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Kaizen Approach to Evaluate Different Oil Sample & Compare with Traditional Chromatographic Approach

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Abstract: *Oil is one of the important formulations in Ayurveda for external as well as internal use. In this study, an evaluation of the commercially available Mahamasa, Mahanarayana, sesamum oil was conducted using two different chromatographic Technique (traditional & modified pre chromatographic TLC).HPTLC is an important designing tool to evaluate the oil sample .But sampling strategy of oil in the context of traditional chromatographic method is very lengthy, costly and less convenient. Here we have modulate the chromatographic method with respect to continuous improvement plan(Kaizen approach) such as need based acceptation of saponification and paradigm shift of direct application of oil on TLC plate. Direct application of oil on plate concept adopted from pre-chromatographic derivatization, which oil sample direct applied on TLC plate and developed with suitable solvent system, and during development only unsap material will we separate on TLC plate and then compare with traditional method outcome. Separation pattern of oil on plate are same both method traditional and modified method. That means separate operation will not require for oil separation like hydrolysis of oil, extraction of unsaponifiable material and sample preparation. However modified method is less time, chemical consuming and more convenient for economically chromatographic evaluation of oil sample.*

Keywords: *Traditional chromatographic, Prechromatographic, Kaizen, Unsaponifiable, HPTLC, Pattern, Oil.*

I. Introduction:

In Ayurvedic formulary various type oil & ghee base formulation are mentioned. Their qualitative evaluation is mentioned official Ayurvedic Pharmacopoeia. This work mainly deals with chromatographic fingerprinting authentication of different oil base formulation both traditional chromatographic & modified prechromatographic method. Pre-chromatographic method is mainly nondestructive method. Oil containing formulation in context of sampling of high –level instrument like HPTLC is more time consuming and also cost specific in traditional chromatographic method.

Standardization context: Pattern of different chromatographic (TC & MPC) of respective various oil formulation is more or less same and slight different. In that narrow range of various oil formulation (Sesamum oil, Mahamasha taila, Mahanarayana taila) ,this study build a database of chromatographic authentification.

According to traditional method for HPTLC for separation of oil sample, many problems are faced like, more time and chemical composition, more time and chemical consumption, expensive and less convenient methods. So a new Kaizen approach has been introduced in demine cycle & also cause –effect relationship.

Kaizen is a concept as well as tool for employee involvement. It is originates from the Japanese words, 'Kai' that means change, whereas, 'zen' means for the better, therefore, it means '**change for the better'.** First, it was been introduced and applied by Imai in 1986 to improve efficiency, productivity and competitiveness in Toyota[1]. Regarding the same as above Kaizen is used from the prospects of oil for modifying and improvement of traditional method of oil sample for HPTLC.

Shifting sample technique in direct plate to control environmental factor (temperature, humidity, heat,) and evaluate the chromatographic pattern in both modulate pre chromatographic method and traditional unsaponifiable sample containing chromatographic method.

This method showed similar chromatographic pattern of respective sample (Mahanarayana, Mahamasa, etc) on both above stated two method. Kaizen philosophy is introduced to develop chromatographic fingerprinting pattern.

Direct develop in chromatographic plate in some conditional operation shows same chromatographic result compares to traditional method.

II. Materials and Methods

Solvents& Instrumental

Methanol, Diethyl ether (C_2H_5-O-C_2H_5), Hexane, Potassium hydroxide (KOH), Acetone are analytical grade (Loba, Chemie, PVT, LTD).Mahamasa, Mahanarayana , Sesamum oil sample from pharmacy of Gujarat Ayurved University , solutions used in TLC analysis were prepared as 4% (v/v).The solvent-system employed for HPTLC was Hexane: diethyl ether(DEE)(7:3).HPTLC analysis Equipment: Linomat v CAMAG TLC sample applicator; Syringe(500µl, Hamilton); Twin- trough TLC chamber for 20X20 cm plates from CAMAG; TLC atomizer; Digital camera, Canon, Power Shot SX 100 IS, 8 MEGAPIXELS, 10X optical zoom was used for capturing images for the sprayed chromatograms. TLC plates- 20×20 cm with 0.25 mm thickness, silica gel 60 $F_{254}$with aluminum support (E. Merck, Darmstadt, Germany).

Traditional method[3]: About 5 g of the oil sample hydrolysis with 40 ml of alcoholic KOH. Then transfer the hydrolyses contents of the flask to a separating funnel with the aid of 100 ml of hot *water* and, while the liquid is still warm, shake very carefully with three quantities, each of 100 ml, of *peroxide-free ether*. Combine the ether extracts in a second separating funnel containing 40 ml of water, swirl gently for a few minutes, and allow separating and rejecting the lower layer. Wash the extract with two quantities each of 40 ml, of *water* and with three quantities, each of 40 ml, of a 3 per cent w/v solution of *potassium hydroxide*, each treatment being followed by a washing with 40 ml of *water*. Finally, wash the ether layer with successive quantities, each of 40 ml, of *water* until the aqueous layer is not alkaline to *phenolphthalein solution*. Transfer the ether layer to a weighed flask, washing out the separating funnel with *peroxide-free ether*. Distill off the ether and add to the residue 6 ml of *acetone*. Remove the solvent completely from the flask with the aid of a gentle current of air. Dry at 100º to 105º for 30 minutes. Cool in desiccators and weigh the residue.

Sample preparation for chromatographic separation:-

Take a above extracted unsap material and prepare sample with hexane then followed by chromatographic method , sample then application of at the one end of the Precoated plate through Linomat v the plate is then developed by the suitable mobile phase (hexane: diethyl ether) in a chromatographic chamber which was previously saturated with the mobile phase . Then after development it is visualized into day light, short UV (254nm) and long UV (366 nm) or by derivatization of the plate with suitable reagent. The Rf value and the colors of resolved bands and fingerprinting profiles are recorded.

Modified method[4]:First of all take a sample and 10 time diluted with hexane (w/v) then application of the sample at the one end of the Recoated plate through Linomat v then on the sample zone again applied alcoholic KOH then leave for 10-15 minute at 60 to 80℃ in oven. The plate is then developed by the suitable mobile phase in a chromatographic chamber. Then after development it is visualized into day light, short UV (254nm) and long UV (366 nm) and/or by derivatization of the plate with suitable reagent. The Rf value and the colors of resolved bands and fingerprinting profiles are recorded.

III. Result and Discussion

Traditional method is being used since times for the evaluation of oil in planer chromatographic methods .There are some problems with different attributes which are encountered while applying traditional method.(Table-1)

Traditional Process Status :- Table no.1 : Tila Taila:-Traditional Method

S.no.	Sample	Operation or steps	Time (Minute)	Chemical		Apparatus
				Name	Volume	
1	Tila taila (5gm)	• Hydrolysis of oil	60	Methanol KOH	40 ml 02 gm	WM,CF,MS, WB,BKR,VF
		• Extraction of unsap	120	DEE	300 ml	SF,MS,BKR,SF holding stand
		• Washing with water	90	Distilled Water	120 ml	MS,SF,BKR
		• Washing with KOH	90	Distilled water KOH	120 ml 4gm	MS,SF,BKR
		• Solidifying	12	-------	--------	WB,ED
		• Make moisture free	10	Acetone	6 ml	WB,ED,MS
		• Sample preparation	10	Haxen	5 ml	ED,MS

(**DDE**- Diethyl ether, **KOH**- Potassium hydroxide **WM**-weighing machine , **CF**-conical flask , **MS**- measuring cylinder ,**WB**-water bath , **BKR**- Beaker , **VF**- volumetric flask , **SF**- separating funnel **ED**- evaporating dish)
Same condition followed by Mahanarayana tail and Mahamasa taila. These results indicate that traditional method will be the cost of process time and performance by the interaction excess consumption of chemicals along with more no of apparatus.
Applying Kaizen approach to show continuous improvement in context of respective attributes which applying modified method (Table-2)

- **Table 2 : Status of Modified Method:-**

S.no.	Sample	Operation or Steps	Time(Minute)	Chemical		Apparatus
				Name	Volume	
1.	Tila Tail (0.5gm)	Dilution	3	Hexane	5 ml	Pipette, Test tube.
		Hydrolysis	15	KOH Methanol	0.35 gm 5.00 ml	Pipette, Test tube ,weighing machine
2.	Mahamasa tail(0.5gm)	Dilution	3	Hexane	5 ml	Pipette, Test tube
		Hydrolysis	15	KOH Methanol	0.35 gm 5.00 ml	Pipette, Test tube, weighing machine
3.	Mahanarayana Tail(0.5gm)	Dilution	3	Hexane	5 ml	Pipette, Test tube
		Hydrolysis	15	KOH Methanol	0.35 gm 5.00 ml	Pipette, Test tube, weighing machine

The presence of Kaizen approach suggests that modified prechromatographic method is stabilized for the less process time and better performance by the less consumption of chemical along with less no of apparatus.

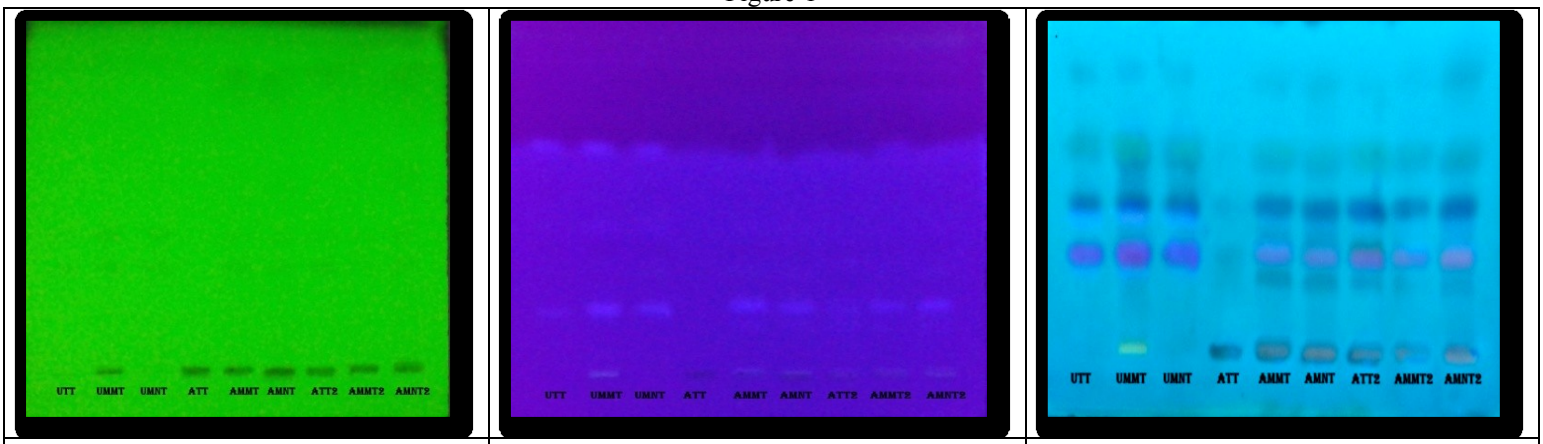
➢ **Table No.3 : Comparison between traditional and Modified method as per HPTLC Data on the basis of Rf**

Solvent system : Hexane :Diethyl ether (7 :3)v/v						
S. NO.	**Method**	**Conditions**	**Sample Name**	**Sample ID**	**NO. of Spot**	**Rf**
1.	Traditional	Short UV - 254 nm	Tila Tail	UTT	4	0.01, 0.25, 0.33, 0.43
		Long UV – 366 nm			2	0.01, 0.33
	Modified	Short UV - 254 nm		ATT	3	0.01, 0.33, 0.43
		Long UV – 366 nm			2	0.01 ,0.30
2.	Traditional	Short UV - 254 nm	Maha Maas Tail	UMMT	3	0.01, 0.33, 0.43
		Long UV – 366 nm			1	0.01
	Modified	Short UV - 254 nm		AMMT	4	0.01, 0.33, 0.43, 0.59
		Long UV – 366 nm			1	0.01
3.	Traditional	Short UV - 254 nm	Maha Narayan Tail	UMNT	4	O.O2, 0.06, 0.33,0.43
		Long UV – 366 nm			1	0.01
	Modified	Short UV - 254 nm		AMNT	6	0.01 ,0.06 ,0.29, 0.33, 0.43, 0.61
		Long UV – 366 nm			1	0.01

(UTT- Unsap of Tila tail , **UMMT**- Unsap of Mahamasa tail , **UMNT**-Unsap of Mahanarayana tail , **ATT**-Amit Tila tail , **AMMT**-Amit Mahamash tail , **AMNT**- Amit Mahanarayana tail)

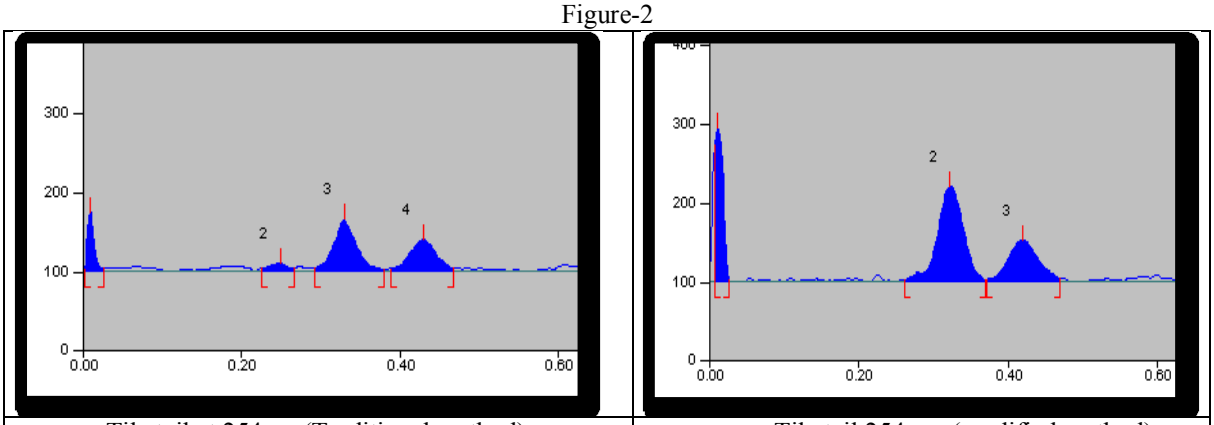
Our experimental results demonstrate that two different method of chromatographic technique show the same pattern of zone at 254 nm. But at 366 nm separation is not seen prominent.

Figure-1



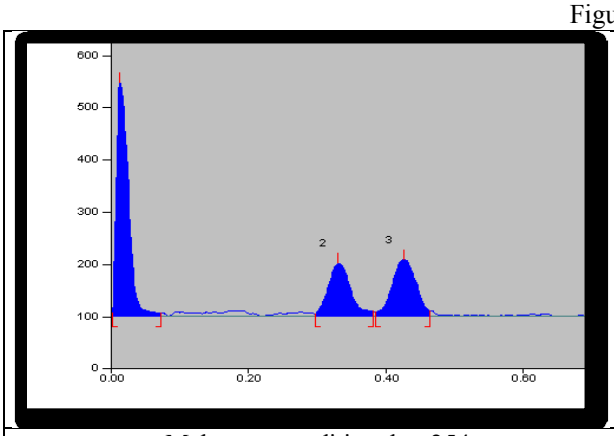
AT 254 nm | AT 366 nm | AFTER VISUALIZING

Figure-2

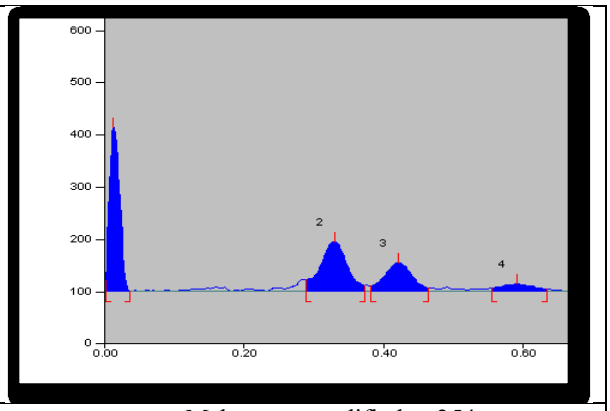


Tila tail at 254nm (Traditional method) | Tila tail 254 nm (modified method)

Figure -3

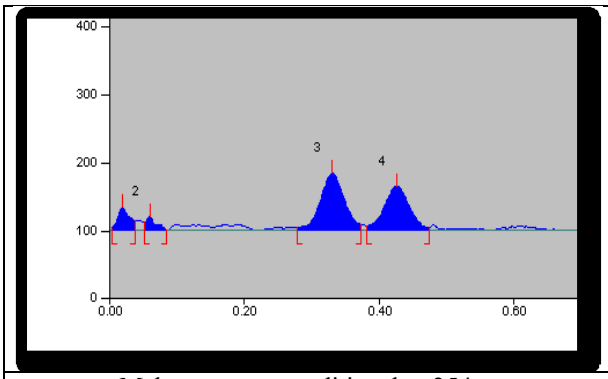


Mahamasa traditional at 254 nm

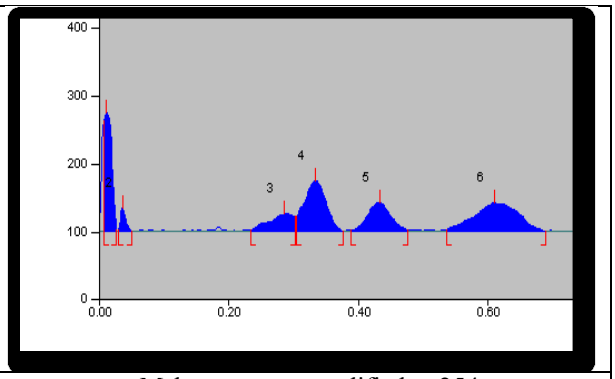


Mahamasa modified at 254 nm

Fig -4



Mahanarayana traditional at 254nm



Mahanarayana modified at 254nm

Above explaining fig(1),fig(2),fig(3) and fig (4) shown respective sample plate,densitogram of respective oil at 254nm.

IV. Conclusion

In context of two method basically unsaponifiable material are evaluated in separation purpose. Kaizen approach using tool of modified prechromatographic method is used in contrary wet method (unsaponifiable matter) in direct TLC plate. In Tradition method hydrolysis of oil, extraction of unsap material, washing, were main problem which made up almost 80 % of defect .In modified method also faced some problem like dilution factor and temperature factor. Dilution is major responsible factor that affects the separation on plate and cause Tailing and Fronting affect these problem controls by using static and process repeatability. Another is Temperature factor, cause problems during comparison of standard and sample on same plate to control micro environmental factor and human error. Above explaining circumstances overcome as a kaizen approach .Result are shown in both more or less similar type of pattern retardation factor & Densitogram.

Kaizen approach well applied and adopted in planar chromatographic system with specific reference to oil samples. And the method has merits to reduce time of analysis, cost factor etc with reliable or comparable Separation profile.

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