free fatty acid (0.02%) and peroxide (0.08 mEq/g) values were obtained with this enzyme.

FLAVOR COMPONENTS AND STABILITY OF FLAVOR SUNFLOWER OIL

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Abstract

In the past decade, the demand for sunflower oil in China has sharply increased due to the increasing oil annual consumption and consumers' transferred demand for mid-to-high end oil. In China, planting of sunflower seeds had a long history, and oil sunflower seeds planting are now mainly distributed in two north provinces, Xinjiang and Inner Mongolia. Flavor sunflower oil is quite favored by local consumers because of its unique rich flavor with roasted sunflower seed flavor and/or burnt flavor. Flavor sunflower oil is mainly processed by traditional processing. After roasting at high temperatures, the sunflower seeds were immediately pressed by screw squeezer to obtain flavor sunflower oil. Its characteristic flavor was mainly formed during processing, especially high temperature roasting. The proteins, sugars and lipids contained in sunflower seeds underwent a series of complicated reactions to generate a large amount of volatile and non-volatile components during roasting process, which had a significant impact on the flavor and quality of flavor sunflower oil products. And also, the flavors would be quite different by dealing with various roasting temperature and time.

The flavor substances of flavor sunflower oil were mainly composed of three major categories: terpene compounds, Maillard reaction products and lipid oxidation products, which respectively provided flavor sunflower oil with sunflower seed flavor, roasty/nutty or burnt flavor, and oxidation flavor. These compounds were combined together to give the unique flavor of flavor sunflower oil. Among them, the proportion of terpene compounds and Maillard reaction products had a significant effect on the flavor characteristics of flavor sunflower oil. And these also would affect the flavor stability during shelf life of the product, which is quite worthy of being further investigated and has significance for the sunflower oil industry.

GENETIC MODIFICATION OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) FOR HIGH OLEIC ACIDS CONTENTS

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Abstract

Pakistani nation is a fat loving country where most of the traditional cuisines are cooked through deep frying requiring high amount of vegetable oil. However, most of the oils used for cooking are high in polyunsaturated fatty acid making them vulnerability to oxidation and deterioration during deep frying. Oleic acid is major fatty acid providing oxidative stability to the edible oil. The present study was carried out to improve the oleic acid concentration in sunflower edible oil. Parental lines differing for high oleic and oil contents were used for development of F_2 population. The parent P.I. 1806 showed significant higher oleic acid when compared with other parent B-124. Contrastingly this parent showed lower oil contents. F_2 population showed significant variation for oil and oleic acid contents. Heritability estimates were moderate for oil contents and high for oleic acid showing that both traits were selectable under a specific environment. Higher estimate of heritability indicated lower masking of the genotypes under specific environment. The selection for high oleic acid and oil contents was facilitated through marker assisted selection. Several primers were found to be polymorphic such as ORS-728, ORS-488, ORS-311 and ORS-591. Grouping on the basis of contrasting bands showed significant differences in oleic acid and oil contents. The same marker was used to select the homozygous high oleic acid and oil contents in the F_2 population. As a result marker assisted selection, 19 plants were selected in F_2 to establish F3 plant progenies. Selected plant progenies were evaluated for the same traits which showed high selection response for both traits. Among the traits, oleic acid contents showed higher selection response than oil contents. Thus showing that MAS selection had differential impact on both traits and more strongly correlated with oleic acid than oil contents.

Key words: Fatty acid, Molecular marker, Marker assisted selection, Oil contents

DRY TRIBO-ELECTROSTATIC PROTEIN ENRICHMENT OF SUNFLOWER SEED MEAL

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Abstract

Electrostatic separation is a completely dry process requiring no water or chemicals. Dry electrostatic separation methods offer an opportunity to generate new and more functional plant protein products, including sunflower seed meal with increased protein content for use as a high value animal feed.

A sample of hexane extracted sunflower seed meal was obtained by the researchers. The feed was finely milled (dry) into two particle sizes, a coarser feed with a d50 = 70 micron, prepared with a hammer mill and a finer feed with a d50 = 25 micron, prepared with an air classified mill. The dry sunflower seed meal samples were then separated using a high throughput tribo-electrostatic belt separator. Subsamples of the negatively charged and positively charged products were measured for protein using the DUMAS method.

Finely milled dry sunflower seed meal samples demonstrated significant separation of protein. For the coarser (d50 = 70 micron) sample, the feed sample containing approximately 40% protein (dry basis) was separated into a product containing 52% protein and a by-product with a 29% protein, in a single pass through the separator. For the finer (d50 = 25 micron) sample, a product with a 53% protein content was generated, with a by-product with 25% protein, in a single pass through the separator.

The tribo-electrostatic belt separator demonstrated the capability to process finely ground sunflower seed meal to significantly upgrade the protein content, making it more valuable as an animal feed. The tribo-electric belt separator is a high rate, low energy usage, industrially proven processing device suitable to commercialize the recent developments in electrostatic food and feed processing.

SUNFLOWER OIL MARKET IN CHINA: GROWTH AND CHANGES

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Abstract

During the last decade, China has a constant increasing in vegetable oils consumption year by year due to the increase of total population and income. The demand for vegetable oils is continuing in China, and the domestic resource couldn't provide enough supply to Chinese oil market, therefore imported oilseeds and oils become more and more important in Chinese oil market.

Over the past ten years, sunflower oil is remarkably one of the sharpest growing in terms of consumption and import in Chinese oil market. Despite stable domestic production of sunflower oil, imported oil is cheaper than local one. This fact together with growing consumptions are the key drivers of import. China has already become the third largest sunflower oil importing country among the world and the import amount is still keep on increasing. The total sunflower oil consumption volume in China is expected to hit 2 million tons per year by 2020.

Despite significant consumption growth, sunflower oil still accounts rather small share of Chinese vegetable oils market. Its share in total vegetable oils consumption in China is only 4% now against 2% ten years ago. However, the structure of vegetable oils consumption in China is gradually changing. Consumption of mid-to-high end oil is increasing while that of soybean oil as well as blends of different oil types is going down significantly. For sunflower oil, besides its nutrition & non-GMO, imported from Europe extremely attracts consumers in China. Moreover, due to McDonald's 2017 announcement of shifting to high-oleic oil for frying in China, consumption of high oleic sunflower oil will increase due to its good frying performance in the near future. In a word, there are still a lot of opportunities for sunflower oil development in Chinese market.

BETTER AND PROFITABLE SUNFLOWER PRODUCTION: CURRENT SITUATIONS AND FUTURE DIRECTIONS

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Abstract

Sunflower is grown generally in drylands in the world. Therefore, it influence more from environmental conditions such as soil, humidity, climate, etc.. Especially hot temperatures during the grain filling period one of the most reduced factors of seed yield in sunflower production. Yield is comprised by three main factors in the plant production as plants per area, seeds per plant and seed weight. Therefore, to get better seed and oil yields and to reduce of environmental stress factor effects needs well understand that how sunflower plant response these stresses, what is the mechanism, how to escape or cope with these yield reducing factors. In dryland farming, producers generally only could control actively or arrange only effectively planting time and density. Other two major factors are mainly controlling by acclimating conditions. Therefore, farmers should prepare very good seedbed to be warranty emergence to reach enough plant density. Farmers should press soil over sunflower seeds after planting because seeds should reach and attach soils as much as quickly after emergence to grow quickly and properly getting necessary nutrients from soil. As much as early planting is better option to escape from higher hot temperatures during the grain filling period. Furthermore, less distances than 70 cm between rows is one the easiest and practical solution to increase plan density for higher seed and oil yielding. On the other hand, producers should choose proper hybrid seeds suitable for their fields related to possible diseases and other biotic and abiotic stresses to get higher yielding. Downy mildew, broomrape parasite, weeds are major reducing biotic factors affecting sunflower yield in Turkey. Therefore, farmers should choose IMI or SU herbicide resistant hybrids as well as resistant to new races of downy mildew and also broomrape parasite. In the future, other major disease resistance and also abiotic stress such as drought will combine these common resistance and super hybrids will be developed affecting less from stress conditions then sunflower yield and production will be increased.

Keywords: Sunflower, Turkey, Seed production, Hybrid breeding, Stress conditions.

TRENDS AND OPPORTUNITIES OF HIGH OLEIC SUNFLOWERS IN THE HEALTHY CONSUMPTION

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Abstracts

Domesticated twice; 4.600 years ago in Mexico and 3.200 years ago in Mississippi valley, the sunflower crop was introduced to Europe in 1510 by Spanish and spread through Europe as ornamental plant. The first use of sunflower oil in food was in Russia in 1830 and after the release of the Russian sunflower cultivars with high oil content and black seed during the 1960s, this oil crop spread to become today the fourth world food vegetable oil after palm, soybeans and rapeseed oils. The undisputed beauty of the sunflower inflorescence serves as a publicity claim in food products using sunflower oil around the world. But the question in how much of this beautiful image is supported by scientific knowledge regarding the health quality of sunflower oil. Conventional sunflower oil is rich (>60%) in Omega 6 (linoleic) fatty acid. This essential fatty acid, which cannot be systemized by our body, is a component of the cell membranes and needed for growth as well as many metabolic routes. Thus, conventional sunflower oil consumption help to balance the excess saturated fatty acids present in meat and milk based diets. However, for balanced diets 35% of calorie daily intake should come from fats and oils of which 10% should be saturated and 5% polyunsaturated leaving 20% for the monounsaturated oil. Thus, neither saturated fats nor conventional sunflower oil provides enough oleic acid content as requested for balanced adult diets. High oleic sunflowers cultivars developed after the 1980s, have spread very quickly in the last years is offering the possibility for food manufacturers to offer a healthier food component in their products. However, the main market drivers for the present consumption of HO sunflower oil have been the *trans f*atty acid regulation in US and Europe, the food labelling regulation in UE and the higher oxidation stability and self-life of products elaborated with HO sunflower vs. other unsaturated vegetable oils. The many potential health benefits of HO oils, including: improve of endothelial function, reduce LDL cholesterol and atherogenic indexes, and improve glycemic control and insulin sensitivity in type 2 diabetic patients, offers a new opportunity for food manufacturers worldwide to produce healthier products. Syngenta, the sunflower planting seed world leader, offers a portfolio of sunflower hybrids with high agronomical performance and offers support to all the stakeholders in the integrated supply chain for the sustainable growth of this healthy vegetable oil market.

ECO FRIENDLY TECHNOLOGY FOR SUNFLOWER OIL REFINING

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Abstract

Innovative Sunflower Oil refining process offers several advantages over the conventional method of oil refining. Conceptually, the new technologies could be used in almost all stages of processing. In the present scenario, various attempts made by us towards; Degumming, Bleaching, De-waxing and De-acidification (Physical Refining) and deodorization, resulted in better color, yields, reduced operating cost and add value in byproduct of sunflower oils using new & innovative process technologies have been elaborated in the technical paper. By adopting the new & improved technology in the refining process, which by the order of magnitude can have a far reaching beneficial effects, but further improvement is desirable for continuous industrial adaptability & compatibility, depending upon the scale of operation, besides, any other operating criteria. Sunflower oil is well known because of its diversity of fatty acids profiles which allow different uses (food: dressing salads, margarines; nonfood: agro fuel, lubricants). Besides, crude oil contains high amounts of desirable minor components (tocopherols, phytosterols, polyphenols, and phospholipids) that present important nutritional features with a positive impact on human health. The improved methods 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. The development of environment friendly process technologies in refining of sunflower oil has its difficulties and challenges. The increase in yield that can be achieved through use of innovative process technologies is certainly beneficial. As the growing trend of healthy products in which less processed products are well appreciated & rewarded with premium prices, this scenario is without doubt an opportunity that industry cannot afford to ignore. The increasing public awareness of the environment has also helped to change the paradigm. Buyers do not mind paying more for organic and chemical free products. Furthermore, the possibility of clean production can also be developed due to the possibility to reuse the byproducts generated. The ease of application is clearly the advantage of process technology, moreover, the plant performance could be further improved, like higher yield & better quality products, with low energy costs and less carbon footprints. With the advantages mentioned above during my presentation, there is no reason for the industry to not be able to produce high quality sunflower oil with environment friendly methods, all the more because it is much appreciated with a high price in the market.

POTENTIAL APPLICATIONS OF ENZYME-ASSISTED PROCESSES IN SUNFLOWER OIL PRODUCTION

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Abstract

Enzyme-assisted processes have been gaining interest in the food industry due to enhanced yield/recovery of the end product, reduced by-product and waste, mild process conditions leading to reduced energy cost as well as improved sustainability, and better market acceptance when enzymes are promoted as "natural" process tools. Oil production facilities can make use of enzymes to obtain high quality oils together with protein-rich meal as the by-product without using organic solvents. The present talk will address the potential applications of enzyme-assisted processes, especially aqueous enzymatic extraction along with enzymatic degumming, in comparison with conventional processes in terms of process conditions, oil yield and quality.

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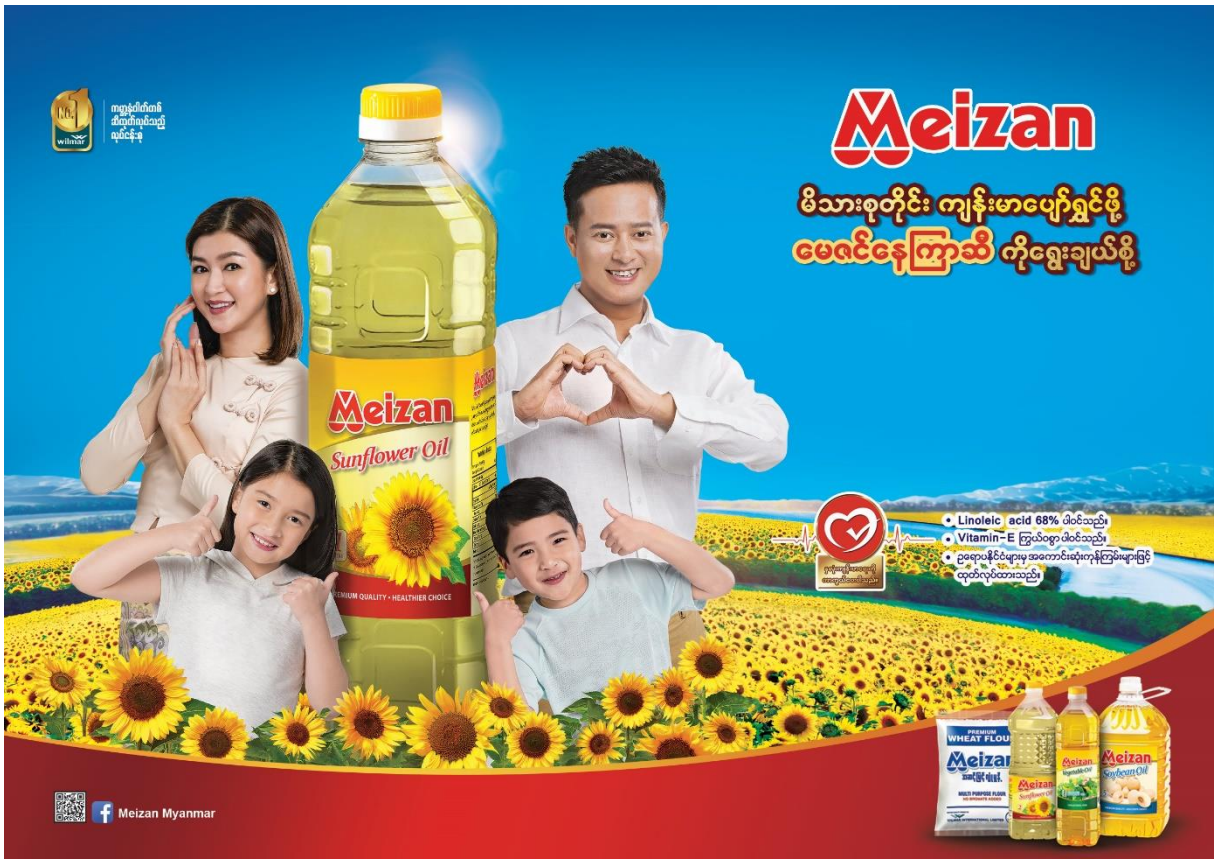

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