FORMULATION, DEVELOPMENT & CHARACTERIZATION OF *SHOREA ROBUSTA* RESIN AND *CARTHAMUS TINCTORIUS* OIL

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ABSTRACT

OBJECTIVE- The formulation, development, and characterization of *Shorea robusta* resin and *Carthamus tinctorius* oil are the primary objectives of the current work.

METHODS: 100 g of *Shorea robusta* resin powder was methodically extracted in a Soxhlet method with 200 ml of ethanol. The extract was thoroughly dried in a rotary evaporator at 40 °C (yielding 68.0 g), and then it was kept at room temperature for usage. To identify different phytoconstituents, ethanolic extracts underwent a variety of qualitative chemical assays. Tween 80 and polyethylene glycol (PEG) were used in a 3:1 ratio to create a nano-emulsion without the use of any drugs. 3ml of tween 80 and 1ml of PEG were combined in this. 10% of the formulation ratio i.e. 1ml, of *Carthamus tinctorius* oil, was added. The 3:1:1 ratio of tween 80, PEG, and CTO solution was mixed with the help of a magnetic stirrer rotating at 500 rpm, and continuous stirring was done until the emulsion was created. For the parameters of appearance, odor, color, homogeneity, pH, and spreadability, all the produced ointments were evaluated.

RESULTS- The physical appearance, color, smoothness, separation of phase, homogenization, and initial skin sensation of the ointment compositions are all examples of organoleptic qualities. All of the formulations' viscosities were measured and found to range between 2345.33 3.06 and 2396.33 10.69 CPS at 10 rpm.

CONCLUSION- The gelling polymer formulation using *Shorea robusta* resin and *Carthamus tinctorius* oil was determined to be more promising than other formulations since it exhibits noticeably better physicochemical properties.

KEYWORDS: *Shorea robusta,* Resin, *Carthamus tinctorius* oil, Characterization.

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INTRODUCTION:

Herbal remedies, also known as phytomedicine, include herbs (such as leaves, seeds, roots, and bark), herbs materials (such as essential oils and fresh juices), ayurvedic preparations (such as extracts, fatty oils, and tinctures), and herbal goods in their final forms. It is a composite mixture of elements drawn from many chemical classes; the potency of these elements is combined to produce a result that comes from the interaction of the individual elements. There are also inactive components that serve as fillers or ballast in addition to these. Since multiple bioactivities combine to produce a range of effects, the drug under evaluation is a complex mixture both chemically and biologically [1]. Even now, a sizable portion of the global population relies on herbal remedies. The majority of natural medications come from plants, even though others are made with minerals and animal ingredients. Around 75% of the population is thought to rely on medicinal plants to treat their illnesses. Although synthetic medicine has gained the lead, herbal remedies are still in high demand, particularly for the treatment of a few types of illnesses. Modern medications contain chemical precursors originating from plant components in about 25–30% of cases. Modern synthetic medications are potentially hazardous, and expensive, and their use is followed by a recurrence of symptoms. Herbs, however, are typically claimed to be non-toxic because they come from a natural origin and have been utilized since the dawn of civilization [2]. The formulation, development, and characterization of *Carthamus tinctorius* oil and *Shorea robusta* resin are the primary goals of the current work [3,4].

MATERIAL & METHODS:

Extract *Shorea robusta* resin:

With the use of a Soxhlet device, 100 g of *Shorea robusta* resin powder was methodically extracted. The extract was completely dried using a rotary vacuum evaporator at 40 degrees Celsius (yield 68.0 g) and then maintained at room temperature up to the use [5].

Initial Phytochemical Examinations:

Qualitative chemical studies of ethanolic extract were performed to detect several phytoconstituents [6].

Formulation of Nano-emulsion:

Without Drug Formulation:

For the formulation of nano-emulsion without drug, tween 80 and polyethylene glycol (PEG) were taken in the ratio of 3:1. In this 3ml of tween 80 and 1 ml of PEG were taken together. 1ml of *Carthamus tinctorius* oil (i.e. 10% of the formulation ratio) was added. Using a magnetic stirrer set to 500 rpm, 5ml of water (i.e. 50% of the formulation ratio) was added into a 3:1:1 ratio of tween 80, PEG, and CTO solution with continuous stirring till the emulsion was formed [7].

With drug formulation:

for preparing the nano-emulsion of *Carthamus tinctorius* oil and *Shorea robusta* resin, 1 ml of *Carthamus tinctorius* oil was heated at 80°ctemp by adding 1gm of ethanolic extract of *Shorea robusta* resin. After dissolving, maintain the solution at room temperature. Then tween 80 and polyethylene glycol (PEG) were added in a ratio of 3:1 into the drug solution. This 3ml of tween 80 and 1 ml of PEG were taken together. Using a magnetic stirrer set to 500 rpm, 5ml of water (i.e. 50% of the formulation ratio) was added into a 3:1:1 ratio of tween 80, PEG, and CTO solution with continuous stirring till the emulsion was formed [8].

Formulation of Ointment:

Formulation of Crude drug:

For the formulation of crude drug, *Shorea robusta resin* was taken along with *Carthamus tinctorius* oil. White beeswax was taken as the base for the formulation of ointment.

Carthamus tinctorius oil was heated at 60°C. Crude drugs of *Shorea robusta resin* were added slowly into heated C.T. oil with continuous stirring till it got completely soluble in C.T. oil. A porcelain dish was filled with white beeswax and heated to 60°C. The mixture of *Shorea robusta resin* and C.T. oil were added into melted white beeswax uniformly to get mix with each other. The above hot mixture was taken on an ointment slab and mixed uniformly to avoid lumps. Ointment of the crude drug was prepared after cooling this mixture [9].

Fig. 1: Formulation of Ointment of crude drug of SRR

Table 1: Following coded values were used for the optimization of crude drug formulation

Sr. No.	Coded Values	
	X1	X2
1	-1	-1
2	0	-1
3	1	-1
4	-1	0
5	0	0
6	1	0
7	-1	1
8	0	1
9	1	1

X1: 1% w/w crude drug of *Shorea robusta resin* and *Carthamus tinctorius* oil

X2: for white bees Wax

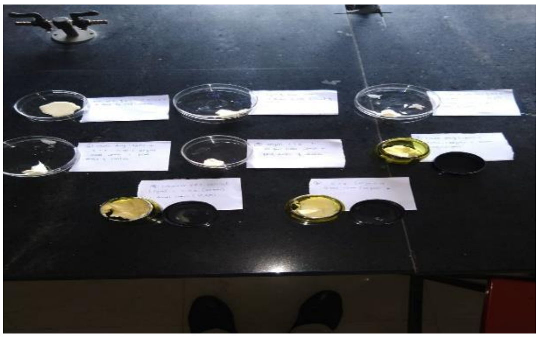

Fig. 2: Formulation of different coded Ointments of SRR

Table 2: For the above-coded values following weights were taken for the preparation of crude drug formulation:

	Large (-1)	Medium (0)	High (1)
X1 1% w/w crude drug of SRR and *Carthamus tinctorius* oil	8 gm	10 gm	12 gm
X2 white bees Wax	3 gm	4 gm	5 gm

Table No. 3: Optimization of herbal formulation following weight was taken

Sr. No.	Coded Values	
	X1	X2
F1	08 gm	03gm
F2	10gm	03gm
F3	12gm	03gm
F4	08gm	04gm
F5	10gm	04gm
F6	12gm	04gm
F7	08gm	05gm
F8	10gm	05gm
F9	12gm	05gm

Formulation of ethanolic extract of *Shorea robusta resin*:

The methanol extract of *Shorea robusta* resin was combined with *Carthamus tinctorius* oil for the formulation. For the ointment's base, beeswax was used.

Carthamus tinctorius oil was heated at 60°C. Ethanolic extract of *Shorea robusta resin* was added slowly into heated C.T. oil with continuous stirring till it got completely soluble in C.T. oil. White bees wax was taken into a porcelain dish and heated at a temperature of 60°C. The mixture of ethanolic extract of *Shorea robusta resin* and C.T. oil was added into melted white beeswax uniformly to get mixed. The above hot mixture was taken on an ointment slab and mixed uniformly to avoid lumps. After cooling this mixture, a *Shorea robusta* resin ethanolic extract was created as an ointment [10].

Table 4: Following coded values were used for the optimization of crude drug formulation:

Sr. No.	Coded Values	
	X1	X2
1	-1	-1
2	0	-1
3	1	-1
4	-1	0

5	0	0
6	1	0
7	-1	1
8	0	1
9	1	1

X1: 1% weight-weight of ethanolic *Shorea robusta* resin extract and *Carthamus tinctorius* oil

X2: for white bees Wax

Table 5: For the above-coded values following weights were taken for the preparation of crude drug formulation:

	Large (-1)	Medium (0)	High (1)
X1 1% w/w ethanolic extract of SRR and *Carathamus tinctorius* oil	8 gm	10 gm	12 gm
X2 white bees Wax	3 gm	4 gm	5 gm

Table 6: Optimization of herbal formulation following weight was taken

Sr. No.	Coded Values	
	X1	**X2**
F1	08gm	03gm
F2	10gm	03gm
F3	12gm	03gm
F4	08gm	04gm
F5	10gm	04gm
F6	12gm	04gm
F7	08gm	05gm
F8	10gm	05gm
F9	12gm	05gm

Formulation of *Carthamus tinctorius* oil ointment:

For the formulation of *Carthamus tinctorius* oil ointment, *Carthamus tinctorius* oil was taken. Beeswax was taken as the base for the formulation of ointment.

White beeswax was taken into a porcelain dish and heated at a temperature of 60°C. Add C.T. oil into melted white beeswax uniformly to get mix with each other. The above hot mixture was taken on an ointment slab and mixed uniformly to avoid lumps. An ointment of *Carthamus tinctorius* oil was prepared after cooling this mixture [11].

Table 7: Following coded values were used for the optimization of crude drug formulation:

Sr. No.	Coded Values	
	X1	**X2**
1	-1	-1
2	0	-1
3	1	-1
4	-1	0
5	0	0
6	1	0
7	-1	1
8	0	1
9	1	1

X1: *Carthamus tinctorius* oil, X2: White bees Wax

Evaluation of Ointment:

The characteristics of appearance, odor, color, homogeneous, pH, and spreadability were used to characterize all of the produced ointments [12-14].

Organoleptic characteristics:

The formulations' consistency and the presence of large particles were utilized to assess their homogeneity and texture. The immediate skin feel, which included stiffness, grit, and greasiness, was also assessed [15-16].

PH:

The ointment's pH is measured using a pH meter. (pH Tutor, Eutech Instruments). The calculations were done in three copies, and the averages of the three readings were recorded [17].

Spreadability:

To remove air and create a consistent film of ointment between the plates, the two plates were placed on top of a 1000 g weight for five minutes. Better spreadability is indicated by a shorter interval. In order to determine spreadability, the following equation was used [18].

$$S = M \times L / T \qquad (1)$$

Where:

R: is the spreadability factor.

M: stands for "weight in the pan" (attached to the top slide)

L: is the distance traveled by the glass slide in length, and

T: stands for the length of time (in seconds) needed to entirely separate each slide from the others.

Viscosity:

Rheological tests were conducted using a Synchro –Lectric Brookfield Viscometer (Model RVT) with a Helipath [19].

Result and Discussion:

Extractive Value Determination:

Ethanol was used to extract *Shorea robusta* from dried resin. The yield percentages of all dry extracts were calculated using the equation below.

$$\text{Percentage yield} = \frac{\text{Extract Weight}}{\text{Weight of crude drug powder taken}} \times 100 \qquad (2)$$

Table 8: The appearance and yield percentage of extract (in gm)

Sr. No.	Extracts	The dried extracts' color	Dry extracts' consistency	% Yield (W/W)
1	Ethanolic extract of *Shorea robusta* resin	Dark brown	Dried	68 %

Phytochemical Screening in its Preliminary Stage:

The preliminary phytochemical examination showed that many active ingredients, including sugars, proteins, amino acids, lipids, oils, steroids, terpenoids, glycosides, alkaloids, tannins, and other phenolic compounds, were present in distinct extracts.

Table 9: Chemical testing for qualitative chemical analysis of extracts.

S. No	Phytoconstituents	Chemical Tests	*Shorea robusta*
1	Amino Acid	Millon's Test	Present
		Ninhydrin test	Absent
2	Alkaloids	Wagner's Test	Present
		Dragendorff's Test	Present
		Mayer's Test	Present
		Hager's Test	Absent
3	Flavonoid	Shinoda Test	Present
		Alkaline Reagent Test	Present
		Zinc Hydrochloride Test	Absent
4	Protein	Biuret Test	Present

		Hydrolysis Test	Present
		Test With Trichloroacetic Acid	Absent
5	Phenolics (Tannins)	Gelatin Test	Present
		Phenazone Test	Absent
		Ferric Chloride Test	Present
6	Carbohydrates	Benedict's Test	Present
		Fehling's Test	Present
		Molish's Test	Absent
7	Triterpenoids and Steroids	Libermann-Burchard test	Present
		Salkowski test	Present
8	Cardiac glycosides	Baljet's test	Present
		Legal's test	Present
		Keller-killiani test	Present
9	Saponin glycosides	—	Present
10	Coumarin glycosides	—	Absent
11	Anthraquinone glycosides	Borntrager's test	Present
		Modified Borntrager's test	Present

Characteristic of organoleptic:

Table 10 displays the ointment formulations' organoleptic characteristics, such as their physical appearance, color, texture, phase separation, homogeneity, and initial skin sensation. The findings demonstrated that the ointments were all homogeneous, had a smooth texture, and showed no evidence of phase separation. All formulas had an aromatic scent and were white in color.

Table 10: Physical-chemical analysis of ointment formulations

Formulation code	Physical appearance	Texture	Phase separation	Homogeneity	Immediate skin feel
F-1	Opaque	Rough and hard	No	Homogeneous	No roughness or greasy feel
F-2	Opaque	Rough and hard	No	Homogeneous	No roughness or greasy feel
F-3	Opaque	Smooth	No	Homogeneous	No roughness or greasy feel
F-4	Opaque	Rough and hard	No	Homogeneous	Very little dirt and no grease
F-5	Opaque	Rough and hard	No	Homogeneous	No roughness or greasy feel
F-6	Opaque	Smooth	No	Homogeneous	No roughness or greasy feel
F-7	Opaque	Rough and hard	No	Homogeneous	No roughness or greasy feel
F-8	Opaque	Rough and hard	No	Homogeneous	No roughness or greasy feel
F-9	Opaque	Smooth	No	Homogeneous	No roughness or greasy feel

pH:

All formulations' pH values were found to range between 6.65±0.03 and 7.063±0.03, which is within the range shown in Table 11. All formulas' pH values fall within the skin's typical pH range.

Viscosity:

All of the formulations' viscosities were measured and found to range between 2345.33 3.06 and 2396.33 10.69 CPS at 10 rpm, as shown in Table 11. The pseudoplastic flow was visible in all of the formulations. The standard deviation was estimated using the average of three readings (n = 3).

Spreadability:

Three categories of ointment spreadability exist: low, moderate, and high. It was discovered after screening that it is inversely proportional to the white bees. The ointment thickened as the number of white bees rose, which reduced its spreadability. All formulations' spreadability was assessed, and it was found that formulation F6 spreads more readily than the other formulations in Table 11.

Ointment of Crude drug									
Formulation Code	**F-1**	**F-2**	**F-3**	**F-4**	**F-5**	**F-6**	**F-7**	**F-8**	**F-9**
pH (mean± SD)	7.0567± 0.04	7.06± 0.03	7.06± 0.01	7.02±0.02	7.03±0.01	7.05±0.01	7.03±0.02	7.04±0.01	7.046± 0.0058
Viscosity at 10 rpm (CPS) (mean± SD)	2396.33 ± 10.69	2354.0 ± 4.00	2345.33 ± 3.06	2395.67 ± 4.93	2363.33± 5.03	2351 ± 3.00	2386.00± 4.00	2367.67± 4.93	2348.33 ±5.13
Spreadability g.cm/s (mean± SD)	114.46± 5.46	116.36 ±6.30	141.50 ± 8.34	114.46 ± 5.46	109.24 ± 4.97	194.87 ±8.88	109.24 ± 4.97	110.97 ± 5.74	157.54 ± 15.28

Ointment of ethanolic extract of *Shorea robusta resin* and *Carthamus tinctorius* oil									
Formulation Code	**F-1**	**F-2**	**F-3**	**F-4**	**F-5**	**F-6**	**F-7**	**F-8**	**F-9**
pH (mean± SD)	6.83 ± 0.15	6.81± 0.09	6.97± 0.06	6.80± 0.10	6.81± 0.05	6.94 ± 0.04	6.81 ± 0.05	6.82 ± 0.03	6.94± 0.02
Viscosity at 10 rpm (CPS) (mean± SD)	2384.33 ± 4.51	2366.00 ± 5.29	2358.33 ± 4.04	2390.67 ± 4.16	2370.67 ± 3.21	2360.67 ± 3.06	2383.67 ± 3.79	2378.00 ± 3.61	2354.33 ± 3.51
Spreadability g.cm/s (mean± SD)	109.24 ± 4.97	110.97 ± 5.74	129.16 ± 10.87	109.24 ± 4.97	109.24 ± 4.97	225.45 ± 12.60	110.82 ± 3.00	107.51 ± 2.74	133.61 ± 7.43

Ointment of *Carthamus tinctorius* oil									
Formulation Code	**F-1**	**F-2**	**F-3**	**F-4**	**F-5**	**F-6**	**F-7**	**F-8**	**F-9**
pH (mean± SD)	6.70 ± 0.047	6.76± 0.05	6.83± 0.04	6.71± 0.03	6.83± 0.01	6.80 ± 0.05	6.65 ± 0.03	6.76 ± 0.04	6.80± 0.04
Viscosity at 10 rpm (CPS) (mean± SD)	2386.67 ± 4.16	2378.67± 4.16	2356.67± 4.16	2387.33 ± 4.16	2377.67± 3.51	2354.33± 3.51	2387.67± 2.08	2378.33± 4.04	2354.67± 3.21
Spreadability g.cm/s (mean± SD)	153.33 ± 5.77	133.61 ± 7.43	126.55 ± 6.67	144.12 ± 5.09	133.61 ± 7.43	124.21 ± 3.65	147.06 ± 5.09	133.61 ± 7.43	130.99 ± 4.05

To determine the efficacy of these folklore medicines, modern science must begin a systematic investigation of them utilizing cutting-edge scientific procedures and methods. Today, several compounds extracted from plant sources are widely utilized in modern medicine, including a variety of older medications like morphine and quinine as well as more recent ones like artemisinin, mevastatin, etoposide, and camptothecin [20-22].

Formulation *Shorea robusta* resin and *Carthamus tinctorius* oil have both been tested for their capacity to heal wounds. Although both plants' leaves have the ability to cure wounds, there isn't much scientific research to support this claim. These plants' resins were chosen for the study as a result. Formulation *Shorea robusta* resin and *Carthamus tinctorius* oil were used to create several extracts, which were then tested for their ability to speed up the healing of surgical and burn wounds. Ethanolic extracts of Formulation *Shorea robusta* resin and *Carthamus tinctorius* oil were taken for additional research based on the qualitative phytochemical evaluation [23].

The goal of the current effort is to create and test herbal emulgels made from *Carthamus tinctorius* oil and *Shorea robusta* resin for their ability to heal surgical and burn wounds. Investigations were done on the various extracts from both plants' wound-reviving and injury-evaluation properties. Since the highest wound healing activity was seen at 4% w/w *Shorea robusta* resin and *Carthamus tinctorius* oil, these concentrations were chosen for the formulation of emulgels. To determine the two emulgels formulations' efficacy, safety, and pharmaceutical quality, each one was produced individually and tested [24].

Physical inspection was done of the gellified emulsions of *Carthamus tinctorius* oil and *Shorea robusta* resin. *Carthamus tinctorius* oil and *Shorea robusta* resin both have a bright green hue. There was no apparent separation of the aqueous and oily phases in any of the formulations. The formulated emulgels have a pleasing aesthetic quality, which is necessary for product marketing [25].

The pH of all of the formulations was found to be between 6.8 to 7.0.

Triethanolamine was added to the formulations to adjust the pH to the desired range. It was clear that the pH environment had an impact on how well wounds healed. Both acute and chronic wounds undergo a transition from an alkaline to an acidic state as they heal. Since they do not affect the physiology of the skin, gel formulations with a pH range of 6.2 to 7 are ideal for the skin [24].

With an increase in the amount of gelling polymer utilised, the compositions become more viscous. By lowering interfacial and surface tension, gelling polymers raise the liquid phase's viscosity. To have improved spreadability and extrudability, emulgels should have a moderate viscosity [23].

The spreadability of a gel when applied to the epidermis measures the size of the area where it easily scatters. The formulation's spreadability is also a factor in how effective it is at treating problems. All of the formulations showed a reasonable level of spreadability. The spreadability of *Carthamus tinctorius* oil with *Shorea robusta* resin varies from 10.23 to 22.10 g.cm/sec [22].

Extrudability describes how simple it is to expel them from their container. It is the force necessary to eject the contents of their container. The extrudability of the emulgel grows as the force needed to extract it from its container increases. The formulation's spreadability decreases as the extrudability value increases. The extrudability ratings of *Carthamus tinctorius* oil with *Shorea robusta* resin range from 11 to 16 g/cm2. All formulations were determined to have satisfactory extrudability [23-25].

CONCLUSION:

The gelling polymer formulation using *Shorea robusta* resin and *Carthamus tinctorius* oil was ultimately discovered to be more promising than other formulations since it exhibits noticeably improved physicochemical properties and stronger pharmacological activity.

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