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Formulation and Evaluation of Polyherbal Hematinic Capsule for Pediatrics

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Abstract:- Hematinic deficiencies in children, including those related to iron, folic acid, and vitamin B12, are a serious health issue that impact a child's growth, development, and general wellbeing. Administration of dose, taste, and compliance are common problems with conventional therapies. To address these issues, the production and testing of polyherbal hematinic capsules intended for pediatric usage is the main focus of this work. Strong hematinic properties in plant extracts are selected with care, and the right processing methods are used for young users. The capsule size is adjusted for ease of swallowing, and the polyherbal mixture is improved to increase compliance. To ascertain the effectiveness, safety, and suitability for use in pediatric settings, testing is done. The created polyherbal hematinic capsules exhibit outstanding disintegration time, flow characteristics, and an hourly cumulative drug release of 97.7%. The results imply that hematinic polyherbal capsules have potential as a safe and efficient option for treating paediatric hematinic deficits, addressing compliance concerns and providing an appealing dose form.

Keywords:- *Hematinic; Polyherbal; Extract; Pediatric; Disintegration*

I. INTRODUCTION

The World Health Organization (WHO) has approved medical goods based on limited medicinal herbs labelled with active substances, plant materials or mixes of materials, aerial or subterranean sections of the plant, or other plant components **(1)**. Polyherbal formulations are those that include two or more natural medicines with distinct pharmacological activities and therapeutic effects. Herbal treatments are now widely used as medicinal agents for a wide range of illnesses, including diabetes, rheumatoid arthritis, liver disease, cough treatments, and memory boosters **(2)**. Considering the medicinal qualities associated with a tough medicine, it is critical to preserve its excellence and integrity in the company's portfolio. The fact remains, nevertheless, that the drugs being sold are frequently tainted and do not adhere to the standards set forth for legitimate drugs. The majority of conventional medical systems work well, but they are not standardized, hence a method for standardization must be created. To standardize these traditional formulas, the Central Council of Research in Ayurveda and Siddha has produced preliminary recommendations. In order to ensure batch homogeneity in the manufacturing of herbal formulations, assessment methodologies must be developed **(3)**. Drugs identities are implied by their standardization, which also ensures their purity and quality. At first, the only way to identify the raw medications was by comparing them to the standard description. The active ingredients and physical constants of crude pharmaceuticals are currently estimated using a variety of techniques, including botanical, chemical, spectroscopic, and biological approaches, as a result of the growing awareness of the chemical makeup of raw medications **(2)**.

The present study is aimed to formulate polyherbal capsules using the leaves extract of *Psidium guajava*, *Trigonella foenum-graecum*, *Cymbopogon citratus*, *Moringa oleifera* and bark extract of *Mangifera indica* and evaluate the same as given to treat haematopoiesis disease in pediatrics.

Anaemia is a frequent nutritional deficiency illness that has serious implications for human health as well as the social and economic development of both developing and industrialized nations. It is a global public health concern (WHO 2005). Over 2 billion people, or one-third of the world's population, suffer from anemia as a result of an imbalance in their intake of nutrient-dense foods, according to WHO statistics from 2004 **(4,5,6)**.

The process that produces all of the cellular constituents of blood and blood plasma is known as haematopoiesis. The hematopoietic system (as shown in the Fig. 1), which consists of tissues and organs like the liver, spleen, and bone marrow, is where it takes place. It starts long before birth, early in an embryo's development, and lasts the entirety of an individual's life **(7,8)**.

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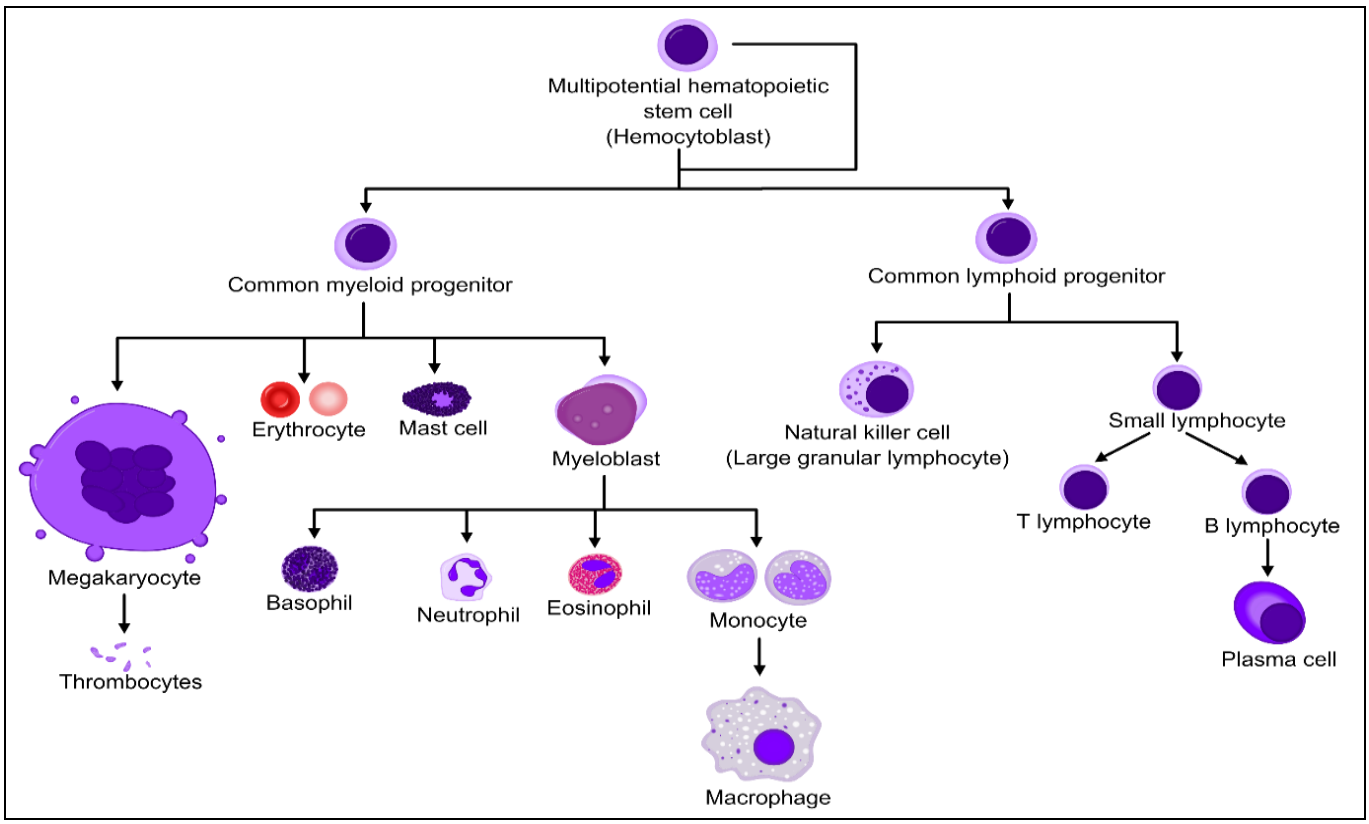

Fig 1: Diagram Showing the Development of Different Blood Cells from Haematopoietic Stem Cell to Mature Cells

(A)Psidium (B) Moringa Oleifera (C) Cymbopogon Citratus

(D) Mangifera Indica (E) Trigonella Foenum-Graecum

Fig 2: Collected Powdered Herbal Raw Materials

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II. MATERIALS AND METHODS

The plant parts selected were all available in and around the locality, they were collected in person from the respective during the Months of APRIL-JUNE, 2023.The procured plant materials were washed thrice in running water, and cleaned thoroughly. They were then dried under shade for a week or so. Once they were completely dried, they were ground into coarse powder (as shown in the Figure 2), and stored in air tight containers and preserved for the further processing.

A. Extraction of Plant Material :

Samples of both the bark and the leaves were broken up and put through a 40 mesh sieve. The bark of Mangifera indica and leaves of Psidium guajava, Trigonella foenum-graecum, Cymbopogon citratus, and Moringa oleifera were coarsely powdered in a shaded area and placed in a Soxhlet apparatus. The mixture was then extracted using petroleum ether (60–62°C), chloroform, ethanol, and water until the extraction process was completed. Following the success of extraction, the solvent was eliminated by distillation. Using a rotator evaporator, the extracts were dried. Following storage of the residue in a desiccator, the yield % was determined.

B. Organoleptic properties of Collected Raw Materials :

This study evaluates organoleptic characteristics of plant materials, including physical appearance, taste, and odour (as shown in Table 1), to establish quality and determine the degree of quality through sensory organs.

Table 1: Organoleptic Properties of Collected Herbs

S.No.	**Name of the Plant**	**Nature**	**Colour**	**Odour**	**Taste**
1.	*Mangifera indica (bark)*	Coarse powder	Light brownish	Odourless	Tasteless
2.	*Psidium guajava (leaves)*	Coarse powder	Dull green	Odourless	Slightly bitter
3.	*Trigonella foenum-graecum (seeds)*	Coarse powder	Yellowish	Pungent	Bitter
4.	*Cymbopogon citratus (leaves)*	Coarse powder	Dark green	Pungent	Sour
5.	*Moringa oleifera (leaves)*	Coarse powder	Dull green	Odourless	Bitter

III. RESULTS AND DISCUSSION

A. Preliminary Quality Control of Collected Raw Materials:

➢ *Loss on Drying*

10 g of the sample materials (without initial drying) were taken and put in a tarred evaporating dish. The samples were prepared without the use of a high-speed mill, and they were then dried and weighed every hour. The samples were kept in the drying chamber (105°C) for 5 hours and values were noted down as shown in Table 2.

Loss on drying % = final weight of the sample/ initial weight of the sample × 100.

Table 2: Loss on Drying Values of the Powders.

S.No.	**Name of the Plant**	**LOD (% w/w)**	**Acceptable Limits (%W/W)**
1.	Mangifera indica (bark)	4.38±0.75	NMT 8
2.	Psidium guajava (leaves)	3.12±0.68	NMT 6
3.	Trigonella foenum-graecum (seeds)	4.23±1.25	NMT 5
4.	Cymbopogon citratus (leaves)	3.45±1.12	NMT 8
5.	Moringa oleifera (leaves)	4.34±0.89	NMT 5

The value are expressed as mean ± SD, (n=3); NMT-Not more than

B. Calibration Curve of Poly Herbal Extract in 0.1N HCL Buffer:

A working stock of 1000 µg/ml was prepared by dilution of polyherbal extract in pH 1.5 HCL buffer. Primary and secondary dilutions were created, and absorbance was measured and noted (as shown in Table 3), using a UV visible spectrophotometer. A linear graph of absorbance Vs concentration was plotted (as shown in Figure 3), confirming compliance with Beer's law over a range of 2-10 µg/ml.

Table 3: Calibration Data of Polyherbal Extract.

S.No.	**Concentration (µg/ml)**	**Absorbance (nm)**
1.	0	0
2.	2	0.138
3.	4	0.241
4.	6	0.346
5.	8	0.453
6.	10	0.552

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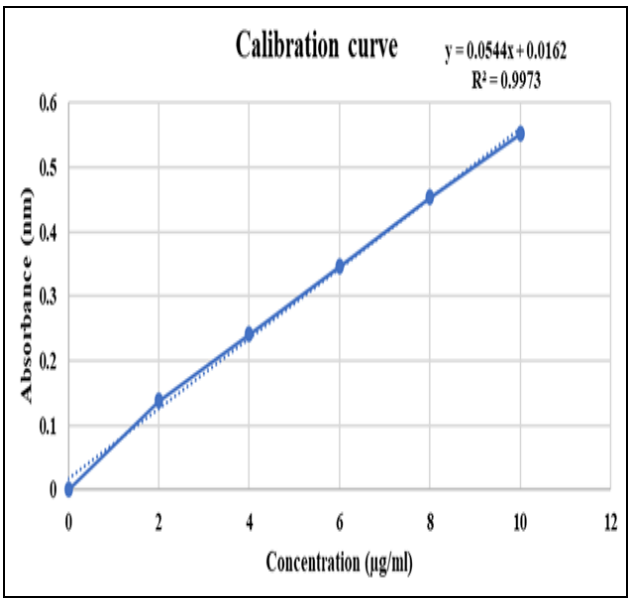

Fig 3: Calibration Curve of Polyherbal Extract

C. Formulation of Dosage Forms

The formulation contained the herbal extracts of *Psidium guajava*, *Trigonella foenum-graecum*, *Cymbopogon citratus*, *Moringa oleifera* and *Mangifera indica* and various grades of HPMC polymers (HPMC K_{15}, HPMC K_{4M}, HPMC K_{100}) were prepared in the varied ratio (as mentioned in Table No. 4). The formulation quality was assessed in accordance with WHO criteria for herbal material quality control. In accordance with the recommendations, detailed analyses of powder characteristics, including bulk density, tapped density, angle of repose, and so forth, were conducted, and noteworthy findings were documented.

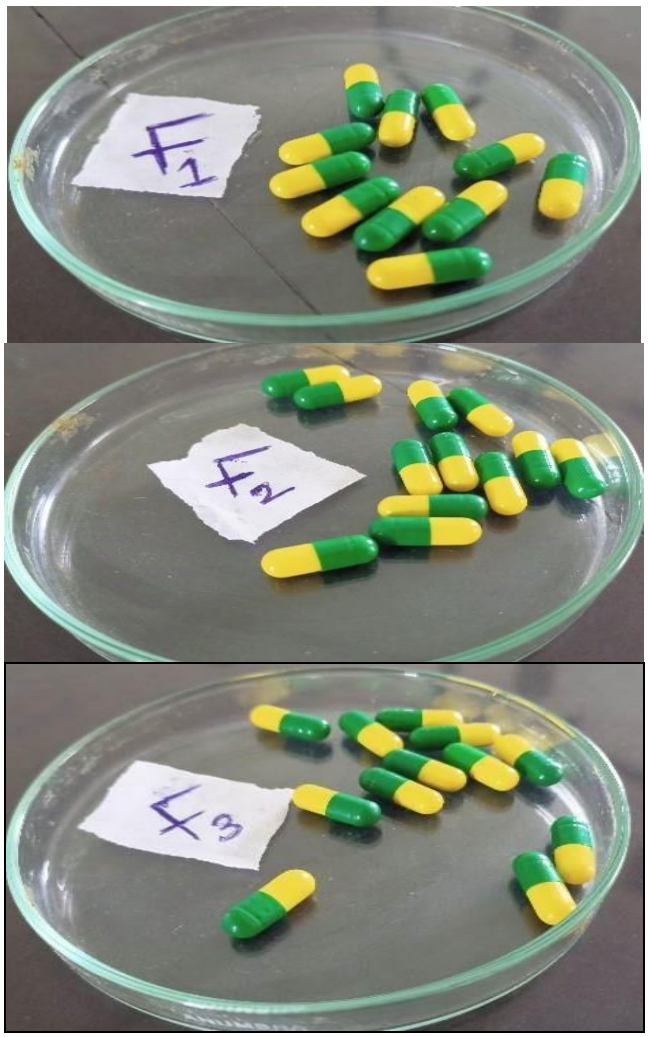

Fig 4: Formulated Polyherbal Hematinic Capsules

Table 4: Composition of the formulated Dosage Form

S.No.	Materials	F_1 (mg)	F_2 (mg)	F_3 (mg)
1.	Mangifera indica	4	4	4
2.	Psidium guajava	4	4	4
3.	Trigonella foenum-graecum	4	4	4
4.	Cymbopogon citratus	4	4	4
5.	Moringa oleifera	4	4	4
6.	Micro crystalline cellulose	30	30	30
7.	Starch	q.s.	q.s.	q.s.
8.	HPMC K_{15}	10	__	__
9.	HPMC K_{4M}	__	10	__
10.	HPMC K_{100}	__	__	10
11.	Magnesium carbonate	3.5	3.5	3.5
12.	Sodium methyl paraben	1.5	1.5	1.5

The ethanolic extracts were freeze-dried before being used in a formulation procedure. The dried herb extracts were weighed and combined to create 20 mg of extract. Magnesium carbonate was added for adsorption. The mixture was then triturated and sieved. Preformulation experiments were conducted on the obtained fine powder.

D. Preformulation Studies

Preformulation parameters such as bulk density, tapped density, compressibility index, hausner's ratio, angle of repose were performed and the values were noted down as shown in Table 5.

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Table 5: Preformulation Studies of Obtained Formulation

Parameters	F_1	F_2	F_3
Bulk density (g/cm2)	0.70±0.04	0.55±0.01	0.9±0.05
Tapped density(g/cm2)	0.71±0.02	0.61±0.04	1.04±0.04
Compressibility index (%w/w)	17.5±0.63	19.1±0.46	14.7±0.04
Hausner's Ratio	1.14±0.13	1.17±0.15	1.12±0.13
Angle of repose (degrees)	32.32±0.06	34.02±2.46	30.04±3.62

The value are expressed as mean ± SD, (n=3); NMT-Not more than

E. Development of Dosage Form (Capsule) by Wet Granulation Method:

Trials were conducted to determine the best ratio of binders to use, as well as the amount of lubricants and preservatives to add before the process was finally refined. The polyherbal extract was combined in the ratio shown in Table No. 4 after being finely powdered (sieve 40). further used to prepare capsules using the wet granulation method with a lactose solution acting as a binder. To get granules, the moist bulk was run through filter number 22. The granules were dried at 45°C in a tray dryer. The grains were greased or lubricated with magnesium stearate. Preservatives and diluents were used.

Following this, a capsule filling machine was used to fill the yellow-green, size "5" capsules with the improved batch's granules. After that, the capsules were removed and placed into labeled poly bags (as shown in Fig. 4). Samples were then assessed in accordance with the testing specifications. The extracts of Psidium guajava, Trigonella foenum-graecum, Cymbopogon citratus, Moringa oleifera, Mangifera indica, and Microcrystalline cellulose, together with excipients: quantity sufficient (q. s.), were present in every 65 mg of polyherbal capsules, as indicated in Table No. 4.

E. Evaluation Of Finished Product (Capsules) :

The developed polyherbal capsules were assessed based on their description, weight uniformity, disintegration time, moisture content, pH and dissolution profile and the values were noted down as shown in Table 6. Indian Pharmacopeial standards were followed in order to determine the weight uniformity.

Table 6: Physical parameter values of the obtained finished product

S.No.	PARAMETER	OBSERVATION		
		F1	F2	F3
1	Description	Dull brown powder contained in Green cap/ yellow body “5” size capsule	Dull brown powder contained in Green cap/ yellow body “5” size capsule	Dull brown powder contained in Green cap/ yellow body “5” size capsule
2	Colour	Light brown	Light brown	Light brown
3	Odour	Pungent	Pungent	Pungent
4	Taste	Mint flavour	Mint flavour	Mint flavour
5	pH (1% aqueous solution)	7.33±0.21	7.41±0.32	7.4±0.22
6	Moisture content	17 ± 0.7	25±0.76	13±0.25
7	Uniformity of weight	61.2±0.88	63.3±0.98	65.7±0.97
8	Disintegration time	27’10 sec.	20’15 sec.	13 min.

➢ *In-Vitro Drug Release Studies of Obtained Capsules*

The study conducted in-vitro dissolution studies for Polyherbal hematinic capsules using USP apparatus type I at 50 rpm and pH 1.5 HCL buffer. Samples were withdrawn every 10 minutes, and absorbance was measured at 220nm (as shown in Table 7), using UV Visible spectrophotometer. Cumulative drug release (%CDR) was determined and a graph was plotted as shown in Figure 5.

Table 7: Cumulative Drug Release Studies of Formulations (F1-F3)

Time intervals (min)	% Cumulative Drug Release		
	F1	F2	F3
10	3.7±0.08	4.8±0.21	8.14±0.5
20	20±0.12	21.3±0.12	24.4±0.17
30	34±0.13	40±0.07	44.7±0.38
40	51±0.22	61.7±0.1	69.2±0.47
50	58.3±0.19	68.4±0.12	81.4±0.87
60	66.5±0.076	85±0.42	97.7±0.67

Results are reported as Mean ± Standard deviation (n=3)

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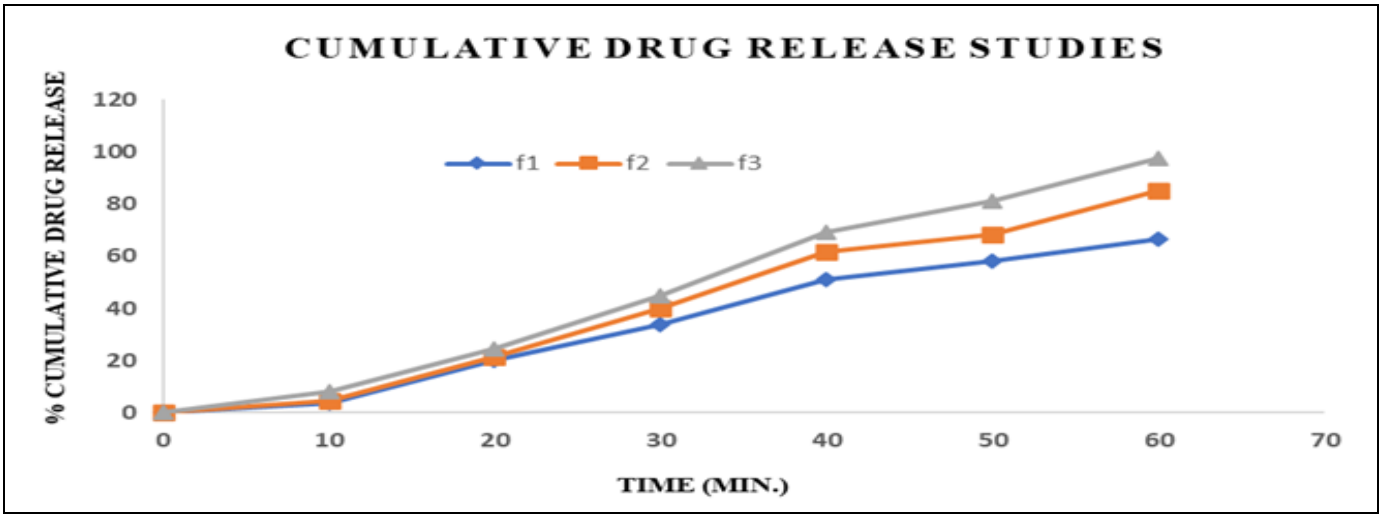


Fig 5: In-Vitro Dissolution Studies of Formulated Polyherbal Capsules

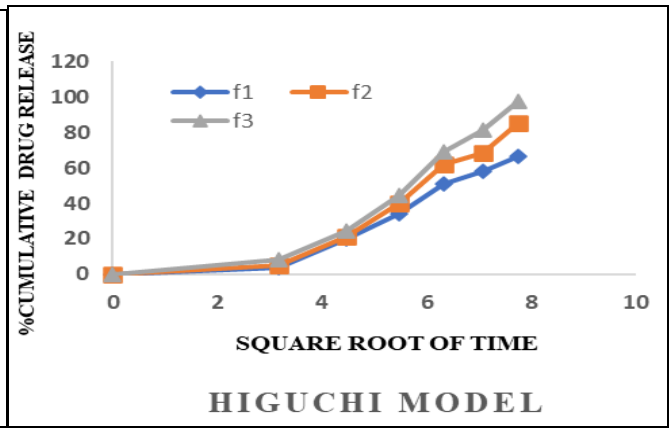
Based of the faster release rate of Formulation-3 capsules, it proves to be the best optimised formulation for drug kinetics study. Hence the kinetic study of all the formulations was done and the values obtained were noted down.

F. Drug Release Kinetics Study For in-Vitro Dissolution Studies

Kinetic studies were performed for the formulations and the values were noted down as shown in Table 8, and the graphs are plotted as shown in Figure 6.

Table 8: Drug Release Kinetics for Formulations (F_1-F_3).

Formulation	Zero order	First order	Higuchi	Korsmeyer- peppas	
	R^2	R^2	R^2	n	R^2
F_1	0.9806	0.9653	0.8744	1.0935	0.937
F_2	0.9826	0.9487	0.8578	1.1367	0.9551
F_3	0.9883	0.9249	0.8623	1.1507	0.9866



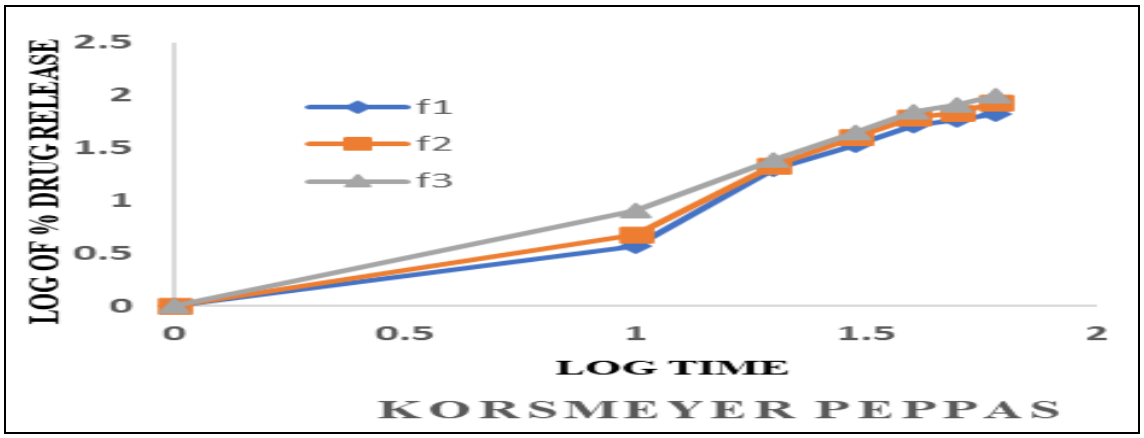


Fig 6: Drug Release Kinetics of zero Order, First Order, Higuchi and Peppas Model

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IV. CONCLUSION

Therefore this study is an attempt to formulate and evaluate the folklore claims of five indigenous herbs viz., Mangifera indica (bark), Psidium guajava (leaves), Trigonella foenum graecum, Cymbopogon citratus, Moringa oleifera ,as capsules for the treatment of anaemia. The selected plant powders were subjected to preliminary evaluation. The physio-chemical constants like ash values, loss on drying, were performed. The results obtained proved the procured raw materials were of good standard. The phytochemical constituents were noted based on previous works on these herbs. The presence of Iron, flavonoids, vitamins and some proteins give favourable effects to use these herbs in this formulation.

The drug release was affected by the concentration of HPMC K15, HPMC K4M, and HPMC K100. The concentration of HPMC K15 also controls the drug release. The herbal raw materials were analysed for identity, quality and purity as per the standards prescribed by WHO and Ayurvedic Pharmacopeia of India.

The dried polyherbal extract was optimized for its quality measures and its batch consistency by making three different formulation batches. The formulated polyherbal hematinic capsules of F3 showed excellent flow property, disintegration time with controlled release and showed 97.7% of cumulative drug release within an hour of time. Optimised formulation F3 was observed to follow zero order kinetics.

REFERENCES

[1]. Ernst E. Herbal medicines: balancing benefits and risks. Novartis Found Symp. 2007;282:154-67. DOI : https://doi.org/10.1002/9780470319444.ch11.
[2]. Parasuraman S, Thing GS, Dhanaraj SA. Polyherbal formulation: Concept of ayurveda. Pharmacogn Rev. 2014;8(16):73-80. DOI : https://doi.org/10.4103/0973-7847.134229.
[3]. Sheth PA, Pawar AT, Mote CS, More C. Antianemic activity of polyherbal formulation, Raktavardhak Kadha, against phenylhydrazine-induced anemia in rats. J Ayurveda Integr Med. 2021;12(2):340-345. DOI : https://doi.org/10.1016/j.jaim.2021.02.009.
[4]. Jobin Johny , Ninad Nagrale and Shriram Kane. A Review Article on Anaemia. Biosc.Biotech.Res.Comm. 2021;Vol 14: No. 07. DOI : http://dx.doi.org/10.21786/bbrc/14.7.7.
[5]. Miller JL. Iron deficiency anemia: a common and curable disease. Cold Spring Harb Perspect Med. 2013;3(7):a011866.DOI: https://doi.org/10.1101%2Fcshperspect.a011866.
[6]. Nathan, D.G. & Gunn, R.B. Thalassemia: the consequences of unbalanced hemoglobin synthesis. Am J Med. 1966 ;41(5): 815-830. DOI : https://doi.org/10.1016/0002-9343(66)90039-8.
[7]. Weatherall, D.J. Thalassemia in the next millennium. Ann N Y Acad Sci. 1998;850:1-9. DOI : https://doi.org/10.1111/j.1749-6632.1998.tb10456.x.
[8]. Jaiswal S, Ebert BL. Clonal hematopoiesis in human aging and disease. Science. 2019;366(6465):eaan4673. DOI : https://doi.org/10.1126/science.aan4673..