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Eco Friendly PVC Plasticizer for Paints & Plastics from Acid Oil of Waste cooking Oils

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Abstract:

Acid oil manufactured from treatment with sulphuric acid and waste cooking oils, collected from houses, hotels , canteens etc. when esterified with monohydric alcohol like 2-ethyl hexanol and 1-octanol in presence of acid catalyst which result in mixture of large amount of monohydric alcohol ester and small amount of triglycerides. The product was subject to epoxidation and performance of deoxidized product was compared with standard plasticizer in PVC sheets, satisfactory results were found. They are eco-friendly in nature.

.Keywords:- **Plasticizers ,Dispersant, Additives, Plasticity, Polymers**

1. Introduction

The Acid oil are produced by acidulation of waste cooking oils . They are available at a very reasonably cheap price also. The color of acid oils is dark & hence it is used for cheap application. They also having varying composition.

Epoxidized esters prepared from acid oils are known for their use as plasticizers for PVC Heat stabilizers and effect of epoxidised oils from waste cooking oils and its metal soaps on thermal degradation of PVC have been reported. Vegetable oil processing units also produce large quantities of by products such as gums, soap stock, acid oil etc. and its metal soaps on thermal degradation of PVC have been reported. Vegetable oil processing units also produce large quantities of by products such as gums, soap stock, acid oil etc. Acid catalyzed esterification of high FFA oils with methanol to iso-propanol followed by alkali catalyzed alcoholysis to obtain monohydric alcohol esters is also reported. and its metal soaps on thermal degradation of PVC have been reported. Vegetable oil processing units also produce large quantities of by products such as gums, soap stock, acid oil etc.

Acid catalyzed esterification of high FFA oils with methanol to iso-propanol followed by alkali catalyzed alcoholysis to obtain monohydric alcohol esters is also reported. With a view to explore newer avenues for utilization of acid oils, monohydric alcohol ester prepared from acid oils have been used for manufacture of new products. This study present utilization & up gradation of by products from waste cooking oils & also from oil refinery and allied products.

2. Materials and Methods :-

I) **Materials** :The waste cooking oils ware collected from houses, hotels , canteens etc. Preparation of Esters : The acid oil and monohydric alcohol were taken 5% excess in three necked flask. The p-tolune sulphuric acid was used as a catalyst, to speed up the reaction. First the reaction mixture is slowly heated under nitrogen bubbling using heating mentle. The formation of water during the course of reaction was allowed to remove (Dean & Stark apparatus). The reaction was continue until the acid value drops below 10.

II) **Epoxidation of Esters :** Esters (100 gm) was taken with glacial acetic acid in three necked flask and mixture was warmed upto 500c-600c. Then sulphuric acid and hydrogen peroxide were added slowly over a period 1.5-2 hours. Samples were tested out at regular interval of 1 hrs. till iodine value drops. Kept the mixture overnight in separating funnel, organic layer was separated from aqueous phase, washed the organic layer with hot water until it free from acid. The product was analyzed for oxygen content as per AOCs method.

III) **Weight per Epoxy equivalent determination :**
Epoxidised ester was weighed and dissolved in 25 ml methyl ethyl ketone (M.E.K.) warm the content. Then add 25 ml of hydrochlorination reagent in cooled flask and content was allowed to age for 20 minutes, and was titrated against 0.1 N alc. NaOH solution. The end point was colourless to blue. A blank titration was conducted under identical condition.
The weight per epoxy equivalent was calculated by formula

(W.P.E.) = 1000 x W [(B-S) X N].
W= Weight sample;
N = Normality of NaOH

Epoxy equivalent per 100 gm = 100/W.P.E.Epoxy Oxygen = 16 x Epoxy content.

3. results and discussion

Table-1 : Analysis of waste cooking oil and Acid oil from waste cooking oil

Sr. No.	Oil	Acid Value	Saponification Value	Iodine Value
1	waste cooking oil	2.6	186.2	131
2	Acid Oil from waste cooking oil	182	191.36	126

Table-2 : Fatty acid Composition of waste cooking oil

Sr. No.	Fatty Acids	Percentage
1	Myristic C 14 : 0	-
2	Palmitic C 16 : 0	11.1
3	Stearic C 18 : 0	3.2
4	Oleic C 18 : 1	28.7
5	Linoleic C 18 : 2	53.4
6	Linolenic C 18 : 3	3.74

Table-3 : Composition of Acid Oil from waste cooking oils

Sr. No.	Fatty Acids	% by Weight
1	Total Fatty Acid (TFA)	80.1
2	Mineral Acids (MA)	1.8
3	Moisture Content (M)	2.3
4	Unsaponitiable matter	7.8

Table-4 : Analysis of Epoxidized Ester

Esters of	Acid Value	Iodine Value	% Epoxy Oxygen
2-ethyl hexanol	51.3	14	6.01
1-octanol	37.7	11.3	4.23

Table-5 : Properties of PVC Sheet prepared from Plasticizers Containing Epoxidized Esters and DOP

Plasticizer Used	Properties of PVC Sheet			
	Elongation (%)	Tensile Strength	Glass Tranition Temp. (T0C)	Shore Hardness (A)
1Octanol Ester + DOP (1 : 2)	216.3	326	89	87
2.ethyl hexanol ester + DOP (1 : 2)	239.6	315	94	90
DOP alone	315	312.3	100	92

4. Discussion :-

During esterification with 2-ethyl hexanol using PTSA catalyst the acid value descrease with short span of 2-2 ½ hours. The esters prepared using 2 ethyl hexanol and 1-Octanol on epoxidation gave products with oxirane oxygen content in between 3 to 6. The Table-1 shows the result of analysis of waste cooking oil collected from houses, hotels & canteen .The results of fatty acid composition of waste cooking oil were shown in Table-2. The results of analysis of Epoxidized esters were shown in Table-4.

The epoxidized esters were used as secondary plasticizers in PVC sheets along with DOP (Dioctal Phthalate) various ratio (1:2) and properties like % elongation, tensible strength, glass transition temperanian (TOc) and shore hardness were determine by standard methods. The result were shown in Table-5.

5. Conclusion :-

The result shows that the epoxidized esters of 2-ethyl hexanol and 1-octanol can be used as secondary plasticizers along with DOP without affecting the properties like glass transition temperature, tensible strength, shore hardness of PVC sheet.They eco friendly in nature.The waste cooking oils collected from houses, hotels & canteen could be utilized for preparation of such novel products

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