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FORMULATION AND EVALUATION OF TAZAROTENE TRANSDERMAL PATCHES BY USING DIFFERENT POLYMERS

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ABSTRACT

The aim of the study is to develop and evaluate a transdermal patch of tazarotene for the treatment of psoriasis. Tazarotene is a topical retinoid used in the management of psoriasis by regulating keratinocyte differentiation and reducing inflammation. The transdermal patch of tazarotene was prepared by the solvent casting method using HPMC, ethyl cellulose, poly vinyl pyrrolidine (PVP), and glycerine, dissolving the drug in a minimal amount of water and ethanol. The prepared transdermal patch was designed to provide controlled drug release over a period of 12 hours. The patches were evaluated for physical appearance, surface morphology, thickness, weight variation, drug content uniformity, pH, and in vitro drug release studies. Among the different polymeric combinations, the formulation containing HPMC, glycerine, PVP showed maximum drug release of 92% compared to other formulations. Thus, the developed tazarotene transdermal patch may be a promising system for the effective management of psoriasis.

KEYWORDS: Tazarotene, Psoriasis, Transdermal patch, HPMC, Poly vinyl pyrrolidine (PVP), Ethanol, Glycerine, Ethyl cellulose, Controlled drug release.

NOVEL DRUG DELIVERY SYSTEM (NDDS)

A Novel Drug Delivery System (NDDS) is a system or approach for delivering drugs in a controlled, targeted, or sustained manner to achieve improved therapeutic outcomes, reduce side effects, and enhance patient compliance. NDDS technologies aim to optimize the

pharmacokinetic and pharmacodynamic profiles of drugs by improving bioavailability, site-specific targeting, and drug stability.[1,2]

TRANSDERMAL DRUG DELIVERY SYSTEM (TDDS)

Transdermal drug delivery systems (TDDS), also known as "patches," are dosage forms designed to deliver a therapeutically effective amount of drug across a patient's skin. In order to deliver therapeutic agents through the human skin for systemic effects, the comprehensive morphological, biophysical and physicochemical properties of the skin are to be considered. Transdermal delivery provides a leading edge over injectables and oral routes by increasing patient compliance and avoiding first pass metabolism respectively.[3,4,5,6]

PSORIASIS

Psoriasis is a chronic, autoimmune, non-infectious inflammatory skin disease characterized by the presence of erythematous (red), scaly, and well-demarcated plaques on the skin. It affects both men and women and can begin at any age, though it typically has two peaks: one between 15–35 years (early-onset) and another in later adulthood (after 50 years).[7,8,9,10,11] This disease results from abnormal hyperproliferation and differentiation of keratinocytes, coupled with immune system dysfunction, primarily involving T-helper (Th1 and Th17) cells and cytokines such as TNF-α, IL-17, and IL-23. These immune cells mistakenly attack healthy skin cells, leading to rapid cell turnover, inflammation, and scale formation.[12,13,14,15,16,17,18]

MATERIALS

HPMC (Hydroxy Propyl Methyl Cellulose) used as a polymer. **Polyvinyl pyrrolidine** used as a polymer. **ETHYL CELLULOSE** used as a Polymer. **ETHANOL** used as a solvent.

GLYCEROL used as a Lubricant. **WATER** (q.s.) used as a component in the formulation.

FORMULATION TABLE

INGREDIENTS	FORMULATION BATCHES					
	F1	F2	F3	F4	F5	F6
Tazarotene (mg)	37	37	37	37	37	37
HPMC (mg)	300	300	300	300	300	300
EC (mg)	100	150	200	-	-	-
PVP (ml)	-	-	-	100	150	200
Ethanol (ml)	5	5	5	5	5	5
Glycerol (ml)	0.4	0.4	0.4	0.4	0.4	0.4

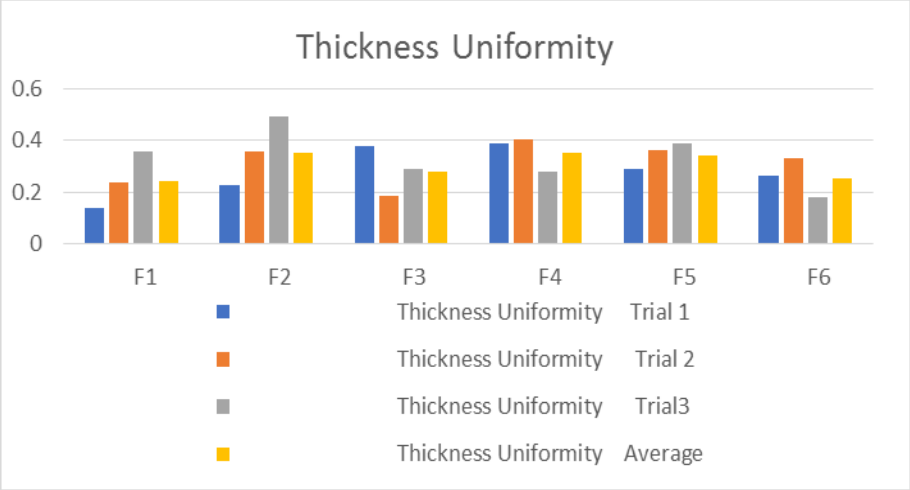
PREPARATION OF TRANSDERMAL PATCHES BY SOLVENT CASTING METHOD

Transdermal patch was prepared by a solvent casting method. Precisely weigh the amount of HPMC and soak in solvent 24hrs before the preparation in a prescribed amount of solvent in a beaker. After soaking the HPMC by using the glass rod gently mix the HPMC solution to form thick viscous solution with less air entrapment. In case of any air bubbles are entrapped in the solution by using sonicator remove the air bubbles. Weigh the approximate amount of the drug and transfer it into the mortar and made fine powder and transfer the powdered drug into HPMC solution and make clear viscous solution. Transfer the solvent in a Petri dish which is pre applied with a lubricant. Place the Petridis in a room temperature for 24 hrs to remove the moisture content and to form thin film. After forming a thin film, it off from the Petri dish with the help of the ointment spatula and store for the further evaluation tests.

EVALUATION OF TRANSDERMAL PATCHES

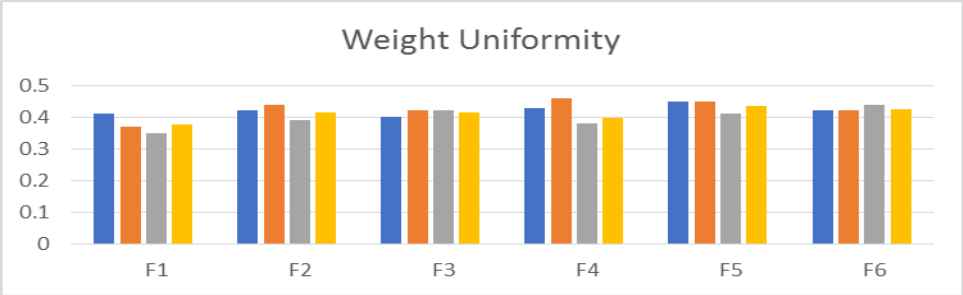
Thickness Uniformity

SI. No.	Formulation code	Thickness Uniformity			
		Trial 1	Trial 2	Trial3	Average
1	F1	0.138	0.239	0.354	0.24
2	F2	0.225	0.358	0.490	0.35
3	F3	0.375	0.186	0.290	0.28
4	F4	0.385	0.401	0.280	0.35
5	F5	0.290	0.360	0.390	0.34
6	F6	0.265	0.329	0.180	0.25



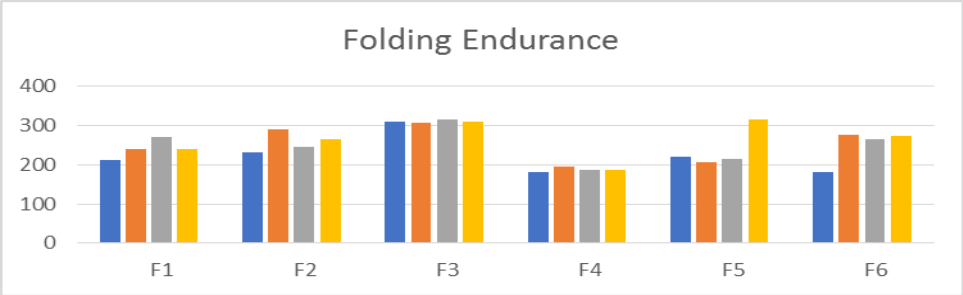
Weight Uniformity

SI. No.	Formulation code	Average Weight (gm)			
		Trial 1	Trial 2	Trial3	Average
1	F1	0.41	0.37	0.35	0.376
2	F2	0.42	0.44	0.39	0.416
3	F3	0.40	0.42	0.42	0.413
4	F4	0.43	0.46	0.38	0.396
5	F5	0.45	0.45	0.41	0.436
6	F6	0.42	0.42	0.44	0.426



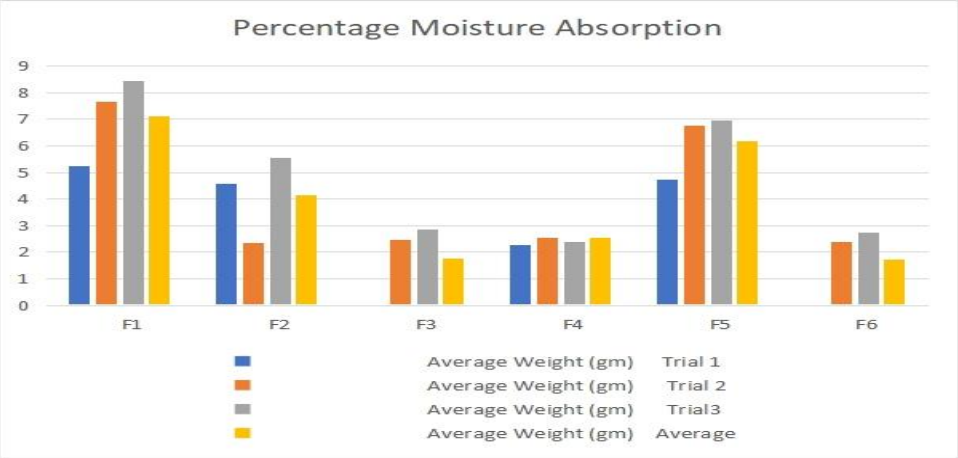
Folding Endurance

SI. No.	Formulation code	Folding endurance			
		Trial 1	Trial 2	Trial3	Average
1	F1	212	240	270	240.6
2	F2	230	290	245	263.3
3	F3	310	305	315	310
4	F4	180	195	185	186.6
5	F5	220	205	215	313.3
6	F6	180	275	265	273.3



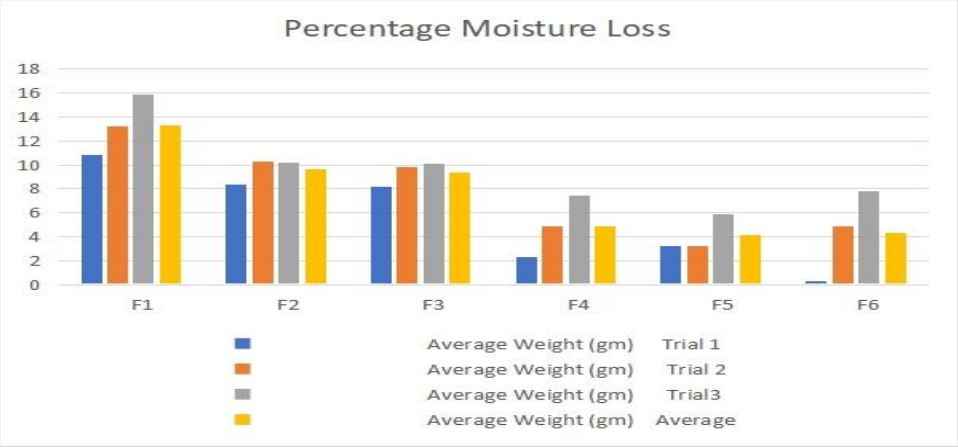
Percentage Moisture Absorption

SI. No.	Formulation code	Percentage moisture absorption			
		Trial 1	Trial 2	Trial3	Average
1	F1	5.24	7.65	8.46	7.116
2	F2	4.56	2.35	5.54	4.15
3	F3	0	2.45	2.86	1.77
4	F4	2.27	2.54	2.38	2.556
5	F5	4.75	6.78	6.95	6.16
6	F6	0	2.40	2.75	1.71



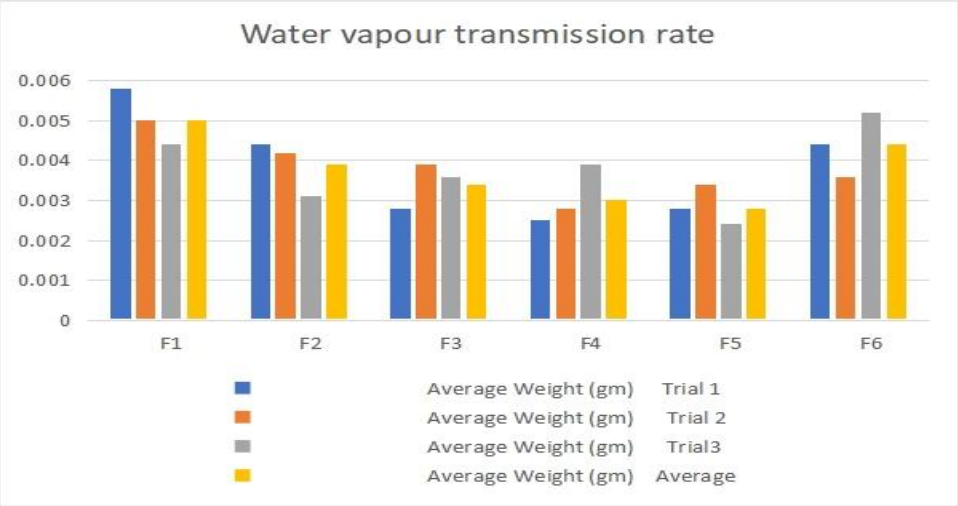
Percentage Moisture Loss

SI. No.	Formulation code	Percentage moisture loss			
		Trial 1	Trial 2	Trial3	Average
1	F1	10.8	13.2	15.9	13.3
2	F2	8.40	10.28	10.22	9.633
3	F3	8.15	9.8	10.1	9.35
4	F4	2.28	4.90	7.4	4.86
5	F5	3.24	3.22	5.85	4.10
6	F6	0.3	4.88	7.76	4.31



Water Vapour Transmission Rate

SI. No.	Formulation code	Water vapour transmission rate			
		Trial 1	Trial 2	Trial3	Average
1	F1	0.0058	0.0050	0.0044	0.0050
2	F2	0.0044	0.0042	0.0031	0.0039
3	F3	0.0028	0.0039	0.0036	0.0034
4	F4	0.0025	0.0028	0.0039	0.0030
5	F5	0.0028	0.0034	0.0024	0.0028
6	F6	0.0044	0.0036	0.0052	0.0044

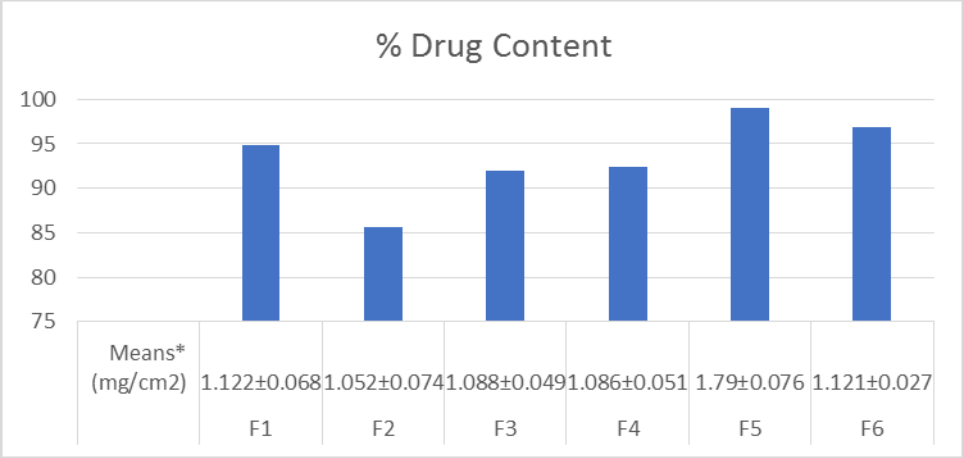


Tensile Strength

SI. No.	Formulation code	Tensile strength			
		Trial 1	Trial 2	Trial3	Average
1	F1	3.92	3.99	3.82	3.91
2	F2	2.93	2.98	3.14	3.01
3	F3	3.22	3.34	3.32	3.29
4	F4	3.38	3.58	3.46	3.47
5	F5	3.42	3.59	3.48	3.49
6	F6	3.36	3.62	3.54	3.50

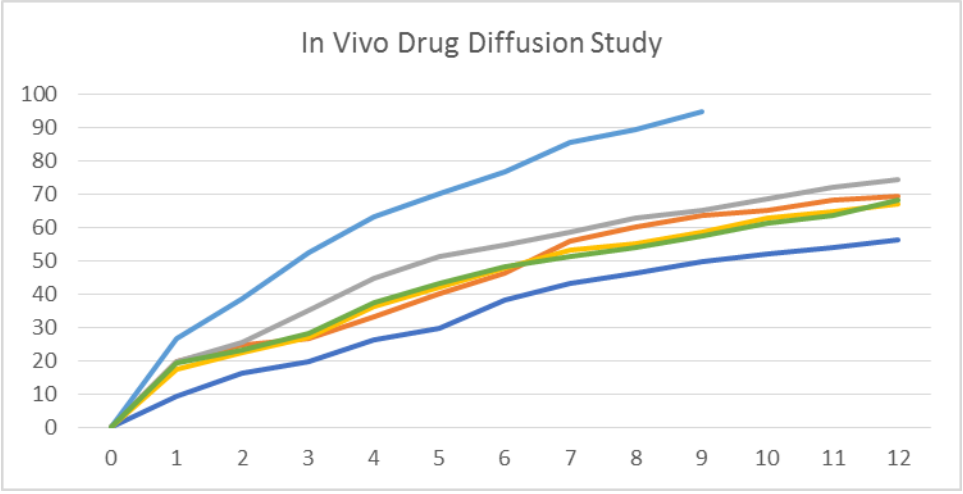
Drug Content

SI.NO	Formulation code	Concentration Means* (mg/cm^2)	% Drug Content
1	F1	1.122±0.068	94.85
2	F2	1.052±0.074	85.68
3	F3	1.088±0.049	92
4	F4	1.086±0.051	92.45
5	F5	1.79±0.076	99
6	F6	1.121±0.027	96.86



In Vivo Drug Diffusion Study

S.NO	TIME(hrs)	% Cumulative Drug Release					
		F1	F2	F3	F4	F5	F6
1	1	9.155	19.543	19.863	17.438	26.543	19.421
2	2	16.178	24.568	25.463	22.463	38.516	23.051
3	3	19.782	26.465	35.015	27.185	52.382	28.321
4	4	26.128	33.123	44.863	36.143	63.126	37.289
5	5	29.542	40.145	51.219	42.158	70.213	43.121
6	6	38.125	46.438	54.655	47.890	76.498	47.984
7	7	43.148	55.789	58.493	52.984	85.584	51.152
8	8	46.153	60.096	62.898	55.093	89.423	54.067
9	9	49.545	63.463	65.123	58.710	94.823	57.215
10	10	52.122	64.998	68.487	62.816	------	61.089
11	11	53.885	68.057	72.143	64.893	--------	63.489
12	12	56.128	69.478	74.163	67.183	---------	68.034



CONCLUSION

Transdermal patches was prepared by using solvent casting method. We prepared total six formulations with different ratios among those six prepared patches, F5 showed the best

physicochemical evaluation results when compared with the other formulations. Therefore, we conclude that F5 is the optimized and most effective formulation.

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