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FORMULATION AND EVALUATION OF ANTHRALIN MICROEMULSION GEL USING KARANJ OIL

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ABSTRACT: The present research work was conducted to formulate and evaluate Anthralin microemulsion gel using Karanj oil with an objective of improving solubility of the Anthralin. The pseudo ternary phase diagrams were developed for combinations of Karanj oil as the oil phase, Span-20 as surfactant and as Capryol 90 as cosurfactant using water titration method. Microemulsions obtained were analyzed for topical permeability of anthralin using Franz diffusion cell through an excised rat skin. Higher *in-vitro* permeation was observed from Karanj oil based microemulsion (ME1) having ratio of 1:1. Thus it was selected for further formulation studies. The developed microemulsion was characterized for globule size, polydispersibility index and results were found be 50 nm and 0.341 respectively. Centrifugation studies were carried out to confirm the stability of the developed formulation. The formulation was thickened with a gelling agent carbopol 940, to yield a gel with desirable properties facilitating the topical application. The developed microemulsion gel was characterized for pH, spreadability, refractive index and viscosity. Optimized formulation was then subjected to *in-vitro* drug release screening in comparison to currently available marketed formulation of anthralin. Optimized microemulsion gel (MEG1) formulation was found to exhibit significant anti-psoriatic activity as compared to marketed formulation. Thus the present study indicates that microemulsion gel can be a promising vehicle for the topical delivery of anthralin.

INTRODUCTION: Topical products are important classes of drug delivery systems and their use in therapy is becoming more widespread. Although topical formulations to treat ailments have existed from ancient times, topical products, for which the skin is used as an alternative route for systemic and regional therapy, are relatively new entities [1].

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The purpose of topical dosage forms is to conveniently deliver drugs to a localized area of the skin [2].

Psoriasis is a common, noncontagious, chronic, inflammatory, multisystem and genetic disease of the immune system which affects predominantly skin and joint manifestations affecting approximately 2% of the population [3]. Psoriasis is driven by the immune system, especially involving a type of white blood cell called a T cell. Normally, T cells help protect the body against infection and disease. In the case of psoriasis, T cells are put into action by mistake and become so active that they trigger other immune responses, which lead to

inflammation and to rapid turnover of skin cells. These cells pile up on the surface of the skin, forming itchy patches or plaques[4]. The first outbreak of psoriasis is often triggered by emotional or mental stress or physical skin injury, but heredity is a major factor as well. The lesions vary in appearance with the type of psoriasis. There are various forms of psoriasis [4] i.e. Plaque psoriasis or psoriasis vulgaris, Guttate or Eruptive Psoriasis, Inverse Psoriasis, Seborrheic Psoriasis, Nail Psoriasis, Generalized Erythrodermic Psoriasis, Pustular Psoriasis, Psoriatic arthritis[5].

Microemulsions can be used to deliver drugs via several routes; these versatile systems have been extensively studied as vehicles for topical administration. Their composition and structure enables them to incorporate greater amount of drug than other topical formulations such as ointments, creams, gels and lotions. These systems are comparatively thermodynamically stable systems because they contain surfactant, co-surfactant, and oil [6].

Microemulsion-based colloidal drug delivery systems have gained wide acceptance because of their enhanced drug solubilization, thermodynamic stability, and ease of manufacture [7]. Based on special network structure, the MEGs have received particular attention especially as topical drug delivery system. The absorption of drug has been found to be faster and better when formulated as MEG which improves bioavailability. Delivery of drugs using these microemulsion gels through skin increases the local/systemic delivery of the drug by different mechanisms that make them suitable vehicles for the delivery of anti-psoriatic [8].

Karanj oil, one of the natural oil, is a non-edible semi drying fixed oil obtained from seeds of *Pongamia pinnata* belogs to the family *Fabaceae* [9]. The literature survey revealed that karanj oil is used as an antipsoriasis agent, in rheumatism, in treatment of scabies, herpes, leukoderma and other cutaneous diseases [10]. Thus, karanj oil can be used as an oil phase for formulation of microemulsion-gel to deliver poorly water soluble drugs by topical route which may enhance its absorption and can prolong the drug release.

Anthralin is an anti-psoriatic drug widely used for the treatment of psoriasis and *Alopecia areata*. Anthralin has abilities to induce lipid peroxidation and reduce levels of endothelial adhesion molecules which are markedly elevated in psoriatic patients. It is very effective in arthritis by exerting anti-inflammatory and anti-proliferative effects [11]. High onset and long duration of action makes anthralin a good candidate for treating psoriasis. But its poor water solubility makes it effective in psoriasis for topical drug delivery system. The drug is soluble in chloroform and having a melting point 176-181°C [12]. It is widely available as cream, lotion, shampoos and gel. Topical drug delivery system localizing the drug at skin will be much favorable for the treatment of skin infections [13].

MATERIALS AND METHODS: Anthralin was a gift sample from Agon Pharma Pvt. Ltd., Pune, India. Capmul MCM, Captex 200, Captex 300 and Captex 355 were a gift sample from Abitec Corporation, WI. Carbopol 940, hydroxy propyl methyl cellulose, Methyl cellulose, Span 20, Tween 80 and Xanthan gum were purchased from Loba chemie, Mumbai, India. Transcutol P and Labrasol was a gift sample from Gattefosse India Pvt. Ltd., Mumbai, India and Karanj oil was purchased from Wagh and sons, Nagpur, India. All the other chemicals were of the analytical grade.

Screening of oils, surfactants and cosurfactants for microemulsion formulations [14]: To find out the suitable components which can be used as the oil phase, surfactant and cosurfactant showing good solubilizing capacity of Anthralin and can be used for microemulsion, screening of various oils, surfactants and co surfactants was carried out. The solubility of Anthralin in various oils including Karanj oil, Capmul MCM, Captex 200, Captex 300 and Captex 355 was determined. Solubility of drug was also determined in surfactants such as Tween-80, Span-20, Labrasol and cosurfactants like Capryol-90, Ethanol, Transcutol P.

For determining solubility, an excess amount of Anthralin was added to each component in closed vial and then mixed by Rotary shaker for 72 h. The equilibrated samples were centrifuged for 30 min at 3,000 rpm to remove the amount of Anthralin remaining undissolved.

From the saturated centrifuged drug solution, the supernatant was filtered through a membrane filter; the concentration of Anthralin was determined by UV spectrophotometer at 254 nm. The experiment was carried out in triplicate and the average solubility of Anthralin was determined. The results are shown in **Tables 1-3**.

TABLE 1: SOLUBILITY OF ANTHRALIN IN VARIOUS OILS

Sr. No.	Oils	Solubility (mg/ml)
1	Karanj oil	15.5 ± 0.20
2	Capmul MCM	5.34 ± 0.11
3	Captex 200	5.57 ± 0.15
4	Captex 300	9.23 ± 0.33
5	Captex 355	4.56 ± 0.21

Data was expressed as mean ± S.D. (n=3)

TABLE 2: SOLUBILITY OF ANTHRALIN IN VARIOUS SURFACTANTS

Sr. No.	Surfactants	Solubility (mg/ml)
1	Span 20	37.6 ± 2.0
2	Tween 80	24.1 ± 0.50
3	Labrasol	25.4 ± 0.38

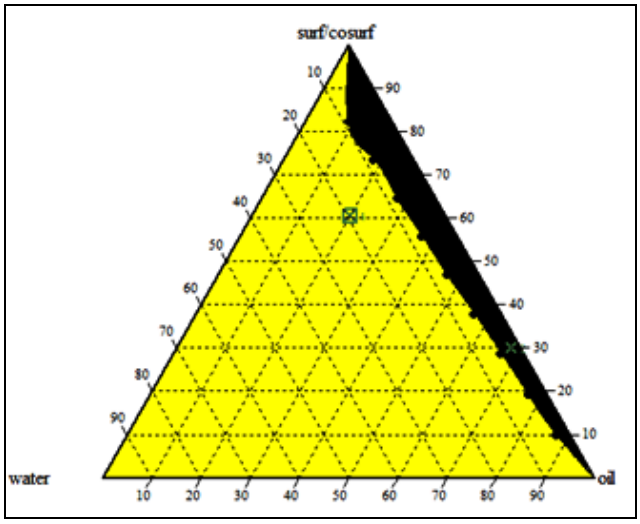
Data was expressed as mean ± S.D. (n=3)

TABLE 3: SOLUBILITY OF ANTHRALIN IN VARIOUS COSURFACTANTS

Sr. No.	Cosurfactants	Solubility (mg/ml)
1	Capryol 90	27.4 ± 0.22
2	Transcutol P	18.5 ± 0.17
3	Ethanol	5.6 ± 0.03

Data was expressed as mean ± S.D. (n=3)

Construction of pseudo-ternary phase diagrams [15]: For construction of pseudoternary phase diagrams two methods can be employed, such as water titration or oil titration. In the present investigation, water titration method was employed to construct a phase diagram. The weight ratio of surfactant to cosurfactant was varied as 1:1, 2:1, 3:1, 4:1. In water titration, mixtures of oil with surfactants and cosurfactants were prepared in the ratios(% w/w) of 1:1, 2:1,3:1, 4:1, 5:1, 6:1, 7:1, 8:1, 9:1 into different vials. A small amount of water, i.e. 10 µl increments was added into the vials. Following each addition, the mixtures in vials were vortexed for 2-3 min and were allowed to equilibrate at 25^0C for 30 min. After equilibration, the mixture was examined visually for phase separation and transparency. The point at which the mixture became turbid or showed signs of phase separation was considered as the end point of titration. The area of microemulsion existence was determined and denoted as microemulsion. The results are represented in **Figure 1**.



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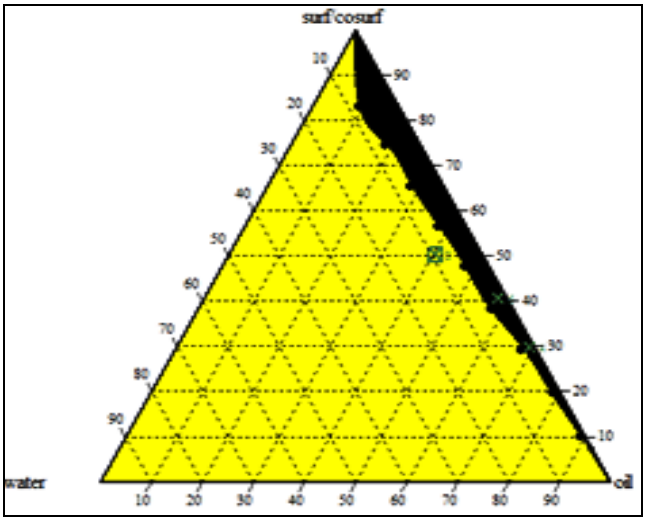

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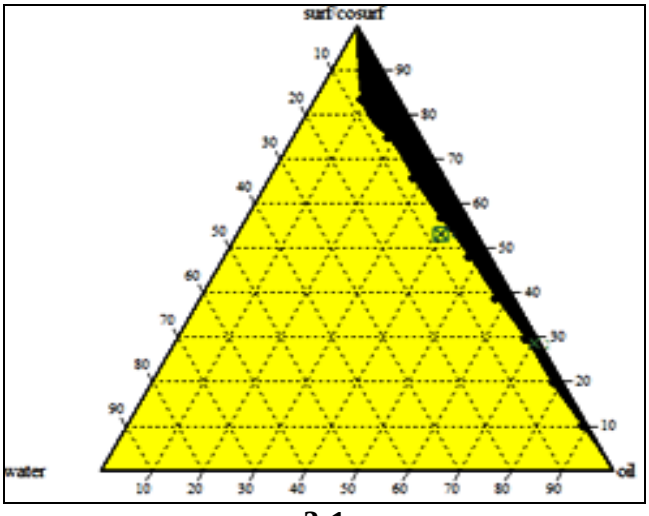

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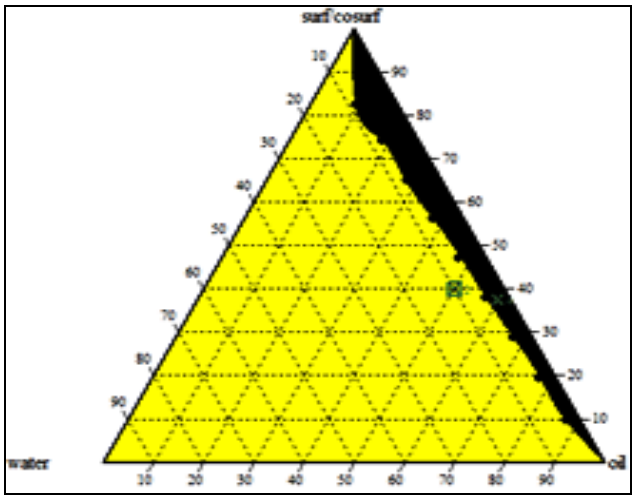

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FIGURE 1: PSEUDOTERNARY PHASE DIAGRAM OF MICROEMULSION COMPOSED OF KARANJ OIL (OIL), SPAN 20 (SURFACTANT), CAPRYOL 90 (COSURFACTANT), WATER

Preparation of microemulsion by water titration method [16]: After the identification of microemulsion regions in the pseudoternary phase diagrams, the microemulsion formulations were selected at different component ratios as described in Table 4. Anthralin (0.1 % w/v) was dissolved into the mixture of oil (Karanj oil) to surfactant (span 20)/cosurfactant (capryol 90) ratio i.e. 1:1, 2:1, 3:1, 4:1 and a transparent homogeneous ME was obtained by water titration method.

TABLE 4: COMPOSITION OF MICROEMULSIONS

Sr. No.	Formulation code	Anthralin % w/v	Karanj oil % w/w	Ratio of span 20 to capryol 90	Span 20 % w/w	Capryol 90 % w/w	Water % w/w
1	ME1	0.1	9	1:1	41.0	41.0	9
2	ME2	0.1	9	2:1	55.34	27.67	8
3	ME3	0.1	9	3:1	62.25	20.75	8
4	ME4	0.1	9	4:1	65.60	16.40	9

Characterisation of microemulsion [17]: The prepared Anthralin microemulsion was inspected for transmittance and visual clarity, centrifugation, pH measurement, refractive index, viscosity, polydispersity index, *in-vitro* drug release studies and particle size.

1. **Transmittance and visual clarity:** The droplets of the microemulsions being smaller than ¼ th the wavelength of visible light, permit white light to pass through the dispersed system making it transparent or translucent. The microemulsion systems were inspected for optical transparency and homogeneity by usual observation against strong light. The system was also checked for the presence of undissolved drug or other solid ingredient. The results are shown in **Table 6**.

2. **Centrifugation:** Physical stability of the microemulsions was studied by centrifugation at 3,000 rpm for 2 hours. After centrifugation the samples were observed for clarity and any phase separation or precipitation. The results are shown in Table 6.

3. **pH measurement:** The pH measurement of the microemulsions were determined by using a pH meter which was calibrated before use with standard buffer solutions at pH 4 and 7. The results are shown in Table 6.

4. **Refractive index:** The refractive index of medicated formulation was determined using an Abbetype refractometer. The results are shown in Table 6.

5. **Viscosity:** The viscosity of the prepared microemulsions was measured using Brookfield viscometer using spindle no. S 64, at 100 rpm. Experiments were carried out in triplicate for each sample, and the results are presented as an average ± standard deviation in Table 6.

6. **Polydispersity index**: Polydispersity index of the optimized microemulsion was determined by photon cross-correlation spectroscopy. The results are depicted in Table 6.

7. ***In- vitro* drug release studies:** The *in-vitro* drug release studies of Anthralin ME were carried out by Franz diffusion cell. Full thickness abdominal skin of a Sprague-Dawley rat (125-150 g) was used. The dermal surface of skin was carefully cleaned to remove subcutaneous tissues and fats without damaging the epidermal surface.

The Franz diffusion cell assembly consisted of donor and receptor compartments. The diffusion cell has a capacity of 20 ml and effective surface area of 3.14 cm^2. The receptor compartment was filled with phosphate buffer [pH=7.4]. The skin was cut to a suitable size and clamped between the two half cells of the cell. The stratum corneum part of the skin was exposed to the donor compartment and the dermal part of the skin was facing the receptor compartment.

The cells were thermostated at 37±1^oC and the receptor solution was stirred with a magnetic stirrer. About 1 ml Anthralin ME was placed on the skin surface in the donor compartment. Aliquots of 1ml were withdrawn at at predetermined time intervals of 1/2 hour, and the experiment was carried out for 4 and 1/2 hrs from the receptor compartment and it was replaced by the 1 ml of fresh receptor medium. . The withdrawn samples were taken into 10 ml volumetric flask; volume was made up to 10 ml and amount of drug diffused across the skin was estimated by analyzing the drug concentration within receptor medium using UV spectrophotometer at 254nm. The results are shown in Figure 2.

8. **Particle size Analysis of formulated microemulsion:** Mean globule size of the optimized microemulsion was determined by photon cross-correlation spectroscopy. Microemulsion was placed in transparent polystyrene cuvette (path length = 1 cm) which was placed in thermostatic sample chamber maintained at 25°C. Sample temperature was set at 25°C and 3 runs of 60s were performed. Detection was carried out at a scattering angle of 90°. From the resulting correlation curves, a 2nd order analysis was performed to calculate the mean globule size and standard deviation. The results are represented in Figure 3.

Preparation of microemulsion gel [18]: The microemulsion was optimized on the basis of the transparency, drug release profile and particle size. The optimized microemulsion was composed of karanj oil (9%), span 20 (41%), capryol 90 (41%) and water (9%). After the formulation and evaluation of microemulsion the task ahead was to bring it into topically applicable form. To convert liquid microemulsion into gel, five gelling agents were used. They were carbopol 940, poloxamer 188, hydroxy propyl methyl cellulose, xanthan gum and methyl cellulose. In case of carbopol 940, the dispersion was neutralized by adding triethanolamine to obtain the gel. The optimized concentration of gelling agents for microemulsion gel is given in **Table 5**.

TABLE 5: COMPOSITION OF MICROEMULSION GEL

Sr. No.	Formulation code of gel	Different gelling agent	Concentration in % w/v
1	MEG 1	Carbopol 940	1
2	MEG 2	Poloxamer 188	25
3	MEG 3	Hydroxy propyl methyl cellulose	3
4	MEG 4	Xanthan gum	1
5	MEG 5	Methyl cellulose	5

Characterisation of microemulsion-gel [19]: The prepared Anthralin microemulsion-gel was inspected for homogeneity, grittiness, viscosity, spreadability, pH, drug content, skin irritancy, *in-vitro* drug release and stability studies.

1. **Homogeneity:** All developed gels were tested for homogeneity by visual inspection after the gels have been set in the container. They were tested for their appearance and presence of any aggregates. The results are shown in **Table 7**.

2. **Grittiness:** All the formulations were evaluated microscopically for the presence of particles. The results are shown in Table 7.

3. **Viscosity:** The measurement of viscosity of the microemulsion gel was done with a Helipath Brookfield viscometer. The gels were rotated at 100 rpm using spindle no. F96. At each speed, the corresponding dial reading was noted. The results are shown in Table 7.

4. **pH measurement:** The pH of each gel was measured, using pH meter, which was calibrated before use with standard buffer solutions at pH 4 and 7. The results are shown in Table 7.

5. **Spreadability:** The spreadability of the gel formulations was determined by measuring the spreading diameter of 1 g of gel between two horizontal plate (20 cm x 20 cm) after one min. The standard weight applied on the upper plate was 125 gm. The results are shown in Table 7.

6. **Drug content:** To ensure uniform distribution of drug in gel formulation, it was sampled from the different locations in the mixer and assayed for the drug content. Drug content of the gel was determined by dissolving an accurately weighed quantity of gel (about 1 gm) in about 100 ml of phosphate buffer pH 7.4. These solutions were quantitatively transferred to volumetric flasks and appropriate dilutions were made with the same buffer solution. The resulting solutions were then filtered from membrane filters (0.45 mm size) before subjecting the solution to spectrophotometric analysis at 254 nm. Drug content was determined from the standard curve of Anthralin. The results are shown in Table 7.

7. ***In-vitro* drug release studies:** The *in-vitro* drug release studies of Anthralin MEG were carried out by Franz diffusion cell. Full thickness abdominal skin of a Sprague-Dawley rat (125-150 g) was used. The dermal surface of skin was carefully cleaned to remove subcutaneous tissues and fats without damaging the epidermal surface.

8. The Franz diffusion cell assembly consisted of donor and receptor compartments. The diffusion cell has a capacity of 20 ml and effective surface area of 3.14 cm^2. The receptor compartment was filled with phosphate buffer [pH=7.4]. The skin was cut to a suitable size and clamped between the two half cells of the cell. The stratum corneum part of the skin was exposed to the donor compartment and the dermal part of the skin was facing the receptor compartment. The cells were thermostated at 37 1^oC and the receptor solution was stirred with a magnetic stirrer. About 1 g Anthralin ME was placed on the skin surface in the donor compartment. Aliquots of 1ml were withdrawn at at predetermined time intervals of 1/2 hour, and the experiment was carried out for 4 and 1/2 hrs from the receptor compartment and it was replaced by the 1 ml of fresh receptor medium. The withdrawn samples were taken into 10 ml volumetric flask; volume was made up to 10 ml and amount of drug diffused across the skin was estimated by analyzing the drug concentration within receptor medium using UV spectrophotometer at 254nm. The results are shown in **Figure 4**.

9. **Stability study:** The stability studies of the Anthralin microemulsion-gel were carried out. All the formulated Anthralin microemulsion-gels were kept in glass containers and undisturbed, in the chamber. The analytical condition was 40 $\pm 2^oC$ temperature and 75±5% RH. Then at specific intervals the samples were withdrawn for pH, viscosity and drug content determination. The results are depicted in **Table 8**.

RESULTS AND DISCUSSION:

Characterization of microemulsion: The formulated microemulsions were characterized for pH, refractive index, centrifugation, transparency/translucency, viscosity, polydispersity index, globule size analysis, *in-vitro* drug release study and stability studies.

1. **Transparency:** All the microemulsions were transparent and appeared like a homogenous single-phase liquid, when observed for visual clarity against strong light. No traces of undissolved drug or other solid ingredient were found in all the formulations. This indicated that the drug was completely soluble in the system.

2. **Centrifugation:** None of the microemulsion systems showed signs of phase separation on centrifugation at 3000 rpm for 2 hours. This result provided a rapid and full proof identification of the system as microemulsion.

3. **pH Measurement:** The pH of microemulsion was found to be in the range of 6.75±0.02 to 6.82±0.01. The range is suitable for skin preparation which is non-irritating.

4. **Refractive index:** The refractive index was in the range of 1.4669±0.001 to 1.4686±0.002. The values of the refractive index of microemulsion showed that the systems were transparent concluding very small particle size of the system.

5. **Viscosity:** The viscosity of the microemulsion was ranged between 150±3.00cp to157±2.00cp. The viscosity values are indicating the w/o nature of microemulsions.

6. **Polydispersity index:** Polydispersity index of the microemulsion was 0.341±0.10 to 0.614±0.11. Polydispersity indicates the uniformity of droplet size within the formulation.

TABLE 6: PHYSICOCHEMICAL CHARACTERISTICS OF MICROEMULSIONS

Sr. No.	Formulations	ME 1	ME 2	ME 3	ME 4
1	pH	6.80 ±0.02	6.81 ±0.02	6.78 ±0.01	6.75 ±0.02
2	Refractive index	1.467±0.01	1.4671±0.002	1.468±0.01	1.4686±0.002
3	Centrifugation	No phase separation	No phase separation	No phase separation	No phase separation
4	% Transmittance	98.6 ± 1.01	95.4 ± 1.03	88.9 ± 1.02	86.7 ± 1.03
5	Viscosity at 100 rpm (cp)	150 ± 3.00	152 ± 1.00	154 ± 1.00	157± 2.00
6	Polydispersity Index	0.341±0.10	0.389±0.14	0.468±0.09	0.614±0.11

Data was expressed as mean ± S.D. (n=3)

***In-vitro* drug release studies:** The results of the *in-vitro* drug release studies of Anthralin from microemulsion formulations indicated that Anthralin showed 97.093% release from microemulsion (ME1) having ratio of 1:1 of span 20/capryol 90 as compared to ME2(86.476%), ME3(86.678%) and ME4(81.207%). The order of drug release was as follows: ME1 > ME3 > ME2 > ME4. The ME1 showed highest drug release. Thus ME1 was optimized formulation of ME for further study (**fig. 2**).

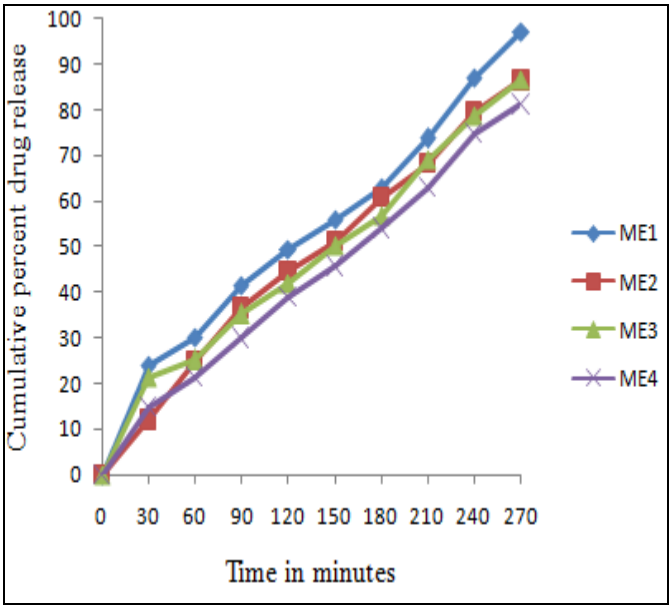

FIGURE 2: CUMULATIVE PERCENTAGE DRUG RELEASE FROM THE MICROEMULSIONS

Particle size Analysis of formulated microemulsion: The particle size of the optimized microemulsion was determined by photon cross-correlation spectroscopy. The particle size of Anthralin microemulsion was found to be 50 nm. The particle size was within the range indicating the microemulsion of very low globule size (**fig. 3**).

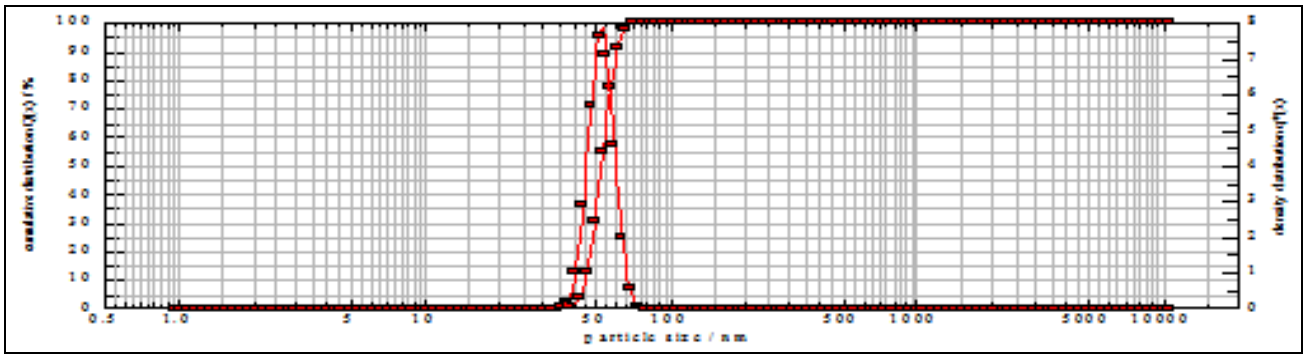

FIGURE 3: PARTICLE SIZE MEASUREMENT OF MEDICATED MICROEMULSION

Characterization of microemulsion gel: The prepared gels were subjected to characterization as homogeneity, grittiness, spreadability, pH, viscosity, drug content, *in-vitro* drug release study and stability studies.

1. **Homogeneity:** The prepared formulations showed a smooth and homogeneous appearance. MEG 1 and MEG 2 showed excellent homogeneity. MEG3 and MEG4 showed good and MEG5 showed satisfactory homogeneity.

2. **Grittiness:** All the formulations were evaluated microscopically for the presence of particles and no appreciable particulate matter was seen under light microscope. Hence, the gel preparation fulfils the requirement of freedom from particular matter and from grittiness as desired for any topical preparation.

3. **Viscosity:** Viscosity is an important physical property of topical formulations, which affects the rate of drug release. An increase in the viscosity vehicles would cause a more rigid structure with a consequent decrease of the rate of drug release. Viscosity of MEG 1, MEG 2, MEG 3, MEG 4 and MEG 5 was found to 6850±10.0 cp, 1750±12.0 cp, 1400±30.0 cp, 1140±45.0 cp, 1110±35.0 cp respectively. Thus, all the microemulsion gels showed an optimum viscosity which confirms adhesive behaviour of gels.

4. **pH Measurement:** The pH of microemulsion gel was found in the range of 4.74±0.11 to 7.05±0.20, which are considered acceptable to avoid the risk of irritation after topical application.

5. **Spreadability:** Spreadability denotes the extent of area to which the readily spreads on application to the skin or the affected part. The efficacy of the formulation or the bio-availability efficiency of the gel also depends on the spreadability value. The higher the value of spreadability of the gel the higher is the absorption area or higher is the bio-available efficiency of the formulation. The spreadability is important for uniform and ease of application of topical preparation from patient compliance point of view. It was found in the range of 1.8±0.04 to 3.5±0.05 cm for different formulations which indicated good spreadability. All preparations were easily spreadable, with acceptable adhesion and fair mechanical properties.

6. **Drug content uniformity:** Drug content uniformity of the formulation is shown in Table 7. The percentage drug content of MEG 1, MEG 2, MEG 3, MEG 4 and MEG 5 was found to be 98.02±0.13 %, 97.31±0.17 %, 95.40±0.16 %, 93.57±0.21 %, 89.78±0.18 % respectively. The microemulsion gels were found to be uniform in drug content.

TABLE 7: PHYSICOCHEMICAL CHARACTERISTICS OF ANTHRALIN MICROEMULSION GELS

Sr. No.	Parameters	MEG 1	MEG 2	MEG 3	MEG 4	MEG 5
1	Homogeneity	+++	+++	++	++	+
2	Grittiness	-	-	-	-	-
3	Viscosity at 100 rpm (cp)	6850±10.0	1750±12.0	1400±30.0	1140±45.0	1110±35.0
4	pH	7.05±0.20	7.36±0.14	5.48±0.07	5.10±0.19	4.74±0.11
5	Spreadability Diameter (cm)	3.5±0.05	3.0±0.01	2.4±0.03	2.1±0.05	1.8±0.04
6	Drug content (%w/w)	98.02±0.13	97.31±0.17	95.40±0.16	93.57±0.21	89.78±0.18

Data was expressed as mean±S.D. (n=3); Excellent +++, Good ++, Satisfactory +, No grittiness -

***In-vitro* drug release studies:** *In-vitro* drug release studies were carried out using Franz diffusion apparatus. The *in-vitro* drug release of microemulsion gels was compared with the marketed preparation (MR) i.e. Drithocreme®. The results are depicted in **Figure 4**.

The *in-vitro* drug release studies performed showed that MEG1, MEG2, MEG3, MEG4, MEG5 and MR released the drug 98.780±0.13%, 95.345±0.11 %, 60.272±0.14 %, 63.848±0.11 %, 65.278±0.12 %, 93.973±0.10 % respectively at the end of 4 hrs. The order of drug release was as follows:

MEG1 > MEG2 > MR >MEG5 > MEG4 >MEG3.

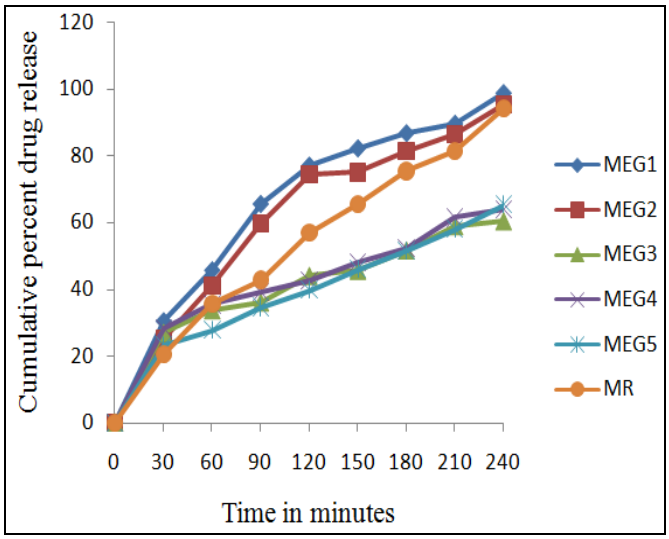

FIGURE 4: CUMULATIVE PERCENTAGE DRUG RELEASE FROM THE MICROEMULSION GELS

The release of Anthralin from microemulsion gel prepared form carbopol 940 (98.78%) was found to be higher than the marketed preparation of Anthralin (87.973%). This may be due to the fact that in the microemulsion system, the solubility of Anthralin might have increased. Further, the gel released the drug in a fast manner as compared to marketed cream.

Stability studies: The result of stability studies shown that there were no significant changes in the pH, drug content and viscosity of the gel, after storing at a temperature of 40ºC ± 2ºC / 75% ± 5% relative humidity for two months. These results indicated that drug remain stable after incorporating in the microemulsion gel system containing carbopol 940 as gelling agent (**table 8**).

TABLE 8: STABILITY STUDIES OF OPTIMIZED MICROEMULSION

Sr. No.	Stability study	pH	Drug content (%w/w)	Viscosity at 100 rpm (cp)
1	0 day	7.05 ± 0.05	99.02 ± 1.65	6850 ± 2.00
2	After 15 days	7.05 ± 0.05	99.02 ± 1.65	6843 ± 3.00
3	After 30 days	7.04 ± 0.04	99.00 ± 1.63	6838 ± 1.00
4	After 45 days	7.03 ± 0.04	98.97 ± 1.60	6831 ± 2.00
5	After 60 days	7.02 ± 0.03	98.96 ± 1.57	6826 ± 5.00

CONCLUSION: The purpose of this study was to construct formulation and evaluation of Anthralin microemulsion gel using Karanj oil for treatment of psoriasis with an objective of improving solubility of the Anthralin. The Anthralin microemulsion gel could be successfully formulated for the treatment of psoriasis. From the results of the present research work it can be concluded that Anthralin microemulsion gel containing carbopol 940 as gelling agent prepared with karanj oil can provide a basis for successful design of topical delivery of Anthralin in psoriasis treatment.

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REFERENCES:

1. Jadhav K, Shetye S, Kadam V: Design and evaluation of microemulsion based drug delivery system, International Journal of Pharmaceutical Sciences 2010;1:156-166.
2. Grampurohit N, Ravikumar P, Mallya R: Microemulsion for topical use-a review. Indian Journal Pharmaceutical Education and Research 2011; 45:100-107.
3. What Is Psoriasis? National Institute of Arthritis and Musculoskeletal and Skin Diseases 2009; 1-3.
4. Bottger WM. Et.al. Journal Pharmacokinetic Biopharma 1997; 23, 24.
5. National Psoriasis Foundation topical treatments for psoriasis, including steroids 2009; 1.
6. Badawi A, Nour S, Sakran W, Samesh S: Preparation and evaluation of microemulsion system containing salicylic acid, American Association of Pharmaceutical Scientist,2009;10:1081-1085.
7. Shinde U, Pokharkar S, Modani S: Design and evaluation of microemulsion gel system of nadifloxacin. Indian Journal of Pharmaceutical sciences 2012; 237-247.
8. Kumar S, Jain S, Prajapati S, Mahor A, Kumar A: Development and characterization of transdermal microemulsion gel for an antiviral drug, International Journal of Pharmaceutical Sciences and Research 2010; 1: 57-74.
9. Kokate C, Purohit A: Gokhale S. Pharmacognosy, 38th edition, Nirali prakashan, Pune 2007; 295-296.
10. Pandey A: Pharmacognostic and phytochemical evaluation of *pongamia pinnata* Linn. Family *Fabaceae.* International Journal of Pharma Research and Development, 2011; 3:11-18.
11. United States Pharmacopoeia–National Formulary, USP30-NF25, vol-III, Port city press; Asian ed., US; 2008; 1421.

12. Tripathi KD: Essentials of medical pharmacology, 6th edition, Jaypee Brothers medical publishers ltd, New Dehli; 2008;850.
13. Pavithran K: Dithranol: Recent views on its mechanism of action. Ind.Jour. of dermatology, venereology and leprology2001; 67:104-105.
14. Magdum C, Naikwade N, Shah R: Preparation and evaluation of fluconazole topical microemulsion. Journal of Pharmacy Research 2009; 2:557-562.
15. Patil S, Shah R: Preparation and evaluation of aceclofenac Topical microemulsion. Iranian Journal of Pharmaceutical Research.2010; 9:5-11.
16. Dhakar R, Maurya1 S, Gupta A, Jain A, Kiroriwal S, Gupta M: Microemulsion as a carrier for nose to brain targeting: a review and update, International Journal of Pharmaceutical Science 2003;2:49-78.
17. Talegaonkar S, Azeem A, Ahmad FA, Khar RK, Pathan SA and Khan ZI.: Microemulsions: A Novel Approach to Enhanced Drug Delivery. Recent Patents on Drug Delivery & Formulation 2008; 2: 238-257.
18. Bansal A, Saleem M: Preparation and evaluation of microemulsion based emulgel formulations of Valdecoxib, Biomedical and Pharmacology Journal 2008; 1:67.
19. Pawar A, Aurangabadkar V, Mahajan S, Derle D: Formulation, development and evaluation of topical microemulsion gels for nimsulide, Journal of Pharmacy Research 2011; 4:1004-1006.

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