OIL TECHNOLOGISTS' ASSOCIATION OF INDIA

R & D ISSUE
JUNE-SEPTEMBER 2010

EASTERN REGION NEWS LETTER

FOR LIMITED CIRCULATION

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**Contributory Price : Rs. 50/- (Rupees fifty only)*

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FROM THE PRESIDENT'S DESK

Festive season is on. During the festive season, gastronomical delights are a part of festivity,along with associated consumption of oils&fats,especially Ghee (Clarified Butter) for offering to God or for human consumption. It may not be out of place to mention that Cow Ghee has a very important place on many social occasions. In order to distinguish between Cow Ghee and Buffalo Ghee, scientists of Jadavpur University have taken up a part of their research work on a different parameter which may serve commercial interest as well. This issue highlights their work for an exposure in this specific discipline.

Diabetes in a very common disease and Research on diabetes cure by nature probably is the safest way to get rid of this ailment. Central drug research Institute, Lucknow has taken up this very relevent issue in their R & D programme. An article "Diabetes : Cure by Nature" may be of interest to the readers as a source of knowledge and prevention. Many answers on 'known but unknown vegetables' like Banana Flower consumed by us has also beneficial effect on human system,-a question posed by a senior member during last National convention in Calcutta is a pleasent surprise. O.T.A.I (E.Z.) wishes all its members

"GREETINGS FOR THE FESTIVE SEASON".

S.K.Roy
President

যাদবপুর বিশ্ববিদ্যালয়
কলকাতা-৭০০০৩২, ভারত

JADAVPUR UNIVERSITY
KOLKATA - 700 032, INDIA

DEPARTMENT OF FOOD TECHNOLOGY & BIO-CHEMICAL ENGINEERING

Ref. No. PS/HG/SBP/10

Date 02.09.2010

To
Mr. S. K. Roy
President
Oil Technologists' Association of India (E. R.)
Kolkata
Dear Sir,

Enclosed please find herewith a copy of the manuscript of our research paper entitled "Viscometric analysis to differentiate between cow ghee and buffalo ghee" by Siba Prasad Sengupta* and Hiranmay Gangopadhyay for publication in your Journal. This is to certify that the reported work in the paper entitled " Viscometric analysis to differentiate between cow ghee and buffalo ghee submitted for publication is an original one and has not been submitted for publication elsewhere. We further certify that proper citations to the previously reported work have been given and no data/tables/figures have been quoted verbatim from other publications without giving due acknowledgement and without the permission of the author(s). The consent of all the authors of this paper has been obtained for submitting the paper to your Journal

With kind regards,
Yours sincerely

Hiranmay Gangopadhyay
Professor
Food Technology and Biochemical Engineering Department,
Jadavpur University, Kolkata-700032,West Bengal, India,
Email-hganguly2@yahoo.com

Siba Prasad Sengupta
Research Student
Food Technology and Biochemical Engineering Department,
Jadavpur University, Kolkata-700032,West Bengal, India,
E mail : SPSengupta.1@gmail.com
* Corresponding author

VISCOMETRIC ANALYSIS TO DIFFERENTIATE BETWEEN COW GHEE AND BUFFALO GHEE

Sibaprasad Sengupta* and Professor Hiranmay Gangopadhyay
Department of Food Technology and Biochemical Engineering
Jadavpur University, Kolkata - 700032

Ghee is a highly preserved milk product prepared from both cow's milk and buffalo's milk which differ in chemical compositions and hence nutritive values. Chemical analysis like determination of Reichert-Meissl [R. M.] value, Iodine value etc. can differentiate cow ghee and buffalo ghee. Viscometric analysis has been carried out to differentiate the said two kinds of ghee. At 20°C both cow ghee and buffalo ghee behaved like non Newtonian fluid. Newtonian behavior in cow ghee was observed at 30°C where as the same characteristic in buffalo ghee was observed at 40°C. Results obtained in viscometric analysis were correlated with experimentally determined R.M. values, Iodine values and B. R. readings.

Keywords : Brook field viscometer, Butyro refractometer, conistency coefficient, flow behavior index, ghee, Reichert-Meissl value, shear strain, shear stress.

Introduction : Ghee is a clarified and ripended butter fat obtained from buffalo's or cow's milk in India and other Eastern countries without any solid particles or water in it. A good quality ghee adds a great aroma, flavor and taste to the food. It is a highly preserved milk product which is maximum among the all products obtained from milk in India. The milk is soured by the addition of butter milk, thus causing the separation of a curdled mass from which the fat is obtained by churning, melting and skimming off the clear liquid (Winton A.L. etal, 2002). Ghee is butterfat that has been separated from the water, proteins and salt in butter. This is accomplished by heating the better as slow as possible over a low fire so that the milk solid does not burn. The butter separates into three layers. The casein, a frothy layer on the top, the clarified butter fat - the ghee - in the middle; and the milk solids, and proteins in the bottom. The casein is skimmed off and the fat is then ladled off.

Ghee produced from different sources have different food values and different applications in industries. Chemical tastes are available to distinguish ghee obtained from different sources (Hilditch T.P., 1927). In this study attempts were made to distinguish ghee prepared from cow milk and buffalo milk by Viscometric analysis at different temperatures. Pure ghee contains more than 142 fatty acids. The full biological significance of many of these fatty acids is not fully understood (Byran H. Webb, 1970). In this study at 20° C both cow ghee and buffalo ghee behaved like non Newtonian fluid. Again at that temperature cow ghee showed

* *Corresponding author*

Bingham plastic character whereas buffalo ghee behaved non-Bingham plastic character. As temperature increased non Newtonian character of ghee changed towards Newtonian character. It has been observed from viscometric analysis that cow ghee behaves Newtonian character at 30°C and buffalo ghee behaves almost the same character at 40°C. This phenomenon has been correlated by determining Reichert-Meissl (R.M.) values, Butyro Refractometer (B.R.) readings and Iodine values of the same.

MATERIALS AND METHODS :

Cow ghee was procured from M/S. Mercantile Daily Project Ltd., Chingrihata, Kolkata. Buffalo ghee was purchased from local market of Fulia, Dist. Nadia, West Bengal. All chemicals like glycerol, sodium hydroxide, concentrated sulphuric acid and phenolphthalein were purchased from local market. R.M. values, B. R. readings and Iodine values of both ghee were determined as per AOAC methods thrice for each ghee.

Rheological properties of ghee prepared from different sources were determined using Brookfield Viscometer (Chemito, U.S.A., Model DV-E) equipped with a torque measuring head and different rotors (spindle number 1 and 4) having radius 0.009425m and 0.001575m respectively and effective length (L) 0.08m and 0.036m respectively. Rotor rotating at different speeds were changed stepwise with a selector switch. The Viscometric guard leg (R_g) having radius 0.015 m was in operation through out the experiment. Readings of torque were taken with increasing rotational speed. The procedure was carried out at 20°C & 30°C for cow and buffalo ghee but at 40°C for buffalo ghee only as cow ghee exhibited Newtonian eharacteristic at 30°C and flow behavior index of cow ghee at 30°C has been found greater that that of buffalo ghee at 40°C (Table-6). Measurements were performed thrice to obtain highly reproducible data and average values were used to calculate rheological character.

VISCOMETRIC ANALYSIS :

For each ghee at each temperature % torque and dial viscosity were noted from the instrument against applied R.P.M. Shear stress, $\tau = M/2\pi LR_s^2$ (Ranganna S, 1986) where M = torque input by the viscometer (0.00006737Nm). Shear rate, $\gamma = 0.22$ N for spindle land 0.209 N for spindle 4 as given in the "MORE SOLUTIONS TO STICKY PROBLEMS" by Brook field Engineering Labs, Inc. for the particular machine where N=RPM applied. Calculated shear stress has been divided by calculated shear rate to get calculated viscosity which were compared with dial reading of viscosity for each ghee at each temperature. Variation in results between dial viscosity and calculated viscosity was determined. $\text{Log}_{10}\gamma$ and $\text{Log}_{10}\tau$ were calculated for each ghee at different temperatures. Above mentioned all data are shown in table 1 to table 5. γ and τ were plotted in graph paper for each ghee at different temperatures. (Figure-1 to 5). Similarly $\text{Log}_{10}\gamma$ and $\text{Log}_{10}\tau$ for

each ghee at different temperatures were plotted along x-axis and y-axis respectively. (Figure-6 to 10). Slopes of the latter lines gave the value of "n", the flow behavior index whereas the intercepts of the same lines gave the values of $Log_{10}K$.

Statistical Analysis :

Linear and nonlinear regression analysis for correlating various properties of the two kinds of ghee was carried out with the Microsoft Excel (Anonymous, 2003). Different values of "n" and "K" with level of confidence ($p<0.01$; $R^2>0.93$ and standard error < 0.035) are shown in table 6.

Results and Discussion :

The Power law for a fluid having a yield stress (C) is $\tau = K.\gamma^n + C$ (Ranganna S, 1986). If there is no yield stress the plotting of $\log_{10}\gamma$ vs $\log_{10}\tau$ along x and y-axis respectively should give a straight line. But at 20°C such plot in case of Buffalo ghee did not give a straight line (Fig6). It indicated that some yield stress was needed to start motion in case buffalo ghee. Plotting of γ vs. τ on a plain graph paper resulted a curvilinear figure and it did not pass through the origin indicating that the buffalo ghee at 20°C is non-Bingham plastic. For Cow ghee above plotting at 20°C proved that it is a Bingham plastic fluid having very less yield stress. (Fig-4).

When temperature was increased to 30°C flow behavior index of cow ghee and buffalo ghee became 0.95 from 0.885 and 0.60 from 0.43 respectively (Table-6). Hence at that temperature cow ghee behaved like a Newtonian fluid (Fig-5) and then the calculated viscosity of cow ghee did not differ too much as in the previous case with K value (Table-6). At that temperature non Newtonian character of buffalo ghee had a tendency to convert into Newtonian character (Fig-2), and the calculated viscosity of buffalo ghee was found comparatively less difference with its K value (Table-6). Further increase in temperature to 40°C raised 'n' value 0.916 from 0.60 of buffalo ghee, but then consistency coefficient (K) of buffalo ghee did not come so closed to its calculated viscosity (Table-6). In this way by viscometric analysis cow ghee and buffalo ghee can be detected as average Reichert-Meissl values of same cow ghee and buffalo ghee were obtained as 28.07 and 31.2 respectively. This difference has also been established by determining B.R. Readings and Iodine values of both cow ghee and buffalo ghee. Knowledge of the rheological behavior of liquid and semi solid foods is important for the design of process control, quality control and product development (Arslanoglu etal, 2005). The science of rheology is devoted to the study of flow and deformation. Knowledge of rheological behavior of cow ghee and buffalo ghee helps to design machineries and equipments required to prepare ghee based food products like laddu, sonpapri and other health foods.

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Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature

Table - 1 (Buffalo Ghee At 20°C)

RPM	SHEAR RATE (SEC^{-1})	% TORQUE	SHEAR STRESS (DYNE / CM^2)	CALCULATED VISCOSITY (POISE)	DIAL VISCOSITY (POISE)	% ERROR	LOG^{10} SHEAR RATE
1.0	0.209	16.5	198.111	947.897	990.00	4.25	-0.680
1.5	0.314	17.5	210.117	670.231	700.00	4.25	-0.504
2.0	0.418	19.4	232.93	557.249	580.00	3.92	-0.380
3.0	0.627	22.2	266.549	425.118	442.00	3.92	-0.203
4.0	0.836	28.3	339.79	406.447	425.00	4.365	-0.078
5.0	1.045	32.7	392.619	375.712	392.00	4.155	0.019

Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature							
Table - 2 (Buffalo Ghee At 30°C)							
RPM	SHEAR RATE (SEC^{-1})	% TORQUE	SHEAR STRESS (DYNE / CM^2)	CALCULATED VISCOSITY (POISE)	DIAL VISCOSITY (POISE)	% ERROR	LOG^{10} SHEAR RATE
2	0.44	47.2	7.041	16.002	14.16	11.51	-0.357
2.5	0.55	51.4	7.667	13.941	12.34	11.48	-0.260
3	0.66	56.6	8.443	12.792	11.32	11.51	-0.180
4	0.88	68.2	10.173	11.561	10.23	11.51	-0.055
5	1.1	79	11.784	10.713	9.48	11.51	-0.041
6	1.32	90.1	13.44	10.182	9.01	11.51	0.121

Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature							
Table - 3 (Buffalo Ghee At 40°C)							
RPM	SHEAR RATE (SEC^{-1})	% TORQUE	SHEAR STRESS (DYNE / CM^2)	CALCULATED VISCOSITY (POISE)	DIAL VISCOSITY (POISE)	% ERROR	LOG_{10} SHEAR RATE
6	1.32	11.1	1.656	1.254	1.110	11.51	0.121
10	202.00	17.3	2.581	1.173	1.038	11.51	0.642
12	2064.00	19.7	2.939	1.113	0.985	11.51	0.422
20	4.40	33.2	4.952	1.126	0.996	11.51	0.643
30	6.60	48.1	7.175	1.087	0.962	11.51	0.819
50	11.00	76.1	11.352	1.032	0.913	11.53	0.041
60	13.20	79.2	13.306	1.008	0.892	11.51	1.121

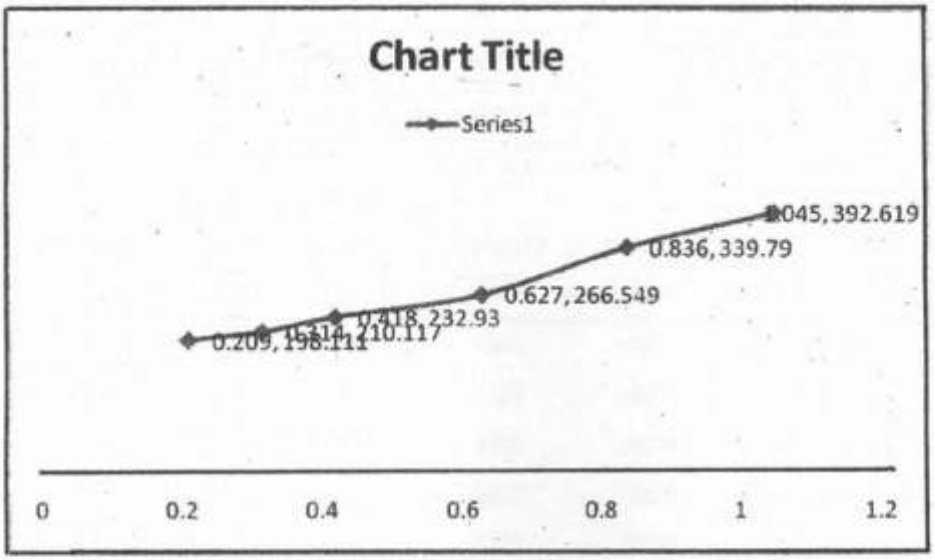
Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature							
Table - 4 (Cow Ghee At 20°C)							
RPM	SHEAR RATE (SEC^{-1})	% TORQUE	SHEAR STRESS (DYNE / CM^2)	CALCULATED VISCOSITY (POISE)	DIAL VISCOSITY (POISE)	% ERROR	LOG_{10} SHEAR RATE
10	2.200	12.6	1.889	0.844	0.756	11.51	0.342
12	2.640	15.1	2.252	0.853	0.755	11.51	0.422
20	4.400	24.2	3.610	0.820	0.726	11.51	0.643
30	6.600	32.9	4.908	0.744	0.658	11.51	0.819
50	11.000	53.0	7.906	0.719	0.636	11.51	1.041
60	13.200	62.5	9.323	0.706	0.625	11.51	1.121

Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature							
Table - 5 (Cow Ghee At 30°C)							
RPM	SHEAR RATE (SEC^{-1})	% TORQUE	SHEAR STRESS (DYNE / CM^2)	CALCULATED VISCOSITY (POISE)	DIAL VISCOSITY (POISE)	% ERROR	LOG_{10} SHEAR RATE
4	0.88	1.8	0.259	0.305	0.318	4.08	-0.056
5	1.1	2.2	0.328	0.298	0.311	4.08	-0.041
12	2.64	5	0.746	0.283	0.295	4.08	-0.422
20	4.4	8.3	1.238	0.281	0.293	4.08	-0.643

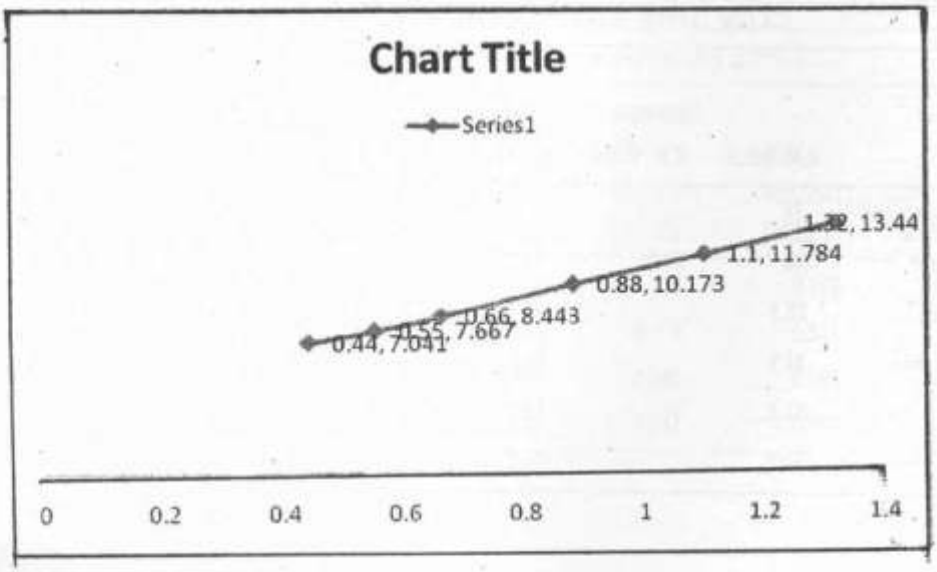
Characteristics Of Shear Rate Vs Shear Stress Of Ghee At Different Temperature							
Table - 6							
Sl. No.	Item	Temparature re	Value of 'n'	Value of "K" (dyne* sec^n/cm^2)	Average dial viscosity (POISE)	Average Calculated viscosity (POISE)	% difference e of "K" & calculated viscosity
1.	Baffalo ghee	20°C	0.43	358.096	588.16	**563.776**	**57.44**
2.	Baffalo ghee	30°C	0.6	11.133	11.09	12.532	12.57
3.	Baffalo ghee	40°C	0.916	1.2573	0.985	1.113	11.48
4.	Cow ghee	20°C	0.885	0.948	0.693	0.781	17.62
5.	Cow ghee	30°C	0.95	0.3009	0.292	0.292	2.96

TABLE - 7 DIFFERENT R.M. VALUES, B.R., READINGS AND IODINE VALUES OF COW GHEE AND BUFFALO GHEE							
Sl. No.	Kind of ghee	R.M. Value	Average R.M. Value	B. R. readings	Average B.R. reading	Iodine Values	Average Iodine value
1.	Cow ghee	28		43		26.1	
2.	Cow ghee	28	28.07	43	43	26.2	26.17
3.	Cow ghee	28.2		43		26.2	
4.	Buffalo ghee	31.2		41.2		30	
5.	Buffalo ghee	31.2	31.2	41.2	41.2	30	30.03
6.	Buffalo ghee	31.2		41.2		30.1	

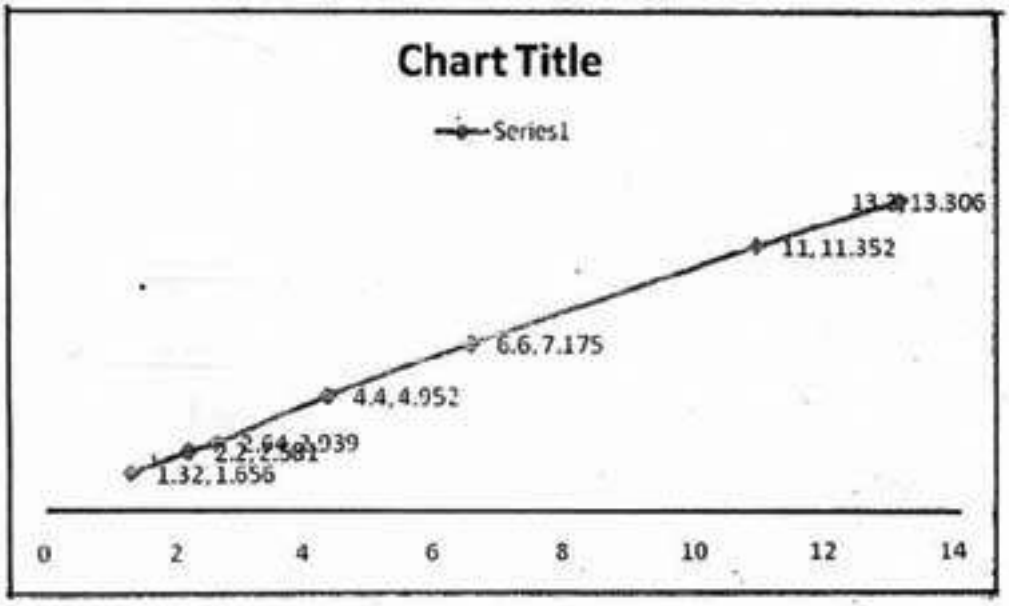
BUFFALO GHEE AT 20^{0}C FIG-1

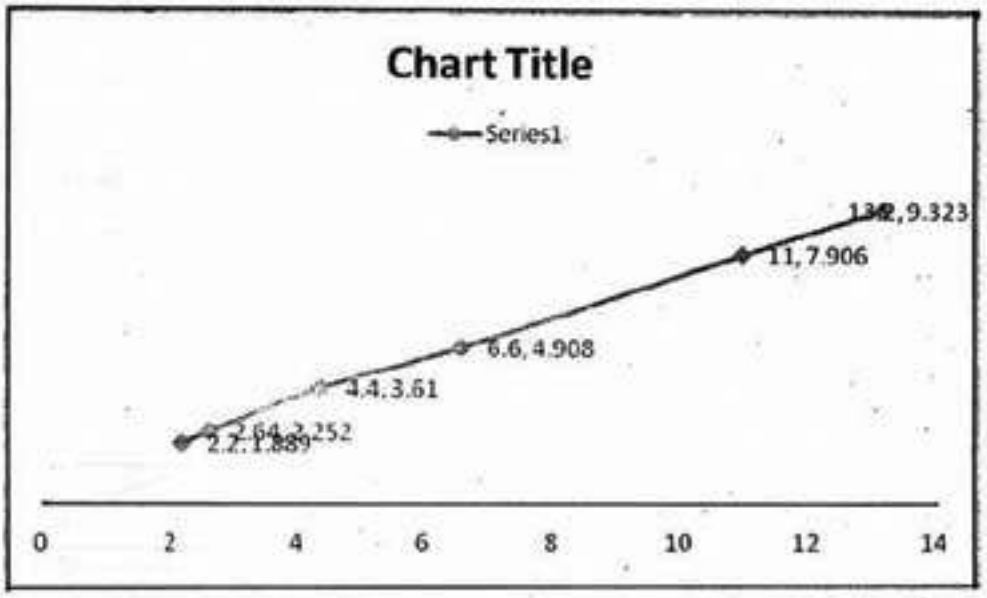


Buffalo ghee at 30^{0}C figure-2



Buffalo ghee at 40°C **figure-3**





COW GHEE AT 20°C **FIG-4**

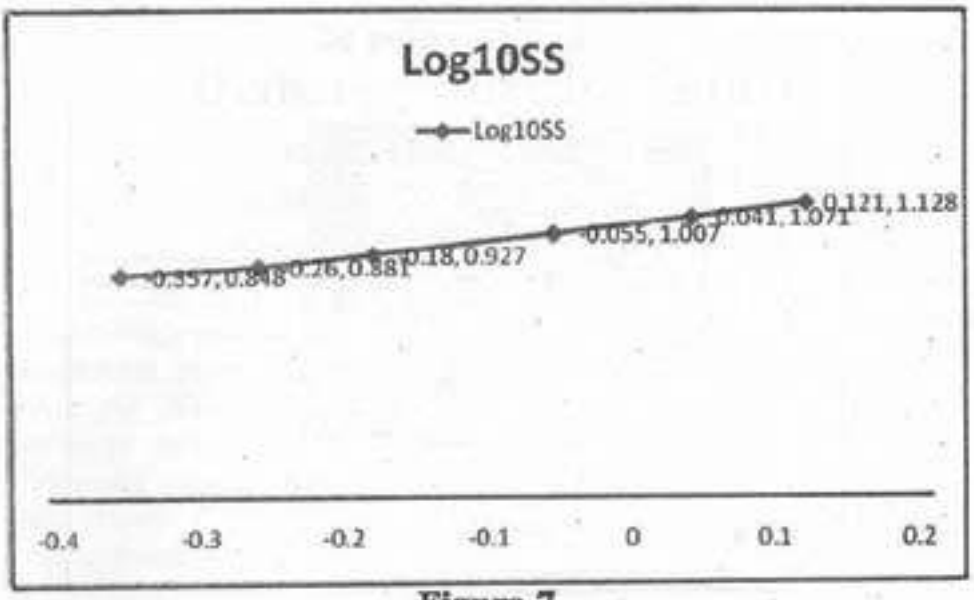
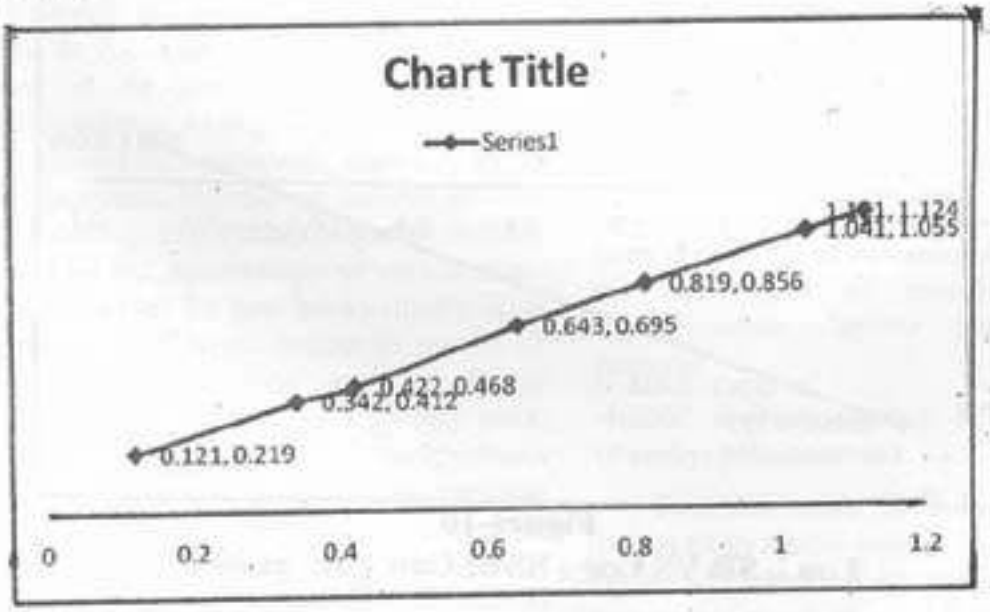


Figure-7

Log $_{10}$ SR VS Log$_{10}$ SS of Buffalo ghee at 30°C

LOG$_{10}$ SR VS.LOG$_{10}$ SS OF BUFFALO GHEE AT 40°C

FIGURE-8



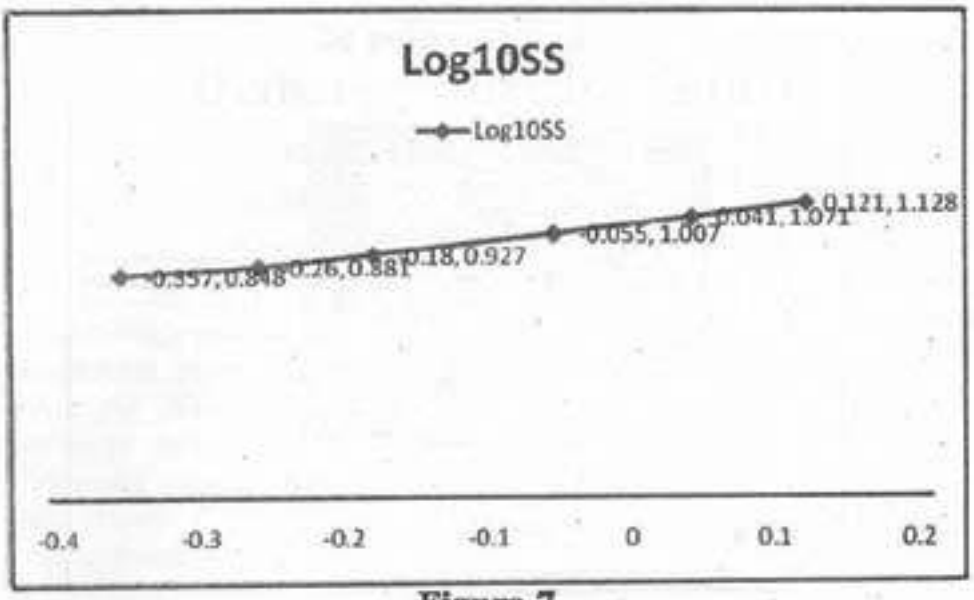
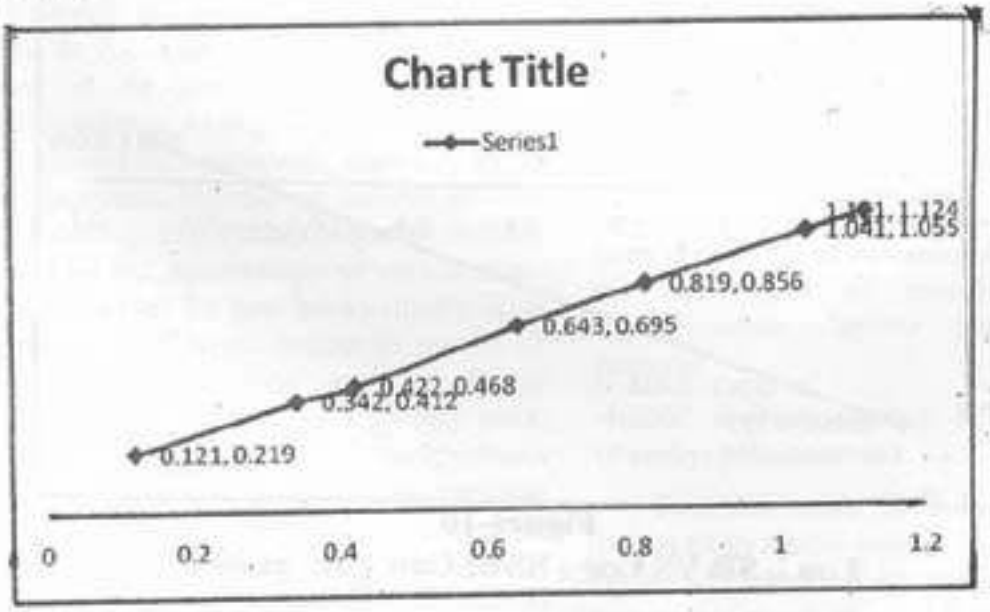


Figure-7

Log $_{10}$ SR VS Log$_{10}$ SS of Buffalo ghee at 30°C

LOG$_{10}$ SR VS.LOG$_{10}$ SS OF BUFFALO GHEE AT 40°C

FIGURE-8



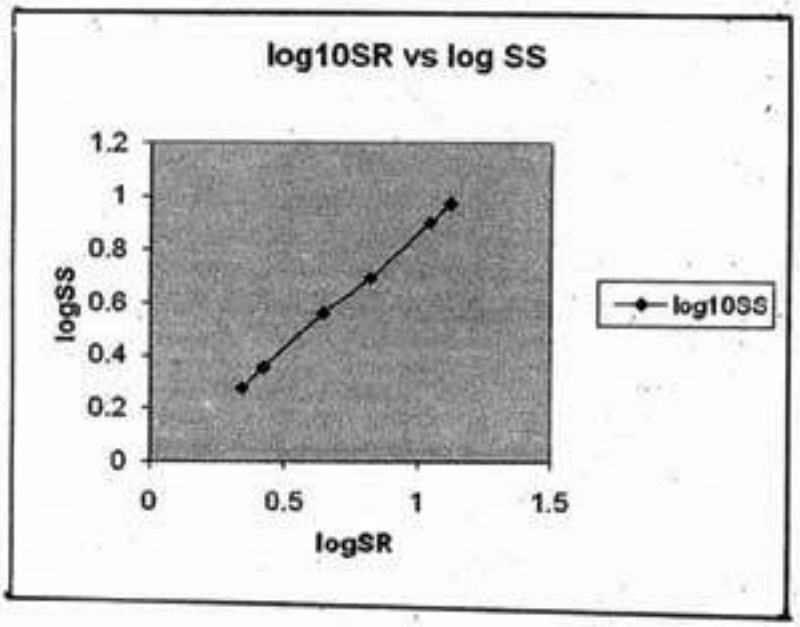


Figure-9

Log $_{10}$ SR VS Log$_{10}$ SS of cow ghee at 20°C

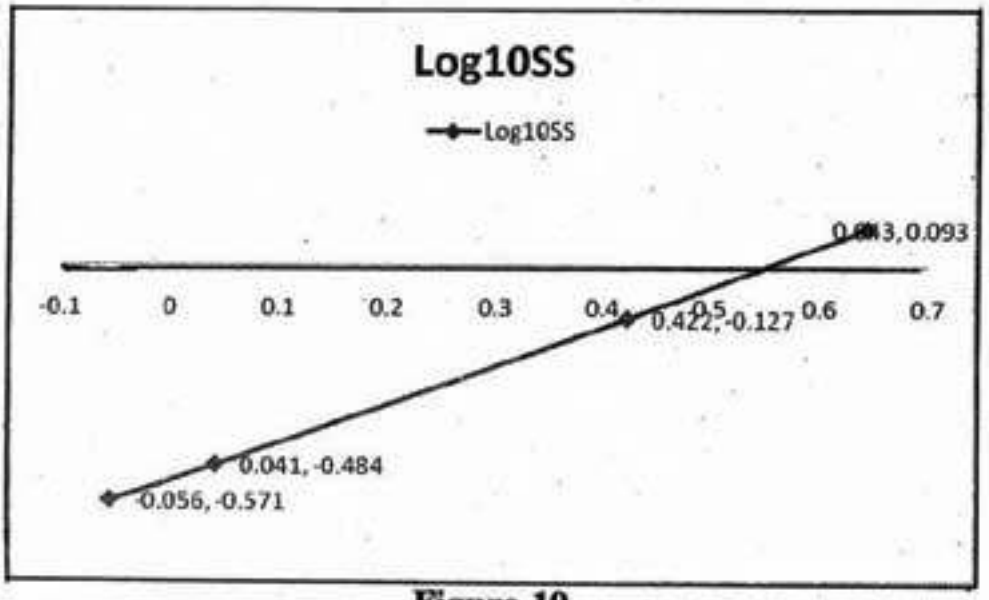


Figure-10

Log$_{10}$ SR VS Log$_{10}$ SS of Cow ghee at 30°C

Diabetes: Cure by Nature

Akanksha and Rakesh Maurya*

Medicinal and Process Chemistry Division,
Central Drug Research Institute, Lucknow

Introduction

During evolutionary process of life on the earth, microorganisms, plants and animals get originated. All the living organisms are interdependent in so many ways, as for food, shelter etc. Some are parasitic saprophytic or mutualists too. Plants possess innumerable number of compounds, having innumerable pharmacological profiles. By its wide range of pharmacologically active compounds, plants protect themselves from various diseases. At the same time, animals are dependent on plants for their food either directly or indirectly. Animals taking food directly from plant get cured from various diseases. Humans take medication to cure or prevent diseases. From very ancient time, wide range of plants is reported to treat various diseases and complications in various ancient medicinal systems. In Ayurveda a number of plants are reported to be used in curing diabetes. Diabetes mellitus, arising as a global problem, can be defined as a metabolic disorder, which is most prevalent. Number of diabetic patients is rising steadily day by day. Diabetes mellitus is caused by the abnormality of carbohydrate metabolism either by low blood insulin level or insensitivity of target organs to insulin [42]. Diabetes can be defined as a group of syndromes characterized by hyperglycemia, altered metabolism of lipids, carbohydrates and proteins. In type 1 diabetes, the pancreas stops producing insulin due to autoimmune destruction of pancreatic beta cells. In case of type 2 diabetes, body cells do not respond to insulin. In absence of insulin, body cells don't get the required glucose for producing ATP, body starts breaking down the muscle tissue and fat for producing energy hence, causing fast weight loss. Dehydration is also usually observed due to electrolyte disturbance. In advanced stages, coma and death is also reported. In both types of diabetes, signs and symptoms are more likely to be similar as the blood sugar is high, either due to less or no production of insulin, or insulin resistance. Common symptoms of diabetes are increased fatigue, polydipsia, polyuria, polyphagia, blurred vision, poor wound healing, quick exhaustion, drowsiness. Synthetic drugs for diabetes treatment are costly and they have many side effects too. Natural products have safer side over synthetic drugs having less or no side effects. Effective treatment includes controlling hyperglycaemia as well as secondary complications. About 800 plants have been reported possessing anti-diabetic potential.[1] Since antiquity, diabetes has been treated with medicines derived from plants. Biological activities of various plants have been proved by phytochemical studies. Below are the briefs of some plants having hypoglycaemic and/or antihyperglycemic potential.

Acacia arabica (Lam.) Muhl. ex Willd. (Family: Mimosaceae)

Common name is Babul in Hindi and Indian Gum Arabic tree in English. Acacia has been used to treat high cholesterol, diabetes, cancer, gingivitis, stomatitis (mouth sores) and

Ack : Current R & D Highlights C. D. R. I., Lucknow

pharyngitis. The powdered seeds of *A. arabica* were administered in doses of 2, 3 and 4 gm/kg body-weight to normal and alloxan-diabetic rabbits. 2, 4, 6 and 8 hours after the administration the blood glucose levels were estimated. It exerted a significant ($p<0.05$) hypoglycemic effect in normal rabbits. It acts through release of insulin from pancreatic beta cells[8].

***Aegle marmelos* (L.) Correa ex Roxb. (Family: Rutaceae)**

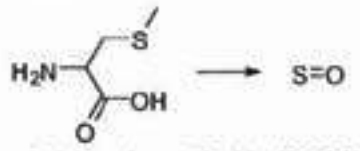
Commonly known as Bael in Hindi. Administration of an oral dose of 250 mg/ kg of alcoholic leaf extract of *A. marmelos* showed significant improvements in ability to utilize the external glucose load in glucose induced hyperglycemic rats. Efficacy of *A. marmelos* was 71% of glybenclamide. This increase in glucose utilization can be attributed either by direct stimulation of glucose uptake or by enhanced insulin secretion[64]. Aqueous extract of fruits of *A. marmelos* is known to exhibit hypoglycaemic effect in streptozotocin-induced diabetes in rats. At the dose of 125 and 250 mg/ kg twice a day for 4 weeks resulted in significant reductions in blood glucose, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin and α-tocopherol and a significant elevation in plasma reduced glutathione and Vitamin C. The effect of the extract at a dose of 250 mg kg^{-1} was more effective than glibenclamide[35]. The effect of methanolic extract of *A.e marmelos* has been studied on a battery of targets glucose transporter (Glut-4), peroxisome proliferator activator receptor gamma (PPARγ) and phosphatidylinositol 3' kinase (PI3 kinase) involved in glucose transport. It was found active at 100 ng/ml dose comparable with insulin and rosiglitazone[3].

***Aerva lanata* (L.) Juss. ex Schult. (Family: Amaranthaceae)**

It is commonly known as Sunny khur. Its alcoholic extract reduced the increase in blood sugar in alloxanized rats by 42% at 375 mg/kg and 48% at 500 mg/kg body weight. The extract also reduced blood sugar level of alloxanized rats significantly upon chronic administration for 2 weeks[48].

***Allium cepa* L. (Family: Liliaceae)**

Commonly known as Pyaj in Hindi and Onion in English. It has been used to treat diabetes and is reputed to lower blood sugar levels. Oral administration of the hypoglycaemic fraction to alloxan-diabetic rabbits improved their glucose tolerance. After 7 days treatment, the more active hypoglycaemic fraction was about half as active as Phenformin in lowering the fasting blood sugar of alloxan-diabetic rabbits[43]. *S*-methyl cysteine sulfoxide (SMCS) isolated from *Allium cepa* was investigated for its lipid lowering action in SD rats, in comparison to the hypolipidemic drug gugulipid. SMCS at a dose of 200 mg/kg body weight for 45 days enhanced the hyperlipidemic condition. Concentrations of cholesterol, triglyceride and phospholipids were significantly reduced with respect to control[38].

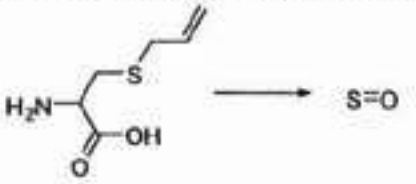


S-methyl cysteine sulfoxide (SMCS)

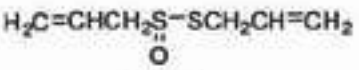
The effects of two dietary doses of freeze-dried onion powder, *i.e.*, onion low (ONL; 0.5%) and onion high (ONH; 2.0%) on streptozotocin (STZ)-induced diabetes rat model was studied. After 4 weeks on the experimental diets, fasting blood glucose levels for both onion-fed groups were found elevated. Serum insulin concentrations and insulin resistance were dose-dependently increased in the onion-fed groups. The ONH group had significantly higher lipid concentrations, ONL group showed a similar hyperlipidemic trend to a lesser extent[31].

***Allium sativum* L. (Family: Alliaceae)**

Commonly known as Lahasun in Hindi and Garlic in English. Ethanolic extract of garlic at the doses of 0.1, 0.25 and 0.5 g/kg body weight was orally given to normal and streptozotocin-induced diabetic rats for 14 days. The level of serum glucose, total cholesterol, triglycerides, urea, uric acid, creatinine, aspartate amino transferase (AST) and alanine amino transferase (ALT) were found decreased. The antidiabetic effect of the extract was found more active than that of glibenclamide[18]. The antidiabetic effect of garlic is thought to be due to the formation of a colloidal type suspension in the stomach and intestines when the mucilaginous fiber of garlic is hydrated, therefore affecting gastro-intestinal transit and slowing glucose absorption[47]. S-allyl cysteine sulphoxide, a sulphur containing amino acid which is the precursor of allicin and garlic oil, has been found to show significant antidiabetic effects in alloxan diabetic rats at a dose of 200 mg/kg body weight. It increased significantly liver and intestinal HMG CoA reductase activity and liver hexokinase activity (Sheela & Augusti, 1992). Allicin (thio-2-propene-1-sulfinic acid S-allyl ester), isolated from garlic, produced significant blood glucose lowering activity in experimental diabetic animals[48].



S-allyl cysteine sulphoxide



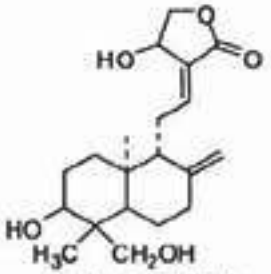
Allicin

***Aloe vera* (L.) Burm.f. (Family: Aloaceae)**

Commonly known as Ghee Kunwar or Kumar panthu in Hindi. Aloes have long been used all over the world for their various medicinal properties. Separate experiments on three groups of rats, namely, non-diabetic (ND), type I (IDDM) and type II (NIDDM) diabetic rats were carried out. *A. vera* leaf pulp and gel extracts were ineffective on lowering the blood sugar level of ND rats. Leaf pulp extract showed hypoglycaemic activity on IDDM and NIDDM rats. Whereas, leaf gel extract showed hyperglycaemic activity on NIDDM rats. This study directed that the pulps of *A. vera* leaves devoid of the gel could be useful in the treatment of non-insulin dependent diabetes mellitus[54].

***Andrographis paniculata* Nees (Family: Acanthaceae)**

Commonly known as Kalmegh in Hindi and King of bitters in English. Andrographolide, a principle present in



Andrographolide

Andrographis paniculata is suggested to increase glucose utilization in peripheral tissue via an insulin-dependent mechanism[80].

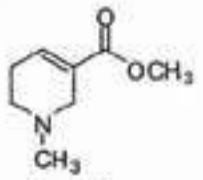
***Annona squamosa* L. (Family: Annonaceae)**

Commonly known as Sharifa or Sitafal in Hindi and Sugar apple or Custard apple in English. Aqueous leaf extract has shown hypoglycemic activity in streptozotocin-

nicotinamide induced diabetic rats. At the dose of 350 mg/kg ethanolic leaf extract has been found to possess hypoglycemic as well as antihyperglycemic potential in normal, streptozotocin- diabetic rats and alloxanized rabbits[48]

***Areca catechu* L. (Family: Arecaceae)**

Commonly known as Supari in Hindi and Betelnut in English. Subcutaneous



Arecoline

administration of alkaloid fraction at the dose 0.05-0.5 mg/kg in alloxanized rabbits showed significant hypoglycemic effect[15]. Arecoline, isolated from *A. catechu* is reported to have hypoglycemic activity[48].

***Artemisia pallens* Wall. ex DC. (Family: Compositae)**

Commonly known as Davana in Hindi. Oral administration of the methanol extract of the aerial parts of *Artemisia pallens*, led to significant blood glucose lowering effect in glucose-fed hyperglycaemic and alloxan-induced diabetic rats. This effect of the extract was dose dependent and significant at 100 mg/kg level in glucose-fed rats. In fasted normal rats, the extract caused a moderate hypoglycaemic effect at 1000 mg/kg[74].

***Azadirachta indica A. Juss.* (Family: Meliaceae)**

Commonly known as Neem. Studies showed that petroleum ether extract of neem seed kernel (NSK) and husk (NSH) showed significant protection against the oxidative damage induced by STZ in heart and erythrocytes of rats. NSK and NSH may act as cardioprotective and free radical scavenger agent. Serum creatine phosphokinase (CPK) increased in diabetic rats was significantly decreased on insulin, NSK and NSH treatments. The decrease in activities of superoxide dismutase (SOD) and catalase (CAT) and increase in lipid peroxidation (LPO) of erythrocytes as observed in diabetes was regained after insulin, NSH and NSK treatments. Results suggest that NSH and NSK prevent oxidative stress caused by STZ in heart and erythrocytes[25]. Pretreatment with *A. indica* leaf extract, blocked the depressive effect of epinephrine in diabetic rabbits as well as in normal ones. In *in vitro* trials, *A. indica* leaf extract, failed to alter the hepatic glycogen, but it partially blocked epinephrine action on hepatic glycogen both in normal and diabetic rabbits[12]. *A. indica* leaf extract blocks significantly the inhibitory effect of serotonin on insulin secretion mediated by glucose[14].

***Barleria lupulina Lindl.* (Family: Acanthaceae)**

Commonly known as Snake bush in English. The methanol extract of aerial parts of *Barleria lupulina* Lindl. showed a pronounced blood-glucose-lowering potential in streptozotocin hyperglycemic rats. The extract at dose of 200 mg/kg body weight exhibited a maximum activity ($p<0.001$) at 12 h after administration. The most significant activity (15.35% blood glucose reduction) was observed for the group administered 300 mg/kg body weight at 12 h after administration, while the standard drug glibenclamide (10 mg/kg body weight) showed an 18.80% reduction of blood glucose at the same time interval[73].

***Beta vulgaris* L. (Family: Chenopodiaceae)**

It is known as Chukander in Hindi and Garden beet in English. Beta vulgarosides II-IV, isolated have been shown to ameliorate glucose tolerance in OGTT conducted in rats. Uncontrolled induced diabetes caused significant increases in nonenzymatic glycosylation of skin proteins, lipid peroxidation and blood glucose. Administration of *B. vulgaris* extract inhibited

these effects except the increase in lipid peroxidation. These findings indicated that the use of *B. vulgaris* may decrease the development of some diabetic complications[23].

***Biophytum sensitivum* (L.) DC. (Family: Oxalidaceae)**

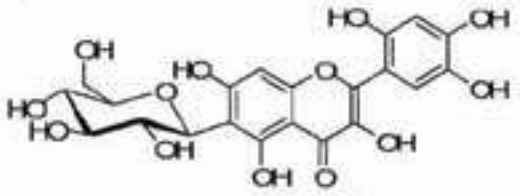
It is commonly called as Lajjalu in Hindi and Life plant in English. Leaf extract has been proved to show antihyperglycemic effect in alloxan diabetic male rabbits. It was found ineffective in severe diabetes[23].

***Boerhavia diffusa* L. (Family: Nyctaginaceae)**

Commonly known as Punarnava in Hindi. Oral administration of *B. diffusa* leaf extract at 200 mg/kg of body weight for 4 weeks resulted in significant reduction in serum and tissue cholesterol, free fatty acids, phospholipids, and triglycerides. It was found to be more effective than glibenclamide in the treatment of diabetic rats[57].

***Bombax ceiba* L. (Family: Bombacaceae)**

Common name is Semul in Hindi and Red silk cotton tree in English. Shamimin, a flavonol glucoside known as Shamimin, isolated from the leaves of the plant has been reported to possess significant hypoglycemic activity at dose of 500 mg/kg in rats[65].



Shamimin

***Brassica juncea* (L.) Czern. (Family: Brassicaceae)**

Common name is Rai in Hindi and Indian mustard in English. Study was made on the effects of daily oral feeding of 10% powder of seeds of *Brassica juncea* for 60 days on serum glucose concentrations and kidney functions in streptozotocin diabetic rats. After 60 days of STZ administration, urine volume per day and UAE levels were significantly higher (P<0.0005) in diabetic controls as compared to normal controls[24].

***Caesalpinia bonducella* (L.) Roxb. (Family: Cesalpinaceae)**

Commonly known as Kantkarej or Kantikaranja in Hindi and Fever nut or Bonduc nut in English. In normal rats, aqueous and 50% ethanolic extracts of *C. bonducella* seeds exhibited hypoglycaemic activity at a dose of 100 mg/kg after 4 hour of administration. The hypoglycaemia produced by the aqueous extract was of prolonged duration as compared to ethanolic extract. In diabetic rats, both the extracts produced significant (p<0.01) antihyperglycaemic effect from day 5 onwards[66].

***Cajanus cajan* (L.) Millsp. (Family: Fabaceae)**

Common name is Tuvar in Hindi and Red gram in English. Oral administration of graded doses of aqueous extract of *C. cajan* leaves in streptozotocin induced type 2 diabetic rats showed significant increase in 14.3 % in fasting blood glucose levels of normal rats. The dose of 1000 mg/kg showed the maximum rise of 17.1, 71.2 and 50.7 % in blood glucose levels of normal, sub and mild diabetic rats respectively in glucose tolerance test[32].

***Camellia sinensis* Kuntze (Family: Theaceae)**

Commonly known as Tea in English. The hot water extract of *C. sinensis* significantly reduced the blood glucose level and was found to possess both preventive and curative effects on experimentally produced diabetes in rats. The green tea as well as black tea both possess antidiabetic activity[20].

***Capparis decidua* (Forsk.) Edgew. (Family: Capparidaceae)**

Commonly known as Keekar, Karir, Kirir, Karril, etc. in Hindi and Caper plant in

English. Oral feeding of diet containing (30%) *C. decidua* fruit powder for 3 weeks to alloxanized diabetic rats showed significant hypoglycemia[23].

***Casearia esculenta* Roxb. (Family: Flacourtiaceae)**

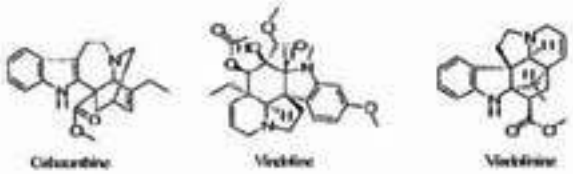
Commonly known as Saptarangi in Hindi. The plant root extract exhibited significant hypolipidaemic and antiperoxidative activity in red blood cells of streptozotocin diabetic rats[48].

***Cassia auriculata* L. (Family: Cesalpinaceae)**

Common name is Tanner's Cassia. Extract of flowers of *C. auriculata* suppressed the elevated blood glucose and lipid levels in diabetic rats at doses of 0.15, 0.30 and 0.45 g/kg body weight for 30 days. At the dose of 0.45 g/kg was found to be comparable to glibenclamide. Extract significantly reduced the levels of serum and tissue lipids[56].

***Catharanthus roseus* (L.) G. Don. / Vinca rosea (Family: Apocynaceae)**

Commonly called as Sadabahar in Hindi and Madagascar periwinkle in English. Administration of aqueous extracts of *V. rosea* flower and leaf have been found to regulate the blood sugar level in alloxan diabetic male albino rats[19]. Ethanol extract of *V. rosea* promotes significant wound healing and closure in diabetic rats compared with mupirocin At the dose of 100 mg/kg body weight, it significantly reduced ($p<0.001$) wound size in streptozotocin induced diabetic rats[53]. Alkaloids isolated catharanthine, vindoline and vindolinine lower blood sugar level[48].

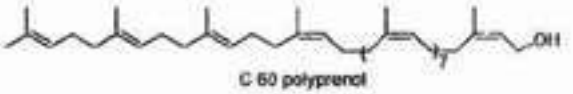


***Citrullus colocynthis* (L.) Schrad. (Family: Cucurbitaceae)**

Common name is Indryan in Hindi and Bitter apple in English. Oral administration of 300 mg/kg of aqueous extract produced significant reduction in plasma glucose after 1 hour and highly significant after 2,3 and 6 hour in normal rabbits. The glycosidic extract at a oral dose of 50 mg/kg significantly lowered the fasting glucose levels after 2 and 3 hour and highly significant after 6 hour. The saponin extract at the same oral dose significantly lowered the fasting glucose levels after 1 and 2 hour and highly significant ($p<0.001$) after 3 and 6 hour[1].

***Coccinia indica* Wight & Arn. (Family: Cucurbitaceae)**

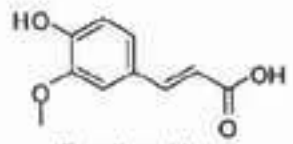
Common name is kundru. It have been used in the traditional treatment of diabetes mellitus. Toluene, chloroform, ethyl acetate and n-butanol fractions of the dried alcoholic extract of the aerial part were fed to alloxan treated diabetic rats orally, twice daily at a dose of 150 mg/kg. The toluene fraction prevented the elevation of lipid profile significantly ($p<0.001$) in comparison to control diabetic rats[10]. Ethanol extract of *C. grandis* showed significant triglyceride (TG) and cholesterol-lowering effects in dyslipidemic hamster model. Activity was proved to be concentrated in chloroform-soluble fraction. Chloroform soluble fraction on repeated column chromatography, furnished a polyprenol characterized as C60-polyprenol. It significantly decreased serum TG by 42%, total cholesterol (TC) 25% and glycerol (Gly) 12%, accompanied HDL-C/TC ratio 26% in highfat diet (HFD)-fed dyslipidemic hamsters at the dose of 50 mg/kg body weight. Results are comparable to standard drug fenofibrate at the dose of 108 mg/kg[70].



C 60 polyprenol

***Curcuma longa* (Family: Zingiberaceae)**

Commonly known as Haldi in Hindi and Turmeric in English. Ethanol extract of rhizome significantly suppressed an increase in blood glucose level in type 2 diabetic mice. The extract stimulated human adipocyte differentiation in a dose-dependent manner and showed human peroxisome proliferator-activated receptor (PPAR)-γ ligand-binding activity in a GAL4-PPAR-γ chimera assay (Kuroda *et al.*, 2005). Ferulic acid (4-hydroxy-3-methoxycinnamic acid) is found in many plants, isolated from *Curcuma* too. It has shown hypoglycemic activity in both type of diabetes[48]



Ferulic acid

***Cynodon dactylon* (Family: Poaceae)**

Commonly known as Doob in Hindi. At a dose of 500 mg/kg, aqueous extract lowered blood glucose level around 31% after 4 hour of administration in normal rats. During glucose tolerance test (GTT) of mild diabetic rats, the same dose produced a fall of 23% in blood glucose level within 1 hour. This dose has almost similar effect as that of standard drug tolbutamide at the dose of 250 mg/kg body weight. A significant reduction of 59% was observed in fasting blood glucose level of severely diabetic rats at same dose given for 14 days. It reduced urine sugar level. In severely diabetic rats total cholesterol (TC), low density lipoprotein (LDL) and triglyceride (TG) levels were decreased by 35, 77 and 29%, respectively, whereas, cardioprotective, high density lipoprotein (HDL) was increased by 18%. These results suggested antidiabetic potential of aqueous extract along with significant hypoglycemic and hypolipidemic effects[70,71].

***Enicostemma littorale* Blume (Family: Gentiaceae)**

Commonly known as Chhota chirata in Hindi and Whitehead in English. At the dose of 1.5 g/100g body weight/day of aqueous extract of *E. littorale* increased HDL levels and decreased serum cholesterol, triglyceride, LDL, VLDL, LDL/HDL ratio in rats fed with hypercholesterolaemic diet. It showed a decrease in activities of erythrocyte catalase, superoxide dismutase and lipid peroxidation levels, with an increase in reduced glutathione levels. It also showed decrease in liver and kidney cholesterol levels and triglyceride levels[76].

***Eucalyptus globulus* Labill. (Family: Myrtaceae)**

Commonly known as Safeda in Hindi. In diabetic rats, the repeated oral administration of *E. globulus* aqueous leaf extract significantly increased the basal plasma insulin concentrations ($p<0.05$)[27]. An aqueous extract of *E. globulus* at the dose of 0.5 g/L enhanced 2-deoxy-glucose transport by 50%, glucose oxidation by 60% and incorporation of glucose into glycogen by 90% in mouse abdominal muscle. In acute, 20 min incubations, administration of 0.25-0.5 g showed stepwise 70-160% enhancement of insulin secretion from the clonal pancreatic β cell line[21].

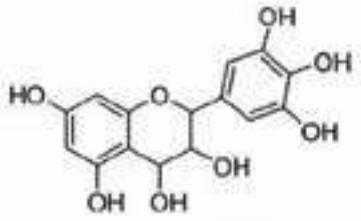
***Eugenia uniflora* L. (Family: Myrtaceae)**

Commonmly known as Surinam Cherry or Brazilian Cherry in English. Ethanolic extract of the leaves of *E. uniflora* inhibited the increase in plasma glucose level and plasma triglyceride level[48].

***Ficus bengalensis* (Family: Moraceae)**

It is known as bargad in Hindi and Banyan in English. 50 mg/kg of hot water extract of *F. bengalensis* was given orally to normal rabbits and rabbits with alloxan induced alloxan-recovered, mildly diabetic and severely diabetic states daily for three days. After a gap of five days, the water extract was

readministered for three days at the same dose level. There was no significant change in fasting blood glucose (FBG), or glucose tolerance test (GTT) in normal rabbits. There was no fall in FBG but improvement in glucose tolerance in alloxanrecovered rabbits. In mildly diabetic rabbits there was 55.8% fall in FBG values and an improvement in glucose tolerance. The extract produced 68% fall in FBG values in severely diabetic rabbits[69]. The bark and aerial roots ethanolic extracts at a dose of 100 mg/kg

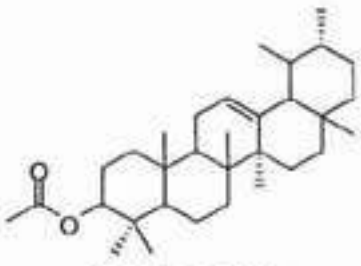


Leucodelphinidin

significantly ($p<0.001$), ($p<0.01$) lowered the blood sugar level of hyperglycemic rats respectively. Barks exhibited better activity than aerial roots[17]. Leucodelphinidin, isolated from the bark of *F. bengalensis* has been reported for its hypoglycemic activity.

***Ficus racemosa* (Family: Moraceae)**

It is commonly known as 'Gular' in India. α-amyrin acetate, isolated from the fruits of *F. racemosa* at the dose of 100 mg/kg body

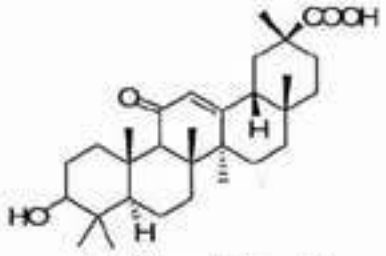


α-amyrin acetate

weight, lowered the blood glucose levels by 18.4 and 17.0% at 5 and 24 hour, respectively, in sucrose challenged streptozotocin induced diabetic rat (STZ-S) model. Its p-chlorobenzoic acid derivative and nicotinic acid derivative showed potent antihyperglycemic activity at 100 mg/kg body weight[52].

***Glycyrrhiza glabra* L. (Family: Fabaceae)**

Commonly known as Licorice. Glycyrrhizin, isolated from licorice root, is composed of one molecule of glycyrrhetinic acid and two molecules of glucuronic acid. After oral administration, glycyrrhizin has been shown to be hydrolyzed by the glucuronidase of intestinal bacteria to its



18β-glycyrrhetinic acid

principal aglycone, 18β-glycyrrhetinic acid. 18β-glycyrrhetinic acid when administered orally at 100mg/kg of bodyweight, showed potential antihyperglycemic effect that is comparable with glibenclamide[34].

***Gymnema montanum* Hook.f. (Family: Asclepiadaceae)**

G. montanum leaf extract possess antihyperglycemic and antiperoxidative effect. Oral administration of 200 mg/kg body weight of the alcoholic extract of the leaf for 3 weeks resulted in a significant reduction in blood glucose and an increase in plasma insulin. The decrease in lipid peroxides and increase in reduced glutathione (GSH), ascorbic acid (Vitamin C) and α -tocopherol (Vitamin E) showed its antioxidant properties[6].

***Gymnema sylvestre* R. Br. (Family: Asclepiadaceae)**

G. sylvestre leaf extract lowers the blood

glucose level in normal fasting, glucose-fed hyperglycemic and diabetic rats compared with placebo-treated animals. The maximum glucose suppression occurred after 2 hour of treatment by the effective dose of 200 mg/kg, PO, of the extract [12,13].

***Helicteres isora* L. (Family: Sterculiaceae)**

Administration of the bark extract of *H. isora* at the doses of 100 and 200 mg/kg body weight for 21 days resulted in significant reduction in serum and tissue cholesterol, phospholipids, free fatty acids and triglycerides in STZ diabetic rats. Significant ($p< 0.05$) decrease in high-density lipoprotein (HDL) whereas significant increase ($p<0.05$) low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) were observed in STZ diabetic rats. The bark extract possesses definite hypotriglyceridemic and antiatherogenic properties in STZ diabetic rats after 3 weeks of treatment[39].

***Hibiscus rosa-sinensis* (Family: Malvaceae)**

Commonly known as Gudhal in Hindi and shoe flower in English. In streptozotocin induced diabetic rats, oral administration of an ethanol flower extract of *Hibiscus rosa sinensis* lowered the total cholesterol and serum triglycerides by 22 and 30%, respectively. Maximal diminution in blood glucose (41–46%) and insulin level (14%) was noticed after 21 days. The hypoglycemic activity of this extract is comparable to that of glibenclamide[63] .

***Hygrophila auriculata* (Family: Acanthaceae)**

It is a wild herb widely used in 'Ayurveda' as 'Rasayana' drug for treatment of various disorders. aerial parts of *H. auriculata* extract possesses significant antidiabetic activity along with potent antioxidant potential in diabetic conditions. Treatment of diabetic rats at the doses of 100 and 250 mg/kg body weight for 3 weeks showed significant reduction in blood glucose, thiobarbituric acid reactive substances (TBARS) and hydroperoxide in both liver and kidney[78].

***Indigofera mysorensis* (Family: Fabaceae)**

In insulin resistant db/db mice extract of the whole shrub of Indigofera at 300 mg/kg for 10 days, produced a 63% reduction in plasma glucose, 41% reduction in plasma triglyceride and 77% reduction in plasma insulin levels, which is better than insulin sensitizer, troglitazone (400 mg/kg). Study showed that the antidiabetic effect of the ethanolic extract of *Indigofera* is due to its insulin sensitizing property and is clearly different from that of sulfonylurea or acarbose[10].

***Ipomoea batatas* (Family: Convolvulaceae)**

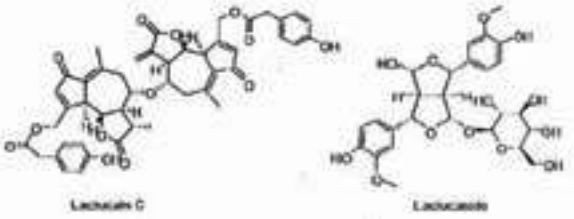
Commonly known as sweet potato. White-skinned sweet potato is useful in the prevention and improvement of diabetic symptoms by stimulating human immunity. It increased phagocytic activity and phagosome-lysosome fusion in neutrophils and monocytes in a dose-dependent manner[46].

***Lantana camara* (Family: Verbenaceae)**

In Hindi, it is known as Caturang. Administration at the dose of 1500 mg/kg/day for 14 days showed significant hypoglycemic effect in rats[23].

***Lactuca indica* (Family: Asteraceae)**

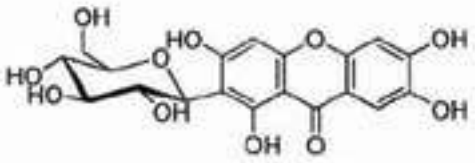
Commonly known as Indian Lettuce. Lactucain C and lactucaside have shown significant hypoglycemic activity[48].



Mangifera indica L. (Family: Anacardiaceae)

It is known as Aam in Hindi and Mango in

English. Aqueous leaf extract at the dose of 1 g/kg p.o. showed hypoglycemic effect when given 60 mins prior to glucose administration in streptozotocin-induced diabetic rats[2]. The chronic intraperitoneal administration of mangiferin, a xanthone glucoside isolated from the leaves of *Mangifera indica* at the doses of 10 and



Mangiferin

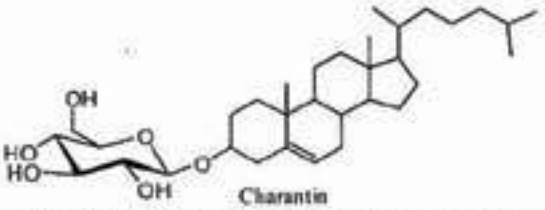
20 mg/kg once daily for 28 days exhibited antidiabetic activity by significantly lowering fasting plasma glucose level at different time intervals in STZ-diabetic rats. At the same doses, mangiferin showed significant antihyperlipidemic and antiatherogenic activities as evidenced by significant decrease in plasma total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL-C) levels coupled together with elevation of high-density lipoprotein cholesterol (HDL-C) level and diminution of atherogenic index in diabetic rats[50].

***Memecylon umbellatum* Burm. f. (Family: Melastomataceae)**

Commonly known as Anjani in Hindi. Oral administration of alcoholic extract of the leaves of *M. umbellatum* (250 mg/kg) caused a significant reduction in the serum glucose levels in normal and alloxanized rats at 30, 60 and 90 min after administration[23].

***Momordica charantia* L. (Family: Cucurbitaceae)**

Common name is karela in Hindi and bittergourd in English. The anti-diabetic potential of *Momordica charantia* is well established in streptozocin or alloxan induced diabetic animals. *Momordica charantia* displays insulin-like properties, remarkably stimulates glycogen storage by the liver and improves peripheral glucose uptake[62]. Charantin, a steroidal saponin isolated have hypoglycemic potential.



Charantin

***Momordica cymbalaria* Fenzl ex Naudin (Family: Cucurbitaceae)**

Commonly known as Kadavanchi in Hindi. It exhibited both hypoglycemic as well as hypolipidemic properties. Its powdered fruit exhibited significant reduction in fasting blood glucose levels in alloxanized rats[23].

***Morus alba* L. (Family: Moraceae)**

Commonly known as Shetut in Hindi and White Mulberry in English. Hot water extract of leaves of *M. alba* showed hypoglycemic activity in fasted and non-fasted STZ diabetic mice at the dose of 200 mg/kg[23].

***Mucuna pruriens* (L.) DC. (Family: Leguminosae)**

It is called as Kavach in Hindi and Cowitch in English. In normal rats, at the the oral administration of 100 and 200 mg/kg body weight, the aqueous extract of the seeds of *M. pruriens* significantly reduced the blood glucose levels after an oral glucose load from 127.5±3.2 to 75.6±4.8 mg %. It also significantly lowered the blood glucose in STZ diabetic rats from 240.5±7.2 to 90.6±5.6 mg % after 21 days of daily oral administration of the extract (Pb0.001)[9].

***Murraya koeingii* (L.) Spreng. (Family: Rutaceae)**

One month oral administration of *M. koenigii* aqueous leaves extract in STZ induced severe diabetic rats, at the dose of 300 mg/kg body weight fasting blood glucose (FBG) levels reduced by 48.2% after 30 days

treatment with the aqueous leaves extract. A fall of 19.2 and 30.8% in total cholesterol (TC) and 22.97 and 37.1% in triglyceride (TG) levels were also observed in the case of treated normal as well as diabetic rats, respectively. Feeding the extract increased the HDL-cholesterol level by 16 and 29.4% in normal and diabetic rats, respectively, as compared with their initial values. In the normal rats after 1 month of oral administration of the extract serum glutamate oxaloacetate and pyruvate transaminases (SGOT and SGPT) levels were decreased by 21.7 and 25.0%. Serum alkaline phosphatase values of the treated normal animals were also reduced by 33% while negligible change was observed in the normal control animals. In the case of diabetic rats, SGOT and SGPT levels were reduced by 36.7 and 32.2%, respectively, whereas phosphatase (ALKP) levels decreased by 39.7%. The serum creatinine levels decrease in normal as well as in the diabetic animals by 17.75 and 18.2%, respectively, as compared to initial values. In the diabetic control animals the urinary sugar remains at +4 level but there was a decrease of 75% in urine sugar in the case of treated diabetic rats [37].

***Musa sapientum* L. (Family: Musaceae)**

Commonly known as Kela in Hindi and Banana in English. Oral administration of 0.15, 0.20 and 0.25 g/kg of chloroform extract of the *M. sapientum* flowers for 30 days resulted in a significant reduction in blood glucose, glycosylated haemoglobin and an increase in total haemoglobin, but in the case of 0.25 g/kg the effect was highly significant. It also prevents decrease in body weight. There was a significant improvement in glucose tolerance in treated animals and the effect was compared with glibenclamide[37].

***Nelumbo nucifera* Gaertn. (Family: Nymphaeaceae)**

This is aquatic plant known as Kamal in Hindi and Lotus in English. Ethanolic extract of the rhizome of *N. nucifera* suppressed blood glucose levels in normal, glucose-fed hyperglycemic, insulin-treated and diabetic rats. The extract improved glucose tolerance and potentiated the action of exogenously injected insulin, The hypoglycemic potential of the extract was comparable with that of tolbutamide in normal and diabetic rats. It was observed that in normal and diabetic rats, the activity of the extract was 73 and 67% compared with that of tolbutamide, respectively[40].

***Nigella sativa* (Family: Ranunculaceae)**

Nigella sativa seeds, commonly known as Black cumin have been used traditionally for treating diabetes. The aqueous extract of *N. sativa* at 0.1 pg/ml to 100 ng/ml, exerted dose-dependent inhibition of sodium-dependent glucose transport across isolated rat jejunum. Chronic *N. sativa* treatment improved glucose tolerance as efficiently as metformin. It also reduced body weight without any toxic effect[45].

***Ocimum sanctum* (Family: Lamiaceae)**

Common name is tulsi in Hindi and Basil in English. The hypoglycemic effect of the alcoholic extract of leaves of *Ocimum sanctum* was investigated in both normal and alloxan-induced diabetic rats. Alcoholic extract of leaves of *O. sanctum* reduced blood sugar levels 204.48 ± 11.0 to 131.43 ± 7.86 in normal rats and 73.54 ± 3.7 to 61.44 ± 2.3 in diabetic rats significantly ($p<0.001$). In addition, the extract also showed a favorable effect on glucose disposition in glucose fed hyperglycemic rats[77].

***Phyllanthus amarus* Schumach. & Thonn./*Phyllanthus niruri* (Family: Euphorbiaceae)**

Commonly known as Jangli Amla in Hindi. Oral administration of 5 g/day of a preparation of the whole plant for 10 days reduces blood glucose in diabetic as well as nondiabetic subjects[23].

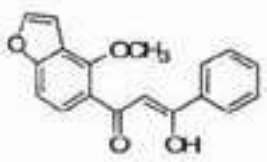
***Picrorrhiza kurroa* Royle ex Benth. (Family:**

Scrophulariaceae)

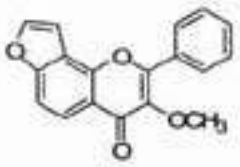
Alcoholic extract of *P. kurroa* at the dose of 75 mg/kg reduced serum glucose by 43 % and at 150 mg/kg reduced by 60%[33].

***Pongamia pinnata* (Family: Fabaceae)**

Commonly known as Karanja in Hindi. The oral administration of ethanolic extract of *Pongamia pinnata* flowers at a dose of 300 mg/kg body weight showed significant antihyperglycemic, and antilipidperoxidative effects and enhancement in antioxidants defense system in alloxan induced diabetic rats. It considerably reduced the blood glucose concentration in a similar extent to that of the reference drug glibenclamide (600 g/kg body weight) in alloxan induced diabetic rats[60]. Antidiabetic potential of the compounds pongamol and karanjin isolated from *Pongamia* have been proved. In streptozotocin-induced diabetic rats, single dose treatment of pongamol and karanjin lowered the blood glucose level by 12.8% (p<0.05) and 11.7% (p<0.05) at 50mg /kg dose and 22.0% (p<0.01) and 20.7% (p<0.01) at 100 mg/kg dose, respectively after 6 h post-oral administration. The compounds also significantly lowered blood glucose level in db/db mice with percent activity of 35.7 (p<0.01) and 30.6 (p<0.01), respectively at 100 mg/kg dose after consecutive treatment for 10 days. The compounds were observed to exert a significant inhibitory effect on enzyme protein tyrosine phosphatase-1B. The results showed that pongamol and karangin isolated from the



pongamol

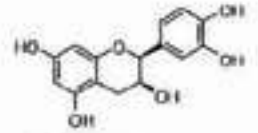


Karanjin

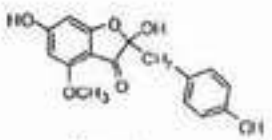
fruits of *P. pinnata* possesses significant antihyperglycemic activity in Streptozotocin-induced diabetic rats and type 2 diabetic db/db mice and protein tyrosine phosphatase-1B may be the possible target for their activity[75].

***Pterocarpus marsupium* Roxb. (Family: Fabaceae)**

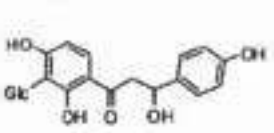
Common name is Vijaysar in Hindi and Indian Malabar in English. Pterostilbene (trans-3,5-dimethoxy-4'-hydroxystilbene), a constituent derived from wood of *Pterocarpus marsupium* caused hypoglycemia in dogs (at the dose of 10 mg/kg IV). Higher dose (20, 30 and 50 mg/kg) caused initial hyperglycemia followed by hypoglycemia lasting for nearly 5h[26]. (-) Epicatechin, Marsupsin, Pterosupin, Pterostilbene, isolated from the bark and heartwood of the plant possess blood sugar lowering activity (Mukherjee *et al*., 2006).



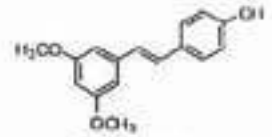
(-) Epicatechin



Marsupsin



Pterosupin



Pterostilbene

***Punica granatum* L. (Family: Punicaceae)**

Commonly known as Pomegranate. 50% ethanolic extract of flower showed blood glucose lowering activity in glucose fed and alloxanized hyperglycemic rats. At the doses of 150, 300, 600 mg/kg showed hypoglycemic activity 12 hour after administration in STZ-diabetic rats[48].

***Ricinus communis* (Family: Euphorbiaceae)**

Commonly known as Eranda or Gandharva hasta in Hindi and Castor in English. 50% ethanolic extract of roots of *R. communis* at the dose of five-hundred milligram per kilogram body weight caused maximum lowering of the fasting blood glucose, both in normal as well as type 1 diabetic animals. It was considered as effective dose. Administration of the effective dose to

the diabetic rats for 20 days showed favorable effects not only on fasting blood glucose, but also on total lipid profile and liver and kidney functions on 10th and 20th day[68].

***Rosmarinus officinalis* (Family: Labiatae)**

Commonly known as Rosemary. Hypoglycaemic effects of oral administration of various doses (50, 100 and 200 mg/kg) of the extract were examined in normoglycaemic and glucose-hyperglycaemic rabbits. Optimal effect was observed in both of the animal groups with a dose of 200 mg/kg of the extract and this activity was independent from the effects of insulin. Acute effect of various doses of the *R. officinalis* extract on blood glucose and serum insulin levels was studied in alloxan-induced diabetic rabbits. Of the three doses of extract, the highest dose (200 mg/kg) significantly lowered blood glucose level and increased serum insulin concentration in alloxan-diabetic rabbits. At the doses of 100 and 200 mg/kg, antihyperglycaemic effect of extract was accompanied by a significant increase in serum insulin levels in diabetic rabbits. Furthermore, during 1 week of treatment of diabetic rabbits with a dose of 200 mg/kg of the extract showed that the extract possessed a capability to inhibit the lipid peroxidation and activate the antioxidant enzymes[7].

***Salacia oblonga* Wall. (Family: Celastaceae)**

S. oblonga root is an Ayurvedic medicine with anti-diabetic and anti-obese properties. Chronic oral administration of the water extract from the root of *S. oblonga* to Zucker diabetic fatty rats, a genetic model of type 2 diabetes and obesity, lowered plasma triglyceride and total cholesterol levels, increased plasma high-density lipoprotein levels and reduced the liver contents of triglyceride, non-esterified fatty acids and the ratio of fatty droplets to total tissue. By contrast, the extract had no effect on plasma triglyceride and total cholesterol levels in fasted Zucker diabetic fatty rats[29].

***Salacia reticulata* Wight. (Family: Celastaceae)**

Commonly known as Kothala himbutu. Aqueous extracts of Kothala himbutu stems decreases fasting blood glucose levels. Results demonstrate that it exerts its effect by gluconeogenic gene regulation in traditional diabetic medicine[30].

***Scoparia dulcis* L. (Family: Scrophulariaceae)**

Commonly known as Sweet Broomweed. The administration of an aqueous extract of . *S. dulcis* at a dose of 200 mg/kg body weight significantly decreased the blood glucose with significant increase in plasma insulin level in streptozotocin diabetic rats at the end of 15 days treatment. *S. dulcis* plant extract protected against streptozotocin- mediated cytotoxicity (88%) and NO production in rat insulinoma cell line (RINm5F). Results suggest its glucose lowering effect to be associated with potentiation of insulin release from pancreatic islets[41].

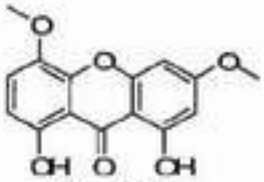
***Sida cordifolia* L. (Family: Malvaceae)**

Commonly known as Bala. It is used in Ayurvedic medicine. *S. cordifolia* extracts of the aerial and root parts showed good analgesic, antiinflammatory and hypoglycaemic activities. The methanol extract of root was found to possess significant hypoglycaemic activity[36].

***Swertia chirayita* (Roxb. ex Fleming) H. Karst. (Family: Gentianaceae)**

Hexane fraction of *S. chirayita* at the dose of 250 mg/kg body weight induced significant fall in blood sugar in albino rats. Daily administration for 28 days resulted in significant lowering of blood sugar and increase in plasma IRI along with a significant rise in liver glycogen. Intestinal absorption of glucose was not inhibited by hexane fraction. It is suggested that hexane fraction of S. chirayita possibly acts through its insulin releasing effect[11]. A xanthone was isolated

from the hexane fraction of the plant, identified as 1,8-dihydroxy-3,5-dimethoxy-xanthone (swerchirin). It has a very significant blood sugar lowering effect in fasted, fed, glucose loaded, and tolbutamide pretreated albino rat models. The ED_{50} for 40% blood sugar lowering in CF male albino rats (body weight 140-165 g) is 23.1 mg/kg/oral[8].



Swerchirin

***Syzigium cumini/ Eugenia jambolana* Lam. (Family: Myrtaceae)**

Administration of the extract for 6 weeks resulted in significant reductions in plasma lipid peroxide, ceruloplasmin and α-tocopherol and a significant elevation in plasma reduced glutathione and vitamin C in alloxan diabetic rats. Insulin restored all the parameters to their normal values. The seed extract was also more effective than glibenclamide in restoring the values of these parameters[58,59]. Oral administration of 2.5 and 5.0 g/kg body weight of the aqueous extract of the seed for 6 weeks resulted in a significant reduction in blood glucose and an increase in total haemoglobin, but in the case of 7.5 g/kg body weight the effect was not significant. It also prevents decrease in body weight. The aqueous extract also resulted in decreased free radical formation in tissues studied. Thus the study shows that Jamun seed extract (JSEt) has hypoglycaemic action. The decrease in thiobarbituric acid reactive substances (TBARS) and increase in reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT) clearly show the antioxidant property of the JSEt. The effect of JSEt was most prominently seen in the case of animals given 5.0 g/kg body weight. JSEt was more effective than glibenclamide.[58,59]

***Terminalia catappa* L. (Family: Combretaceae)**

Commonly known as Badam in Hindi and Indian Almond Tree in English. *Terminalia catappa* fruit extracts have good antidiabetic activity. Petroleum ether, methanol and aqueous extracts of *T. catappa* produced a significant antidiabetic activity at dose levels 1/5 of their lethal doses. Methanol and aqueous extracts of *Terminalia catappa* exhibited significant anti-hyperglycemic activities in alloxaninduced hyperglycemic rats without significant change in body weight[51].

***Terminalia pallida* Brandis (Family: Combretaceae)**

Different doses of ethanolic fraction of fruits of *Terminalia pallida* were evaluated for hypoglycemic and antihyperglycemic activity in normal and alloxan diabetic rats. The oral administration of ethanolic extract at a dosage of 0.5 g/kg body weight exhibited a significant antihyperglycemic activity in alloxan diabetic rats, whereas in normal rats no hypoglycemic activity was observed[61].

***Trigonella foenum graecum* L. (Family: Fabaceae)**

Commonly known as fenugreek. Galactomannan, extracted from *T. foenum* reported to reduce postprandial blood glucose response. Using this fiber, extracted from The segments of jejunum and ileum from genetically determined lean and obese rats were incubated with labeled glucose (2 or 32 mmol/L) in the presence of different concentrations of galactomannan ranging from 0.1% to 0.5% (wt/wt). The uptake of low or high concentration of glucose was significantly and progressively reduced by increasing concentrations of galactomannan in both lean and obese rats. No significant difference was observed in the uptake of glucose between the 2 groups. The viscosity of various concentrations of galactomannan solutions was determined after stirring for 60 minutes at a temperature-controlled (37°C) fixed sheer rate

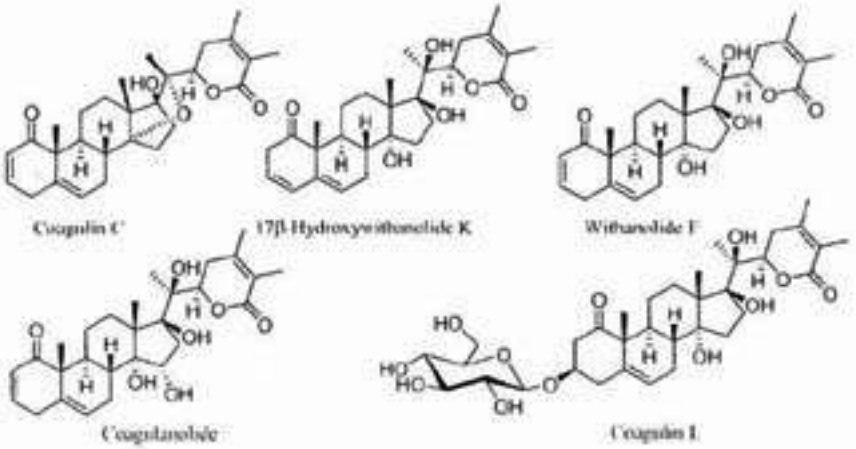
of 1.29 (1/s). The inhibitory effect of galactomannan on glucose uptake was found to be in parallel with the degree of viscosity of the fiber solutions. Because of its viscous property, galactomannan has the potential to reduce intestinal absorption of low or high concentrations of glucose and hence for the benefit of blood glucose management[22].

***Tinospora cordifolia* (Family: Menispermaceae)**

Commonly known as Giloe in Hindi. Treatment with plant extract showed significant anti-hyperglycemic activity in mild to moderate degree of hyperglycemia. In mild diabetes, the maximum percent reduction in glucose levels was 70.37%, seen in groups receiving 400 mg/kg/day of aqueous extract of *T. cordifolia*. In moderate diabetes, 4 months of *T. cordifolia* treatment resulted in a moderate reduction in plasma glucose level of 48.81%. In severe diabetes, it did not show any reduction in plasma glucose level. Since the percentage fall in plasma glucose levels was different in models with varying intensity of hyperglycemia, it implies that the anti-hyperglycemic effect of these plants is dependent upon the dose of diabetogenic agent and therefore on the degree of β-cell destruction[23].

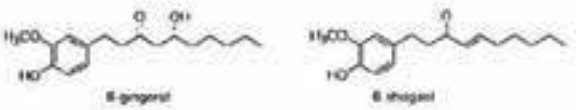
***Withania coagulans* (Family: Solanaceae)**

Commonly known as "Paneer ke phool" in Hindi and Vegetable Rennet in English. At the dose of 1 g/kg of aqueous extract of fruits of *W. coagulans* significantly lowered the blood sugar, serum cholesterol, serum LPO and hepatic LPO levels in streptozotocin induced diabetic rats after 7 days of treatment ($p<0.001$). It also significantly ($p<0.01$) decreased blood glucose level in normal rats (at the dose 1 g/kg; po)[28]. Coagulin C, 17β-hydroxywithanolide K, withanolide F, coagulanolide and coagulin L, isolated from the fruits, showed significant inhibition on postprandial rise in hyperglycemia post sucrose load in normoglycemic rats and in streptozotocin-induced diabetic rats. Coagulin L showed significant fall in peripheral blood glucose profile and also improved the glucose tolerance of db/db mice. It also showed antidyslipidemic activity in db/db mice that is comparable to median effective dose of fenofibrate *i.e.*, 50 mg/kg body weight. The median effective dose of the coagulin L was determined to be around 25 mg/kg in streptozotocin-induced diabetic rats, which is better than the standard drug metformin. Beside this, coagulin L also showed antidyslipidemic activity in db/db mice[44].



***Zingiber officinale* Roscoe (Family: Zingiberaceae)**

Commonly known as Adrak in Hindi and Ginger in English. Treatment with *Z. officinale* produced a significant increase in insulin levels and a decrease in fasting glucose levels in diabetic rats. In an oral glucose tolerance test, treatment with *Z. officinale* was found to decrease significantly the area under the curve of glucose and to increase the area under the curve of insulin in STZ-diabetic rats. Treatment with *Z. officinale* also caused a decrease in serum cholesterol, serum triglyceride and blood pressure in diabetic rats[3]. 6-shogaol (6S) and 6-gingerol (6G), present in *Z. officinale* significantly inhibited the tumor necrosis factor-α (TNF-α) mediated downregulation of the adiponectin expression in 3T3-L1 adipocytes. 6S functions as a PPARγ agonist with its inhibitory mechanism due to the PPARγ transactivation, and 6G is an effective inhibitor of TNF-α induced c-Jun-NH_2-terminal kinase signaling activation and thus, its inhibitory mechanism is due to this inhibitory effect[99].



Conclusion

Treatment of diabetes with synthetic drugs is associated with several complications. The most severe complication associated is condition of hypoglycemia. Plants and natural products are in use to prevent and cure diabetes since past. They show comparatively less or no side effects. As far as cost is concerned, herbal treatment is cheaper than synthetic drugs. A wide and diverse range of plants is reported to prevent and treat diabetes. A lot of work has been done on the antidiabetic potential of various plants by numerous workers. We have worked on *Pongamia pinnata, Pterocarpus marsupium, Withania coagulans, Zingiber officinale* and *Ficus racemosa* and have isolated antidiabetic principals from them. There is endless scope in natural product chemistry for the identification of active leads. Immense work is needed to make new drugs for diabetes of natural origin. Active leads can be derivatized to ameliorate their antidiabetic potential

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PARLIAMENT NEWS

Lok Sabha Unstarred Question No. 1472 Answered on 3rd August 2010

NATIONAL FOOD SECURITY MISSION

Shri Neeraj Shekhar :

Will the Minister of Agriculture be pleased to state :

(a) whether despite the taunching of the National Food Security Mission in the country, the production of foodgrain and oilseed has declined; and

(b) if so, the reasons therefor ?

Answer :
Minister of State in the Ministry of Agriculture and Minister of State in the Ministry of Consumer Affairs, Food and Public Distribution.
Prof. K. V. Thomas.

(a) & (b) The Contrally Sponsored Scheme of National Food Security Mission (NFSM) was launched during Rabi, 2007-08 with an aim of increasing the production by 10 million tonnes or rice, 8 million tonnes of wheat and 2 million tonnes of pulses by the end of Eleventh Five Year Plan (2011-12). The Scheme covers rice, wheat and pulses only. Oilseed is not covered under the NFSM.

The focus and target oriented technological intervention under NSFM has made a significant impact since inception which is reflected by the fact that during the year 2006-07, the food grain production was recorded at 217.28 million tonnes which increased to 234.47 million tonnes during 2008-09 showing an increase of 17.19 million tonnes over the production of 2006-07 i.e. prior to inception of the NFSM scheme. As per the 4th advance estimate of 2009-10, the production of foodgrain is estimated as 218.20 million tonnes. This reduction in food grain production during 2009-10 is due to widespread drought that prevailed in most parts of the country during Kharit, 2009.

As regards Oilseeds, the total production was 242.89 lakh tonnes during 2006-07 and had shown increasing trend i.e. 297.55 lakh tonnes during during 2007-08 which as per 4th Advance Estimate was showing a decilining trend to a level of 249.28 lakh tonnes mainly on account of severe drought in 2009-10.

Lok Sabha Unstarred Question No. 361 Answered on 27th July 2010

PULSE AND OIL SEED VILLAGES

Shri S. S. Ramasubbu

Will the Minister of Agriculture be pleased to state :

(a) whether it is proposed to set up "pulses and oil seed villages" in the country so as to augment the production and to bridge the shortage of the same :

(b) if so, the details thereof;

(c) the number of such villages proposed to be set up, State-wise;

(d) the details of the funds allocated for this purpose; and

(e) the details of the facilities proposed to be provided in such villages ?

Answer :

Minister of State in the Ministry of Agriculture and Minister of State in the Ministry of Consumer Affairs, Food and Public Distribution.

Prof. K. V. Thomas

(a) & (b) : Yes : Madam. In the Budget of 2010-11, an amount of Rs. 300 crores has provided to organize sixty thousand "Pulses and Oilseeds Villages" in rainfed areas during 2011-12. The focus of the scheme is to provide an integrated intervention of water harvesting, watershed management and soil health for enhancing the productivity of the dry and farming areas. The funds would be provided as additional contral assistance under the ongoing scheme "Rashtriya Krishi Vikas Yojana". The program would be implemented in the major pulses and oilseed growing States of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

(c) The number of villages set up are as follows :

	State	No. of Units	No. of villages covered (@ 10 villages per unit)
1.	A. P.	660	6600
2.	Gujarat	540	5400
3.	Karnataka	660	6600
4.	M. P.	1440	14400
5.	Maharashtra	1020	10200
6.	Rajasthan	1140	11400
7.	U. P.	540	5400
	Total	6000	60000

(d) The state wise fund allocations made for implementation of the 60,000 "pulses and oilseed Villages" are as follows :

Sl. No.	State	Allocation (Rs. In Crores)
1.	A. P.	33.00
2.	Gujarat	27.00
3.	Karnataka	33.00
4.	M. P.	72.00
5.	Maharashtra	51.00
6.	Rajasthan	57.00
7.	U. P.	27.00
	Total	300.00

(d) the details of the funds allocated for this purpose; and

(e) the details of the facilities proposed to be provided in such villages ?

Answer :

Minister of State in the Ministry of Agriculture and Minister of State in the Ministry of Consumer Affairs, Food and Public Distribution.

Prof. K. V. Thomas

(a) & (b) : Yes : Madam. In the Budget of 2010-11, an amount of Rs. 300 crores has provided to organize sixty thousand "Pulses and Oilseeds Villages" in rainfed areas during 2011-12. The focus of the scheme is to provide an integrated intervention of water harvesting, watershed management and soil health for enhancing the productivity of the dry and farming areas. The funds would be provided as additional contral assistance under the ongoing scheme "Rashtriya Krishi Vikas Yojana". The program would be implemented in the major pulses and oilseed growing States of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

(c) The number of villages set up are as follows :

	State	No. of Units	No. of villages covered (@ 10 villages per unit)
1.	A. P.	660	6600
2.	Gujarat	540	5400
3.	Karnataka	660	6600
4.	M. P.	1440	14400
5.	Maharashtra	1020	10200
6.	Rajasthan	1140	11400
7.	U. P.	540	5400
	Total	6000	60000

(d) The state wise fund allocations made for implementation of the 60,000 "pulses and oilseed Villages" are as follows :

Sl. No.	State	Allocation (Rs. In Crores)
1.	A. P.	33.00
2.	Gujarat	27.00
3.	Karnataka	33.00
4.	M. P.	72.00
5.	Maharashtra	51.00
6.	Rajasthan	57.00
7.	U. P.	27.00
	Total	300.00

(e) Under the program, it is proposed to supply 6000 tractors of 35 HP capacities each along with the accessories viz. ridge and furrow planter and rotavator in a unit of 10 villages for utilization in custom hiring proposed for the aforesaid assets per unit of asset with a total amount of Rs. 300.00 crores under RKVY. The estimated expenditure for each unit of tractor has been kept at Rs. 4.00 lakhs, for ridge and furrow planter Rs. 30000/- and for rotavator at Rs. 60000/-. Besides this an amount of Rs. 100000/- per tractoris proposed as revolving fund for initial expenditure on wages of the tractor driver and on diesel.

Lok Sabha Unstarred Question No. 403 Answered on 27th July 2010

CRUSHING OF OILSEEDS

Shri S. Sammalai

Will the Minister of Consumer Affairs, Food and Public Distribution be pleased to state : (a) whether huge quantity of oil seeds are lying uncrushed resulting in huge losses to the farmers;

(b) if so, the details thereof and the reasons therefor;

(c) the remedial steps taken by the Government in this regard;

(d) whether any representation has been received from The Solvent Extractors' Association of India in this regard; and

(e) if so, the details thereof and the reaction of the Government thereto ?

Answer :

Minister of State in the Ministry of Agriculture and Minister of State in the Ministry of Consumer Affairs, Food and Public Distribution.

Prof. K. V. Thomas

(a) to (e) Representations from The Solvent Extractors' Association of India received in April and June 2010 indicated higher estimates of uncrushed oilseeds in the Country as under:

Date	Estimated uncrushed oilseeds (in lakh tons)
01.4.2010	185
01.6.2010	125

However, no report has been received on losses to farmers.

These higher stocks were reportedly due to low international demand for oilmeals. However, as per the information received from The Solvent Extractors' Association of India on 22.7.2010, the uncrushed stocks of oilseeds as on 01.7.2010 were only about 16% higher than those on 01.7.2009 Crushing of oilseeds is in progress.

Rapeseed Oil Specifications under PFA

Ministry of Health and Family Welfare
(Department of Health and Family Welfare)
New Delhi

NOTIFICATION

Dated 2nd August 2010

G.S.R. 651 (E) : Whereas a draft notification of certain rules further to amend the Prevention of Food Adulteration Rules, 1955, was published, as required by sub-section (1) of section 23 of the Preventation of Food Adulteration Act, 1954 (37 of 1954), in the notification of Government in India in the Ministry of Health and Family Welfare (Department of Health), number G.S.R. 814(E), dated the 12th November, 2009, inviting objections and suggestions from all persons likely to be affected thereby till the expiry of sixty days from the date on which the copies of the Official Gazette containing the said notification, were made available to the public;

And whereas, the copies of the said notification were made available to the public on 16-11-2009;

And whereas objections or suggestions received from the public within the specified period on the said draft rules have been considered by the Central Government;

Now, therefore, in exercise of the powers conferred by section 23 of the Prevention of Food Adulteration Act, 1954, the Central Government after consultation with the Central Committee for Food Standards, hereby makes the following rules further to amend the Prevention of Food Adulteration Rules, 1955, namely :-

1. (1) These rules may be called the Preventation of Food Adulteration (4th Amendment) Rules, 2010.
   (2) They shall come into force on the date of their final publication in the Official Gazette.
2. In the Prevention of Food Adulteration Rules, 1955, in Appendix-B, for the item A, 17.18 relating to Imported Rapeseed Oil - (Toria-ka-tel) and the entries relating thereto, the following item and entries shall be substituted, namely :-

"A.17.18 - Rapeseed or Mustard Oil - Low Erucic Acid means the oil obtained from clean and sound low erucic acid oil bearing seeds of rapeseed belonging to compostris, juncea, or napus varieties of Brassica by the method of expression or solvent extraction and it shall be clear, free from rancidity, suspended or other foreign matter, separated water, added colouring or flavouring substances or

mineral oil and shall contain not more than 2% erucic acid (as % of total fatty acids) and shall conform to the following standards, namely :-

Butyro-refractometer reading at 40° C .....58.6 - 61.7

OR

Refractive Index at 40° C ..... 1.465 - 1.467

Iodine value (Wij's method) ..... 105 - 126

Saponification value ..... 182 - 193

Acid value ..... Not more than 0.6

Unsaponifiable matter ..... Not more than 20 g/kg.

Bellier test (Turbidity temperature-Acetic acid method) ..... Note more than 19.0° C.

Test for argemone oil shall be negative.
Test for Hydrocyanic acid-(Ferric-Chloride test) ..... Passes the test.

Rapeseed oil obtained by solvent extraction shall be supplied for human consumption only if it is refined and it shall conform to the standard laid down under item A.17.15 except acid value which shall be not more than 0.6. Additionally, it shall have Flash Point (Penske Marten Closed Method) not less than 250° C and the oil so refined shall contain Hexane not more than 5.00 ppm :

Provided that it may contain food additives permitted under these rules".

Sd/-
(Vineet Chowdhury)
Jt. Secy.

F. No. P. 15014/2/2008-PH (Food)

Note : The Preventation of Food Adulteration Rules, 1955 were published in Part II, Section 3 of Gazette of India, vide number S.R.O. 2106, dated the 12th September, 1955 and were last amended vide notification number G.S.R. 488 (E), dated the 9th June, 2010.

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 0 oils ans 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 Technologistists. 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)
Editor

Prof. D. K. Bhattacharyya
M. Sc., (Tech), Ph. D
Emeritus Fellow (AICTE)
Ex-Ghosh Professor of Applied Chemistry

DEPARTMENT OF CHEMICAL TECHNOLOGY
University Colleges of Science & Technology
University of Calcutta
92, Achrya Prafulla Chandra Road
Kolkata - 700 009
Phone : 2350 8366/6395/6387/1857/1014/9937
2352 0051/0052
Gram : SCIENCE Fax : 91-033-351 9755
E-mail : dkb_olltech@yahoo.com

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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