

# Estimation of Properties of Custard Apple Seed Oil and Gasohol

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**Abstract** - Custard apples were obtained from agency areas near to Visakhapatnam and they are deseeded. The seeds are subjected to a sequence of steps to obtain finally an extracted custard apple seed oil using acetone as solvent. The oil thus obtained is subjected to various analyses and its physical and chemical properties are obtained. This oil is also compared with some other widely used domestic oils. An inquiry is also made to compare petrol obtained from different retail outlets in Visakhapatnam. Also gasoline is blended with ethanol in different proportions to produce gasohol and the properties of this gasohol are also obtained.

**Keywords** - *Annona Squamosa, custard apple seed oil, gasohol.*

## I. INTRODUCTION

Now-a-days there is huge demand for energy and the world is looking for many alternative sources. The search for various energy sources became obvious owing to depleting existing reserves which leaves one to explore either totally new sources or reducing the consumption of existing sources. Both these options become viable only when the product fuel can be readily utilized by the consumers. This means the fuel produced in this manner should meet the requirements of consumption. In this regard the present work is taken up.

Custard apples are mainly forest produce and also grown widely in India. Known with several local names such as Sitaphal, Hanuman Phal etc., its scientific name is *Annona Squamosa*. In the present day, where every waste material is utilized for producing energy, the authors examined the suitability of using custard apple seed oil for its potential application for energy production. Custard apple seed oil has plenty of applications in cosmetic industry. It is used for better hair growth that gives strength and provides moisturized hair. It prevents premature graying hair. It is used as base for some of the aromatherapy compounds. It is good for skin rejuvenation. It naturally heals the skin infections. It delays ageing and keeps skin youthful. It is good for pimple-prone skin. The literature survey revealed that there are plenty of works related to the physical properties of custard apple pulp, but the works on the properties of custard apple seed oil are found to be scarce[1-4]. Further, the custard apples obtained from the nearby agency areas were not analyzed for their properties. In this regard, in the present study, custard apples obtained from agency areas near to Visakhapatnam were deseeded and oil from these seeds were extracted and the resulting oil was tested for various important parameters. The chemical properties obtained for the custard apple seed oil are also compared to coconut oil and ground nut oil.

One of the important fuels is gasoline (also known as petrol) which is used in India for running mainly light motor vehicles, two wheelers and autorickshaws. The huge consumption of gasoline has heavy impact on balance of payments on imports of the country. Hence any significant reduction in its consumption gives great relief to the country on payments towards imports. India, being largest producer of sugar, has very high potential to construct integrated molasses fermentation plants for producing ethanol. Ethanol can be blended with gasoline to obtain gasohol which will have comparable properties of gasoline. Therefore, gasohol can be utilized as an alternative fuel to gasoline[5]. In this connection, in the present study, various combinations of gasoline and ethanol were blended and the resulting gasohol is tested for various properties to check its suitability as motor fuel.

## II. MATERIALS AND METHODS

Custard apples were collected randomly from the neighboring agency area. Seeds were removed from the fruits and the seed were cleaned thoroughly with tap water and were subjected to drying at 110°C for a period of one hour. The dried seeds were taken out from the furnace and were allowed to come to room temperature. The dried seeds were then dehulled and are crushed to obtain powder. This seed powder is mixed with acetone solvent with the aid of mechanical stirring for 30 minutes. The mixture is then filtered to separate the cake and the miscella. The miscella is then subjected to distillation to recover the custard apple seed oil from the solvent. The procedure described here has been shown symbolically in a flowsheet in Fig.1.

## III. RESULTS AND DISCUSSION

The custard apple seed oil (CASO) thus obtained has been analyzed for various physical properties using standard methods. Some of the instruments used for analysis are displayed in Fig.2. The results thus obtained are presented in Table I. An examination of the properties of custard apple seed oil reveals that the density of this oil is higher than that of edible oils. The colour of the CASO is brown, whereas the edible oils have the color of yellow. Table II provides some important chemical properties of CASO. It can be seen that the acid value, saponification value and iodine value of this oil suggest that this is not suitable for edible purposes but can be examined as a promising source for biodiesel. In addition to these oils, an inquiry is also made to compare petrol samples from various retail outlets in Visakhapatnam, for their important fuel properties. The properties thus obtained

are compiled and presented in Table III. An examination of the contents of this table reveals that petrol obtained from

HPCL outlet seems to be superior because it has lowest sulphur content.

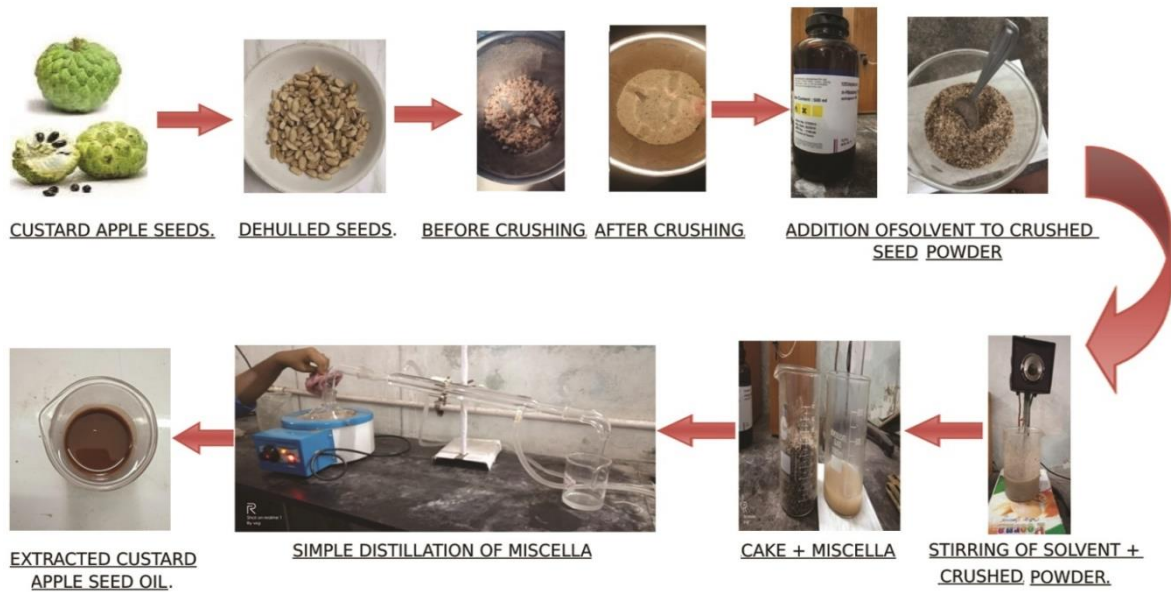


Fig.1. Flowsheet for obtaining custard apple seed oil



Fig.2. Various instruments/items used in this study

TABLE I  
PHYSICAL PROPERTIES OF CUSTARD APPLE SEED OIL

Property	Value	Instrument used
Specific gravity	0.9669	Specific gravity bottle
Density	966.9 kg/m <sup>3</sup>	Hydrometer / Density meter
Odour	Pleasant	Deodorizer
Colour	Brown	Tintometer
Viscosity	36.3 cP	Redwood viscometer
Moisture content	Zero	Hot air oven
Proximate analysis		
Moisture content	1.52 percent	Muffle furnace
Ash content	1.70 percent	Muffle furnace
Volatile matter	1.60 percent	Muffle furnace
Fixed carbon	95.16 percent	Muffle furnace

TABLE II  
CHEMICAL PROPERTIES OF CUSTARD APPLE SEED OIL

Oil	Acid value (mg KOH/g of oil)	Saponification value (mg KOH/g of oil)	Iodine value (mg of hypo/g of oil)
Custard apple seed oil	10.5	55	108
Coconut oil	22.9	258	7.9
Groundnut oil	0.7	207	103
Sunflower oil	10.5	190	140
Rice bran oil	1.5	195	150

TABLE III  
A COMPARISON OF THE PROPERTIES OF PETROL OBTAINED FROM DIFFERENT RETAIL OUTLETS

Property	HPCL sample	BPCL sample	IOCL sample	Reliance sample	Instrument used
Specific gravity	0.745	0.781	0.713	0.706	Sp. gravity bottle
Initial boiling point	40°C	46°C	45°C	42°C	Boiling point apparatus
Final boiling point	208°C	235°C	235°C	230°C	
Flash point	38°C	39°C	47°C	44°C	Abel's apparatus
Fire Point	42°C	43°C	53°C	51°C	
Viscosity, cP	0.8 cP	0.7cP	0.9 cP	0.9 cP	Redwood viscometer
Sulphur content	10ppm	30ppm	30ppm	20ppm	Orsat apparatus

Gasohol with different proportions were prepared and tested for its properties. Preparation of gasohol was made by mixing gasoline (petrol) with ethanol produced in our laboratory by fermentation of synthetic molasses[6]. Fig.3 shows the variation of density with percentage addition of ethanol in gasoline. A close examination of the plot of this graph reveals that the density remained nearly same for change in ethanol composition upto ten percent and after that by increasing ethanol composition the density slightly increased. Fig.4 illustrates the variation of API gravity with ethanol percentage of gasohol. It can be seen from the plot of this graph that the API gravity scale decreased with increase in ethanol concentration in gasoline. The variation in kinematic viscosity with ethanol concentration of gasoline was shown in Fig.5. A close examination of the plot of this figure shows that the kinematic viscosity increased with increase in

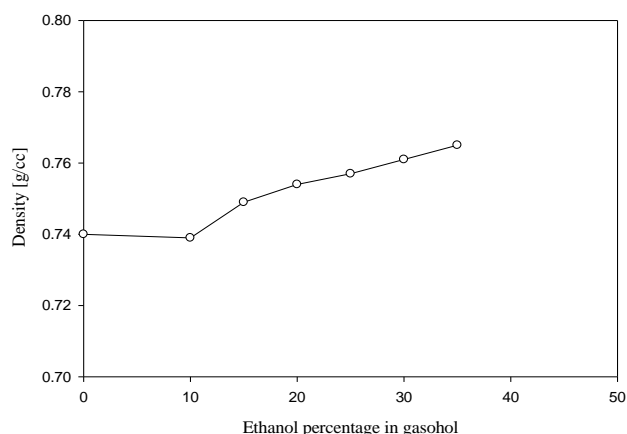


Fig.3. Variation of density of gasohol

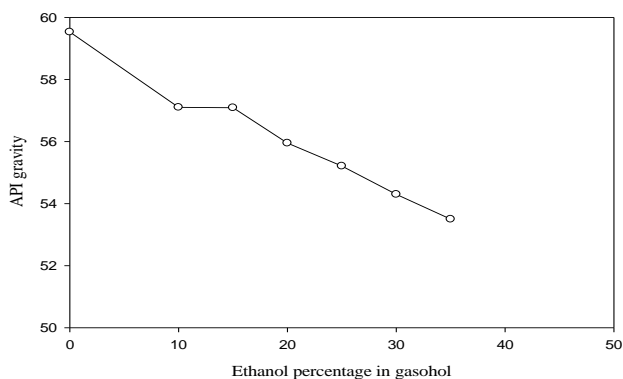


Fig.4. Variation of API gravity of gasohol

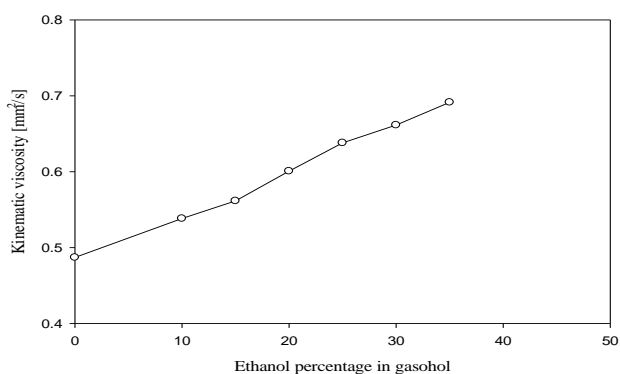


Fig.5. Variation of kinematic viscosity of gasohol

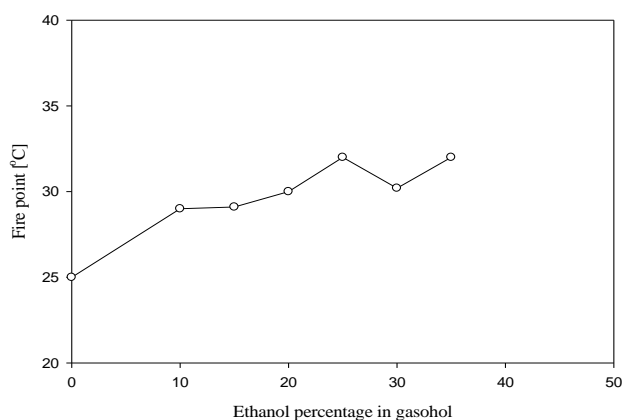


Fig.6. Variation of fire point of gasohol

ethanol percentage of gasoline. The increase in kinematic viscosity is steady. The variation in fire point has been depicted in Fig.6. It can be seen from the plot that the fire point steadily increased with addition of ethanol. This means that engine startup may be difficult at higher ethanol concentrations for those engines which were originally designed for gasoline fuel. Variation of octane number is shown in Fig.7. An inspection of the plot of this figure reveals that the octane number steadily increased with addition of ethanol to gasoline. Data were also obtained for

cloud point. It was found that the cloud point was -23 for gasoline and for all compositions of gasohol the cloud point was above 8 indicating that the presence of ethanol in gasoline has strong effect on cloud point.

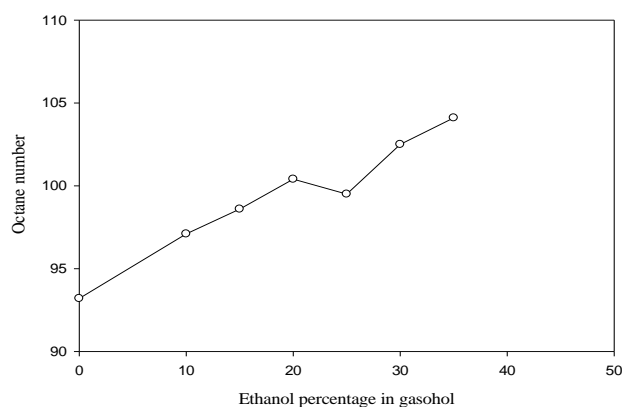


Fig.7. Variation of octane of gasohol

#### IV. CONCLUSIONS

Custard apple seed oil was obtained from dehulled custard apple seeds by a series of steps and finally by extracting with acetone. The oil thus obtained was subjected to various tests to obtain its physical properties and chemical properties. The properties of this oil are also compared with other oils such as coconut oil, groundnut oil, sunflower oil and rice bran oil. Finally a comparison is also obtained for various petrol samples procured from different retail outlets of Visakhapatnam. Further it was reported that the blending of ethanol with gasoline resulted in gasohol. The effects of ethanol composition on various properties of gasohol viz., density, API gravity, kinematic viscosity, fire point, octane number and smoke point were analyzed.

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