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# Use of Karanj Oil (*Pongamia glabra*) In Topical Formulation.

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**ABSTRACT**

Transdermal route of drug administration is an important way of drug application for both local and systemic effects. However in this route the primary barrier is the skin, in particular the stratum corneum is the main barrier for drug penetration. Penetration enhancement technology is a challenging task and that would increase the number of drug administered through transdermal administration. The objective of present study was to assess the effect of Karanj oil *(Pongamia glabra)* as natural permeability enhancer on percutaneous permeation of Diclofenac sodium. In the present study ten different formulations (F1-F10) containing different compositions of karanj oil *(Pongamia glabra)* or other penetration enhancer were studied for their permeation by using diffusion cell apparatus. The study showed the significant improvement in permeability of drug in formulations containing Karanj oil *(Pongamia glabra)* along with other formulation additives. The formulation F3 has shown maximum permeability and formulation F8 has shown minimum permeability.

**Keywords:** Stratum corneum, Penetration enhancement, Karanj oil *(Pongamiaglabra)*, natural permeability enhancer.

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## INTRODUCTION

The transdermal route of administration offers an alternative pathway for systemic drug delivery with numerous advantages over conventional routes. Regrettably, the stratum corneum forms a formidable barrier that hinders the percutaneous penetration of most drugs, offering an important protection mechanism to the organism against entrance of possible dangerous exogenous molecules [1]. Different types of penetration enhancers have shown the potential to reversibly overcome this barrier to provide effective delivery of drugs across the skin. Although certain chemical and physical skin penetration enhancers are already employed by the pharmaceutical industry in commercially available transdermal products, some skin penetration enhancers are associated with irritating and toxic effects[2]. This emphasizes the need for the discovery of new, safe and effective skin penetration enhancers. Penetration enhancers from natural origin have become popular as they offer several benefits over their synthetic counterparts such as sustainable mass production from a renewable resource and lower cost depending on the type of extraction used [3].

Indian system of traditional medicine "Ayurveda and Siddha" use *karanj* to treat various kinds of diseases including diabetes mellitus. The effectiveness of Karanj as a source of biomedicines has been reported [4]. Karanj seed oil contains karanjin, a bioactive molecule with important biological attributes. Six compounds (two sterols, three sterol derivatives and one disaccharide) together with eight fatty acids (three saturated and five unsaturated) have been isolated from the seeds of karanja. The metabolites, beta-sitosteryl acetate and galactoside, stigma sterol, its galactoside and sucrose are being reported for the first time from this plant[5]. The saturated and unsaturated fatty acids (two monoenoic, one dienoic and two trienoic) were present in exactly the same amount. Oleic acid occurred in highest amount (44.24%), stearic (29.64%) and palmitic (18.58%) acids were the next in quantity. Hiragonic and octadecatrienoic acids were present in trace amounts (0.88%). Karangin, pongamol, pongagalabrone and pongapin, pinnatin and kanjone have been isolated [6].

**Pharmacological activities of Karanj (*Pongamiaglabra*)** [7].

Antihyperglycemic and antilipidperoxidative effects, Antifungal and antibacterial activity, Antiinflammatory activity, Nootropic activity, Antinociceptive activity, Protective effect against nephrotoxicity, Antihyperammonemic effect, Antiviral activity, Antifilarial potential.

**Traditional use of Karanj oil *(Pongamia glabra)*:**

The karanj-oil contains medicinal properties and used in itches, abscess and other skin diseases. Karanj seed is used as a medicinal plant, particularly with the Ayurvedic and Sidda medicine systems of India. seed extract can completely inhibit the growth of herpes simplex virus type 1 and type 2 in Vero cells and also possesses hypoglycemic, anti-oxidative, anti-ulcerogenic, anti-inflammatory and analgesic properties [8].

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According to Ayurveda, Karanj is anthelmintic, alexipharmic and useful in diseases of eye, vagina, skin. It is good for tumour, wounds, ulcers, itching, ascites, enlargement of spleen and abdomen, urinary discharges. It also cures biliousness, piles, head pains, leucoderma, skin diseases and wounds. According to Unani system of medicine,seeds are acrid and carminative, purify and enrich blood, relieves inflammations, cure earache, chest complaints, lumbago, chronic fever and hydrocele. Oil is styptic and anthelmintic. It is good in scabies, leprosy, piles, lumbago, chronic fever, liver pain etc [9].

## MATERIALS AND METHODS

Diclofenac sodium was purchased from Research lab Fine Chemical Industry, Karanj oil *(Pongamiaglabra)* was obtained from Sharangdhar Pharmaceutical Pvt. Ltd. Triethanolamine used of Hexon Laboratories Pvt. Ltd. Ethanol was purchased from Changshu Yangyuan Chemical, China. Carbapol 940 LR, Urea, Oleic acid, glycerol used of company Loba Chemie.
10 formulations were selected as per requirement of study for topical delivery. They are prepared as per the formula mentioned in table: 1.

Weighed quantity of diclofenac sodium in required amount of oil and triturated well and dissolved then added respective ingredient as per formulation. Carbapol 940 LR is added to make 10gm gel. A small quantity of triethanolamine is added to make gel consistency. The final formulation was packed in the wide-mouth jar, labelled and evaluated.

**Table 1: Preparation of various formulations of Diclofenac Sodium containing various combinations of drug with Karanj oil**

| Ingredients | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Drug (%w/w) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Karanj oil *(Pongamiaglabra)* (%w/v) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 5 |
| Ethanol (%w/v) | 5 | - | 10 | - | - | - | - | - | - | - |
| Glycerol (%w/v) | - | 5 | - | 10 | - | - | - | - | - | - |
| Oleic acid (%w/v) | - | - | - | - | 2.5 | 5 | - | - | - | - |
| Urea solution (%w/v) | - | - | - | - | - | - | 5 | 10 | - | - |
| Carbapol 940 LR (w/w) | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm | QS to 10gm |

## EVALUATION OF GEL FORMULATION

- **Organoleptic properties:** Prepared formulations were evaluated for their appearance, color, odor and spreadability.
- **Physical properties:** Prepared formulations were evaluated for the pH and viscosity.
- **In vitro Diffusion:** In vitro diffusion studies of the formulations were carried out by using Franz diffusion cell apparatus. The temperature maintained $37^0 \pm 0.5^oC$ and the speed

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was 100 rpm. The samples were withdrawn at various time intervals and analyzed spectrophotometrically at λ max 276 wavelength.

- **Best fit model:** All formulations were evaluated by using best fit model like Zero order, 1st order etc.

**Table no 2: Observation**

| Time in hours | % Drug diffused | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 |
| 30 | 1.49 | 0.98 | 0.63 | 13.58 | 3.82 | 0.97 | 0.26 | 0 | 1.05 | 0 |
| 1 | 2.98 | 9.38 | 1.90 | 17.36 | 7.49 | 4.49 | 1.21 | 0 | 5.29 | 2.59 |
| 2 | 7.4 | 18.27 | 10.79 | 19.56 | 11.11 | 7.31 | 20.02 | 0.13 | 7.41 | 5.19 |
| 3 | 9.96 | 25.67 | 23.49 | 21.91 | 14.98 | 10.32 | 3.50 | 1.18 | 9.53 | 9.09 |
| 4 | 13.45 | 33.08 | 31.14 | 24.57 | 18.91 | 13.84 | 4.99 | 2.63 | 11.65 | 12.99 |
| 5 | 16.94 | 37.53 | 41.90 | 26.92 | 21.80 | 17.31 | 5.80 | 3.56 | 12.71 | 15.59 |
| 6 | 20.42 | 40.49 | 47.61 | 28.60 | 24.49 | 19.21 | 6.61 | 4.08 | 13.77 | 18.19 |
| 7 | 22.41 | 43.45 | 50.15 | 29.32 | 26.92 | 20.64 | 7.15 | 4.61 | 14.83 | 19.49 |
| 8 | 23.41 | 44.44 | 51.42 | 30.29 | 27.33 | 21.52 | 7.42 | 4.87 | 15.89 | 20.79 |

**Table no 4: Best fit model**

| | | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero order | R | 0.9978 | 0.9804 | 0.9879 | 0.7622 | 0.9812 | 0.9928 | 0.9955 | 0.9680 | 0.9584 | 0.9955 |
| | k | 1.8032 | 3.7108 | 3.9481 | 28.2263 | 22.391 | 17.0578 | 2.0566 | 1.2663 | 17.8305 | 16.4278 |
| | T-test | 42.998 | 14.060 | 18.013 | 3.330 | 14.393 | 23.426 | 29.690 | 10.903 | 9.498 | 29.641 |
| 1st order | R | 0.9982 | 0.9885 | 0.9881 | - | - | - | 0.9965 | 0.9670 | - | - |
| | k | -0.019 | -0.042 | -0.0455 | - | - | - | -0.0220 | -0.0132 | - | - |
| | T-test | 47.684 | 18.456 | 18.138 | - | - | - | 33.621 | 10.737 | - | - |
| Matrix | R | 0.9372 | 0.9608 | 0.9101 | 0.9853 | 0.9748 | 0.9505 | 0.9359 | 0.8512 | 0.9826 | 0.9326 |
| | k | 4.1783 | 8.7255 | 9.0631 | 69.1357 | 52.8742 | 39.8034 | 4.7657 | 2.8372 | 42.4464 | 38.0074 |
| | T-test | 7.599 | 9.798 | 6.213 | 16.328 | 12.352 | 8.651 | 7.517 | 4.587 | 14.966 | 7.307 |
| Peppas | R | 0.9985 | 0.9511 | 0.9879 | 0.9932 | 0.9980 | 0.9795 | 0.9888 | 0.9676 | 0.9633 | 0.9767 |
| | k | 1.7175 | 2.7299 | 1.4072 | 85.3182 | 34.2410 | 15.3272 | 1.5810 | 0.1777 | 25.1759 | 9.7748 |
| | T-test | 52.364 | 8.710 | 18.270 | 24.157 | 44.692 | 13.758 | 18.768 | 10.838 | 10.149 | 12.871 |
| Hixson Crowell | R | 0.9982 | 0.9860 | 0.9882 | 0.8181 | 0.9633 | 0.9208 | 0.9962 | 0.9673 | 0.9451 | 0.9104 |
| | k | -0.006 | -0.013 | -0.0145 | -0.3154 | -0.2558 | -0.1851 | -0.0072 | -0.004 | -0.1910 | -0.1775 |
| | T-test | 46.787 | 16.752 | 18.270 | 4.023 | 10.157 | 6.679 | 32.460 | 10.795 | 8.179 | 6.223 |
| Best fit model | | peppas | 1st order | Hix.Crow. | peppas | Peppas | Zero order | Hix.Crow. | Zero order | Matrix | Peppas |

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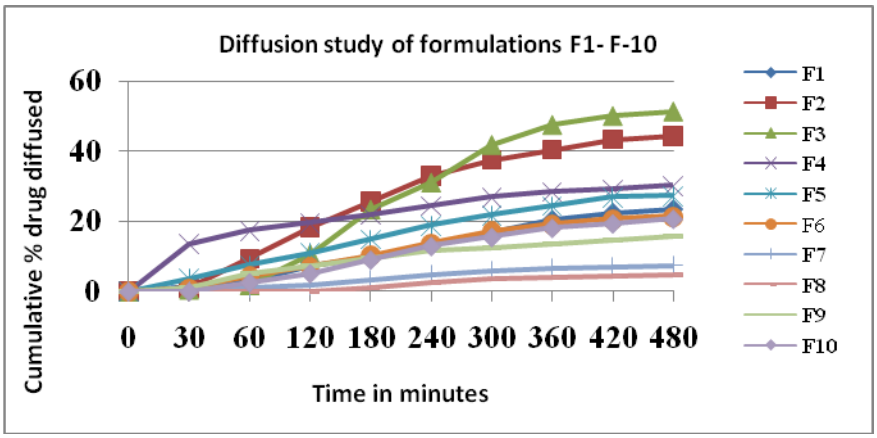
**Table no 3: Comparative graph of formulation no. F1 to F10.**




## SUMMARY AND CONCLUSION

In the present study various formulations F1 to F10 were prepared by using Karanj oil *(Pongamiaglabra)* as one of the component (vehicle) to evaluate its effect on in enhancement and drug permeability. The diffusion studies of F1 to F10 shows the drug diffusion percentage value as follows

F3 >F2> F4 > F5 > F1 > F4 > F6 > F10 > F9>F7>F8.

From this observation, it was clear that formulation equal to showed better permeation than remaining all formulation.

It can be also concluded that, when no Karanj oil *(Pongamiaglabra)* is used (control) the percent drug diffused was F9= 15.89 % as compare to optimized formulation F10 = 20.79% it only contains Karanj oil and no other ingredients. This shows that use of Karanj oil *(Pongamiaglabra)* in semi solid formulation have positive effect on drug permeability may be due to its smoothing effect and an increasing fluidization of skin corneum layer. Formulation number F3 shows diffusion of Hixson Crowell.

Maximum drug diffused from the formulation no F3 (51.42%) contains ethanol. It was also observed that formulation F2 (44.44% ) had shown better permeation. It contain glycerol. This shows additive enhancement effect of glycerol with Karanj oil *(Pongamiaglabra)* in topical drug delivery system.

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