Formulation and Evaluation of Herbal Antidandruff Shampoo Containing Garlic Loaded Solid Lipid Nanoparticles

*Neeta Rai, Abhishek Kumar Jain, Jobin Abraham

Department of Pharmaceutics SIRT College of Pharmacy, Bhopal, M.P, INDIA
_____

ABSTRACT
In the present study, herbal antidandruff shampoo containing garlic loaded solid lipid nanoparticles were formulated by using garlic as a antifungal agent. The ALL -SLNs were formulated by hot homogenization method and evaluated by using different parameter. The zeta potential, particle size and polydispesity index ,SEM and drug release were performed for ALL-SLNs. Result showed of ALL- SLNs containing Tween 80 (1ml) and soy lecithin (10ml) formulations showed the excellent zeta potential, particle size entrapment efficiency, SEM study revealed irregular surfaces with pores. The in vitro release upto 90% and %EE was found to be 30-50% .Then herbal antidandruff shampoo were formulated by using mixing process and evaluated. Result of antidandruff shampoo containing different concentration of CMC and EDTA were excellent appearance, viscosity, pH, foam ability, spreadibility and in vitro release. The pH and viscosity of herbal antidandruff shampoo were found to be 3.7-7.2 and 1010cps -1700 cps. The spreadibility was found to be by different method and result was found to be 46.4% and 53.1%. Foamability was found to be 157ml. The in vitro drug release profile was 79.26 to 80.4%. Thus it is more effective for the treatment of dandruff on scalp and hair with no side effect.

*Address for correspondence:
Neeta Rai
Department of Pharmaceutics SIRT College of Pharmacy, Bhopal, M.P, India.
E-mail: neetarai.2012@rediffmail.com
_____

INTRODUCTION
Dandruff
Dandruff is a scalp disorder which affecting the half of post pubertal population of any ethnicity and both genders [1]. Dandruff affects the aesthetic value and causes the itching and keratinocytes play major role in the expressions and the generation of immunological reaction during dandruff formation [2, 3]. The severity of dandruff may fluctuate with season as a often worsen in winter [4].

Dandruff is common scalp condition that producing the irritating white flakes and itchy scalp. Excessive drying of skin and over-activity of oil gland known as seborrhea [4]. Dandruff is a visible desquamation of scalp is the mildest manifestation of seborrheic dermatitis and caused by P. ovale combine with multiple Malassezia fungus was identified by the French scientist Louis-Charles Malassez in

host factor .It is commonly aggravated by changes in the humidity, trauma (scratching), season and the emotional stress [5]. Dandruff is a dander and represents nothing more than physiological scaling. Seborrhoeic dermatitis is obviously more inflammatory in nature extending outside the limit of scalp surface [6]. The scales are dry, white or greyish and appear as small patches specially at the top of the hairs. Dandruff is a special case where unusually large amount of flaking occurs this causes the redness and irritation of the scalp. The three factors required for the dandruff formation:
a. **NATURAL SEBACEOUS**
b. **MELASSEZIA FUNGI**
c. **INDIVIDUAL SENSITIVITY**
Malassezia Infections:
the late 19th century. Then Raymond Sabouraud identified a dandruff-causing

organism in 1904 and called it "Pityrosporum malassez", honouring Malassez [7].

Garlic:

Garlic is a bulb belonging to family liliaceae. Garlic bulb has usually pink in colour having characteristics odour with pungent and aromatic taste having 1.5-2.5 cm in size [8].

Solid lipid nanoparticles (SLNs):

Solid lipid nanoparticles (SLNs) are lipid-based submicron colloidal carriers system.

Solid lipid nanoparticles possess a solid lipid core matrix that can solubilise liphophilic molecules. The lipid core is stabilized by surfactants (emulsifiers) .SLNs are composed of physiological and compatible lipids with a high melting point as the solid core, which is coated by non toxic amphiphilic surfactants as the outer shell. The nanoparticles are in the submicron size range (50-1000 nm) and in the solid state at both body and room temperatures. SLNs offer unique properties such as small size, large surface area, high drug loading, the interaction of phases at the interfaces, and are attractive for their potential to improve performance of pharmaceuticals, neutraceuticals and other material [9].

Aims of solid lipid nanoparticles [10, 11]

a. Possibility of controlled drug release
b. Increased drug stability.
c. High drug pay load
d. No bio-toxicity of the carrier.
e. Avoidance of organic solvents.
f. Incorporation of liphophilic and hydrophilic drugs.

Shampoo:

Shampoos are used not only for cleansing purpose but also for imparting gloss to hair and to maintain their manageability and oiliness for hairs. Shampoo is generally used to remove dirt on hair. The dirt is removed by detergents. Shampoos have some side effect like drying, irritation on eyes. The drying effect of shampoo leaves the hair too dry and it is not handling by comb. So it is necessary for conditioning of the hair .So these things should be avoided by shampoo [12, 13].

Anti-Dandruff Shampoo:

In this type of shampoo it contains some specific function along with the cleansing action. Shampoo usually contain antidandruff agent, other medicinal agent like vitamins, amino acid, plant extract, antibacterial agent etc [13].

MATERIALS AND METHODS

Garlic was collected from local market. Soy lecithin were obtained from CD fine chemicals, tween 80 and Disodium Hydrogen Ortho Phosphate were obtained from Suvidinath lab, Sodium Lauryl Sulphate were obtained from Sulab lab, methanol, acetone, CMC, EDTA were obtained from Loba Chemie Pvt. Ltd., Mumbai and Potassium di-hydrogen Ortho Phosphate were obtained from Ranken lab. Chloroform was obtained from Qualigens Fine Chemical (Mumbai, India) Ltd. All other chemicals and solvents having of high analytical gradation were used in the present study.

Characterization of Garlic extract

Organoleptic study of Garlic extract:

The samples of Garlic extract were studied for organoleptic characters such as colour, odour and appearance.

Solubility of Garlic extract in Different Solvent:

The solubility of Garlic extract was checked in different organic solvent such as organic solvent, inorganic solvent and water.

Development of analytical method:

A. Preparation of standard stock solutions:

Standard stock solutions (100µg/mL) of Garlic were prepared separately. 1 mL of drug was dissolved in 10 mL of distilled water in 100 mL volumetric flask with shaking and then volume was made up to the mark with same solvent.

B. Preparation of standard calibration curves and selection of analytical concentration ranges:

For Allicin, appropriate aliquots of standard stock solution of the drug were transferred to a series of 10 mL volumetric flasks. The volume was made up to the mark with PBS pH 7.0 to obtain working standard solutions of concentrations of 10, 20, 30….50 µg/mL The absorbance's of three replicates of the working standard solutions of each concentration were measured at the

selected analytical wavelengths. The standard calibration curves of absorbance vs. concentration were plotted.
Formulation development
Selection of Formulation
1. On the basis of pH of Skin for diffusion
The pH of the skin is found to be 6.8.according to this batch lies on range of pH of skin.
2. On the basis of viscosity as spreadibility
The viscosity of shampoo is more important factor because of spreadibility on hairs.
Method of Preparation of Antidandruff Shampoo:
Preparation of phosphate buffer solution:
Phosphate Buffer of pH 6.8 at 0.2M: -
Dissolve 13.872 g of potassium dihydrogen

phosphate 35.084 g of disodium hydrogen phosphate in sufficient water to produce 1000 ml.
Extraction process of garlic:
Freshly prepared 500 gm garlic were taken and washed with the distilled water. Peeled and crushed in a pestle mortar than homogenized with the 1000 ml of phosphate buffer solution at pH 6.8 with homogenizer. The homogenates were squeezed through muslin cloth to remove the large particles. Centrifuged it for 20 minutes and supernant were collected, filtered, stored at definite temperature and residue were discarded. Freshly collected garlic extract used for the preparation of SLNs

Table 1 Compositions of different formulations of Allicin loaded SLNs:

Ingredients	Garlic Extract (ml)	Soy lecithin (ml)	Tween80 (ml)	CHCl$_3$:CH$_3$OH (ml)	Acetone (ml)
SLNs1	10	5	0.5	1:1	10
SLNs2	10	10	0.5	1:1	10
SLNs3	10	15	0.5	1:1	10
SLNs4	10	5	1.0	1:1	10
SLNs5	10	10	1.0	1:1	10
SLNs6	10	15	1.0	1:1	10
SLNs7	10	5	1.5	1:1	10
SLNs8	10	10	1.5	1:1	10
SLNs9	10	15	1.5	1:1	10

PREPARATION OF SLNs:
The SLNs were prepared by hot homogenization method.
i. Formation of lipid layer:
Lecithin was dissolved in 10 ml of acetone. Organic solvent were completely removed by using vacuum rotatory evaporator. Then the lipid layer was dissolved in a mixture of chloroform: methanol (5ml).
ii. Formation of aqueous phase:
An aqueous phase was prepared by dissolving given amount of Tween 80 in a 10 ml of the garlic extract (Allicin).
iii. Mixing process:
Both the organic phase and aqueous phase were heated individually at 70⁰c .Then aqueous solution was mixed to lipid solution followed by homogenization for 10 min by using homogenizer, then further

ultrasonicate for 20 minutes. The garlic loaded SLNs were obtained by allowing cooling at room temperature.
Preparation of Antidandruff Shampoo:
Firstly mixed Allicin loaded SLNs, peppermint oil, lemon oil, carboxy methyl cellulose (2% gel), SLS solution and made a solution in a non leaching clean glass or stainless steel container. EDTA are mixed in little amount of water and added into a SLNs containing solution. Add small amount of saturated solution of Nacl drop wise into it. Nacl acts as viscosity modifier by common ion effect. Add color, perfume and pack the shampoo in a suitable container for evaluation.

Table 2: Composition of Antidandruff shampoo containing allicin loaded SLNs

Ingredients	SH-SLNs 1	SH-SLNs 2	SH-SLNs 3	SH-SLNs 4	SH-SLNs 5	SH-SLNs 6	SH-SLNs 7	SH-SLNs 8	SH-SLNs 9
Allicin-SLNs (%)	6	6	6	6	6	6	6	6	6
Lemon Oil (%)	5	4	4	3.5	4	4	3	4	3
Peppermint Oil (%)	5	5	5	4.5	4	5	4	4	4
SLS (%)	57	58	58	59	59	59	60	60	61
CMC (%)	10.5	9	7.5	8.5	8	10	9.5	10	9
EDTA (%)	1	2.5	4	3	3.5	0.5	2	0.5	1.5
Colour	Light Pink	Light Pink	Light Pink	Light Pink	Light Pink	Light Pink	Light Pink	Light Pink	Light Pink
Perfume	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
Saturated Nacl Solution	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
Water	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S

Evaluation of Allicin loaded solid lipid nanoparticles:

a).**Measurement of zeta potential, particle size and poly dispersity index.**

By using Zetasizer, zeta potential were measured .In this method the samples were diluted with aqueous solution to get 50-200kcps and pH of sample from ranges 6.9-7.2. Zeta potential measurement was carried at 25^{0}C, and the electric field strength was 23.2V/cm[14, 15].

b) Scanning Electron Microscopy (SEM)

The SEM analysis of prepared allicin loaded SLN was performed for morphological studies. The formulations were placed in to circular aluminium stubs using double adhesive tape and coated with gold in HUS - 5 GB vacuum evaporator then it was observed in Hitachi S-3000 N SEM having acceleration voltage of 10 Kv and a magnification of 5000X .[14,15]

c) Entrapment efficiency

The Entrapment efficiency of prepared SLNs was determined by measuring the concentration of free drug in a dispersion medium. It was carried out at least 2 week after preparation due to crystallization. It was determined by adding 1 ml of nano-suspension in to 4 ml of water. Then centrifuged it for 90 min at 15,000 rpm. Then supernants were examined by UV/Vis spectrophotometer with further dilution in water at 324 nm. The amount of free drug was detected in the filtrate and the amount of incorporated drug was determined as a result of the initial drug minus. The entrapment efficiency was calculated by [15, 16].

%Entrapment efficiency = W (TOTAL DRUG-FREE DRUG) /W (TOTAL DRUG ADDED) × 100.

d) In-vitro drug release of allicin loaded SLNs:

The in vitro release of allicin from different SLNs dispersions was determined using the dialysis bag diffusion technique. Dialysis bag consists of 12,000-14,000 MW cut-off. Prior to the experiment, the membrane was washed with warm Milli-pore double distilled water (70°C) for 1 hrs and then rinsed thrice with Milli-pore water to remove the glycerine. 6 mL of suspension were placed inside the dialysis bag, tied at

both ends and dipped in the dissolution medium Stirring of the medium was maintained at 100 rpm using a magnetic bead and the temperature at 37±0.5°c. Two millilitres aliquot were withdrawn at preset time intervals and replaced by an equal volume of a fresh dissolution medium. After suitable dilution, the sample were determined spectrophotometrically by measuring the absorbance at 324 nm .The concentration of Allicin in test samples was calculated by using the regression equation of the calibration curve [14].

Evaluation of Antidandruff herbal shampoo containing Allicin loaded solid lipid nanoparticles:

a) Appearance:

The appearance of the prepared SLNs was visually observed in a black and white background.

b) Viscosity:

The viscosity of prepared Antidandruff shampoo was determined by viscometer.

c) pH testing

pH test were performed by using the standard pH paper [15,16]

d) Foaming Property

By using cylinder shake method the foam test determined [17, 18]

Procedure

1. 50 ml of the 1% shampoo solution was put into 500 ml graduated cylinder then it is covered with hand. Then it is shaken 12 times .the total volume of the foam content after 1 min were recorded.
2. Foam volume was calculated. After shaking the volume of foam at 1 min interval for 4 minutes were recorded.
3. That height of the foam reaches at level of 150 ml is best acceptable.

Foaming properties:

The shampoo should possess good foaming and cleansing property without damaging the hair. At the temperature of 40-45⁰c person wash the hair. It is replicated by hair. Safety of the product by using surfactant they cause irritation. The volunteer animal using for the studies.

Detection of foam height:

A = Foam +Water (V1)

B = Water Only (V2)

e) Spreadibility Testing:

1. Spreadibility testing was developed to access the spreading properties of the Liquids, cosmetics, oils.

2. This test method was developed to study the amount of spread of a sample.

Procedure:

1. Put a new sheet of aluminium foil on to the bench.
2. Choose a filter paper type (p5, p2) and weigh the sheet as accurately. Record this weigh as W1
3. Measure and record the total area of the filter paper.
4. Record the measurement as A
5. Carefully place the filter paper in the centre of the aluminium foil sheet.
6. Do not blend, fold or alter the filter paper .it should remain flat.
7. Choose liquid, cosmetic oil to be tested.
8. Draw several millimetres in to the BD 5ml syringes
9. Hold the syringe over the centre of the filter paper carefully pushes out 20 drops.
10. When 20 drops hit filter paper, start a timer or stopwatch to count down for 10 min. during 10 min liquid will spread in a uniform circular pattern of filter paper.
11. After 10 min filter paper removed from the aluminium foil base and cut it with scissors, cut whole saturated portion of the filter paper away from dry section. For better results.
12. Measure the diameter of the saturated portion of the filter paper. If spread was not perfect circle, then take several diameter readings around the spread area and determine an average diameter. Record the measurement of it.

Different methods to determine spreadibility

There are two methods of determining the percent spread of test liquid on the filter paper. They both the method are in-depended from each other.

i. It can be done by comparing the differences in dry weight.
ii. It can be done by measuring the difference in dry area [18].

f) In-vitro drug release study of herbal antidandruff shampoo

The in vitro release study of the prepared herbal antidandruff shampoo was carried out using Keshary–Chien (K.C) diffusion cell using a cellophane membrane in phosphate buffer pH 6.8 for 24 h. The membrane was mounted in K.C cell, kept at 37⁰C. The

shampoo was spread on donor side. Phosphate buffer pH 6.8 was used as the acceptor medium, from which samples were collected at regular intervals for 90 min and replaced with the same amount of buffer. The drug concentration on the receptor fluid was determined spectrophotometrically at 324 nm and calculated by using the regression equation of the calibration curve [19].

RESULTS AND DISSCUSION
PREFORMULATION STUDIES

Table 3: Organoleptic study of garlic extracts

S.No	Specification	Garlic Extract Remarks
1	Appearances	Liquid
2	Colour	Pale Yellow
3	Taste	Pungent
4	Odour	Characterstics Odour

Analyte the concentration range: calibration curve for Allicin:

After studying the UV spectra of allicin, it was found that they show maximum absorbance at 324 nm respectively. So absorbance at and 324.0 nm was considered as λmax for Allicin. The

Characterization of Garlic extracts (Allicin)
Organoleptic properties

The sample of Garlic extract (Allicin) was found to be pale yellow in color and liquid in nature with pungent taste and characteristics odour and shown on **Table 3**

Solubility of Garlic Extract:

The solubility profile of the Allicin was found that it is soluble in water, alcohol and acetone and shown on **Table 4**

Table 4: solubility study of garlic extract

S.No	Chemicals(10ml)	Garlic Extract (1ml)
1	Ethanol	Soluble
2	Methanol	Insoluble
3	Chloroform	Insoluble
4	Water	Soluble
5	Acetone	Soluble

calibration curve for licin in PBS pH 6.8 is shown in Figure 1 the graph of absorbance vs. concentration for Allicin was found to be linear in the concentration range of 0-10 μg/ml at 324nm. The r^2 of the calibration curve was found to be 0.999 and shown on **Table 5**

Table 5: Concentration and absorbance values for Allicin in PBS pH 6.8

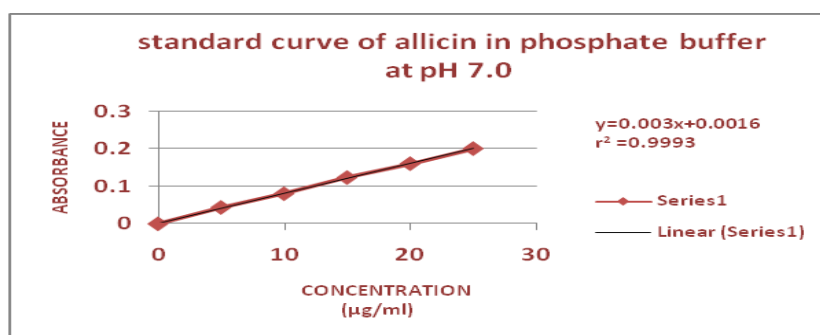| s.no	concentration(μg/ml)	Absorbance(nm)
1	0	0.000
2	10	0.043
3	20	0.080
4	30	0.123
5	40	0.160
6	50	0.200
REGRESSION COEFFIECIENT (r^2)		0.999
SLOPE		0.003
INTERCEPT		0.0016

Figure 1: Calibration Curve of Allicin in Phosphate Buffer pH 6.8 at λmax 324 nm.

Evaluation of Allicin Loaded Soild lipid nanoparticles:

Appearance of Allicin loaded Soild lipid nanoparticles:

The Appearance of Allicin loaded SLNs were found off white to white in colour and liquid to viscous in nature and better result was cream in colour and liquid in nature.

Zeta potential of Allicin loaded Soild lipid nanoparticles:

The zeta potential of Allicin- SLNs was observed and found to be-36.8Mv to -44.27

Mv and better quality to be-38.5 mV and shown on **Table 6**

Particle Size of Allicin loaded Soild lipid nanoparticles: The particle size of Allicin-SLNs was found to be 26.27nm to 33.25nm and better quality to be 31.11nm and shown on **Table 6**

Polydispersity index of Allicin loaded Solid lipid nanoparticles:

The Polydispersity index of Allicin-SLNs was found to be 0.483-0.862 and better result to be 0.657 and shown on **Table 6**

Table 6: Zeta Potential, Particle Size and PDI

S.no	Formulation	Pdi	Particle Size(nm)	Zeta Potential(Mv)
1	SLNs1	0.483	26.27	-36.8±3.22
2	SLNs2	0.361	28.64	-36.4±3.76
3	SLNs3	0.468	28.92	-36.6±4.10
4	SLNs4	0.633	29.56	-37.1±4.84
5	SLNs5	0.657	31.11	-38.5±5.16
6	SLNs6	0.692	31.58	-39.6±5.54
7	SLNs7	0.735	32.64	-39.8±4.69
8	SLNs8	0.794	32.82	-42.6±6.35
9	SLNs9	0.862	33.25	-44.7±7.25

The scanning electron microscopy (SEM) Allicin loaded SLNs

The scanning electron microscopy (SEM) Allicin loaded SLNs was performed and image was found and shown on **Figure 2**
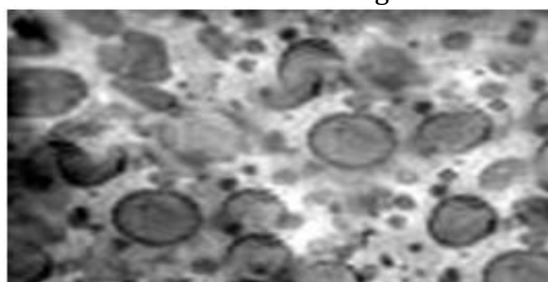

Figure 2: SEM image of SLNs5

Entrapment Efficiency: The Entrapment efficiency was calculated by using the formula and result were shown on **Table 7** and **Figure 3**
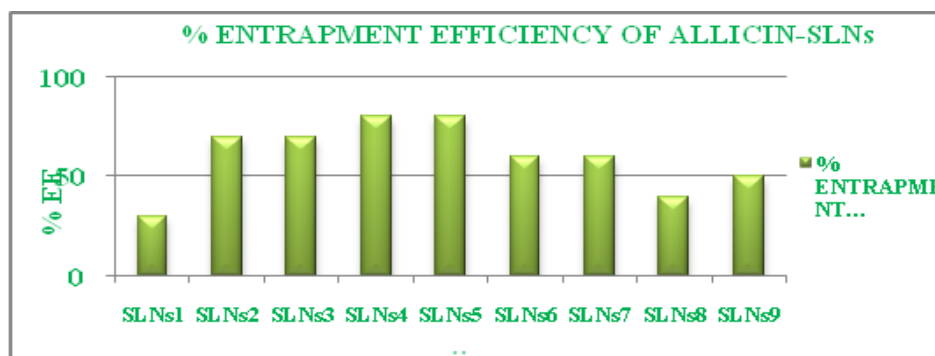

Figure 3: % Ententrapment Efficiency Of Allicin-SLNS

Table 7: Entrapment Efficiency of Allicin-SLNs

S.no	Formulation	Free drug content(ml)	Total drug content (ml)	%EE
1	SLNs1	0.7	1	30
2	SLNs2	0.3	1	70
3	SLNs3	0.3	1	70
4	SLNs4	0.2	1	80
5	SLNs5	0.2	1	80
6	SLNs6	0.4	1	60
7	SLNs7	0.4	1	60
8	SLNs8	0.6	1	40
9	SLNs9	0.5	1	50

In vitro drug release of Allicin-SLNs:
90 min in vitro dissolution study was done for allicin loaded SLNs formulation and following dissolution profile was shown on table no 8 and figure 4, 5, 6

Table 8: %Cumulative Release of Formulations

Time (min)	%Cumulative release of formulation								
	SLNs 1	SLNs 2	SLNs 3	SLNs 4	SLNs 5	SLNs 6	SLNs 7	SLNs 8	SLNs 9
0	0	0	0	0	0	0	0	0	0
15	15.33	18.51	23.12	20.36	22.74	19.85	18.55	19.64	20.17
30	22.15	30.75	40.5	35.24	38.75	37.21	31.42	32.61	34.43
45	47.62	45.12	57.31	53.24	56.79	52.19	49.53	54.12	56.93
60	52.13	59.31	62.31	68.4	63.89	60.77	63.45	60.44	65.14
75	60.99	75.65	80.75	83.94	84.52	81.95	76.34	73.42	84.81
90	74.77	83.35	92.64	94.3	95.81	93.33	84.24	80.11	92.34
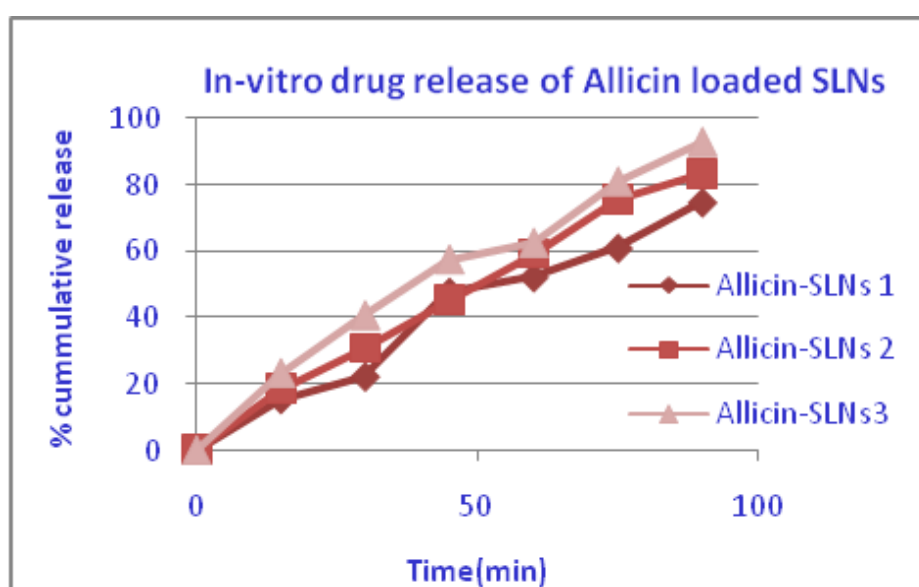
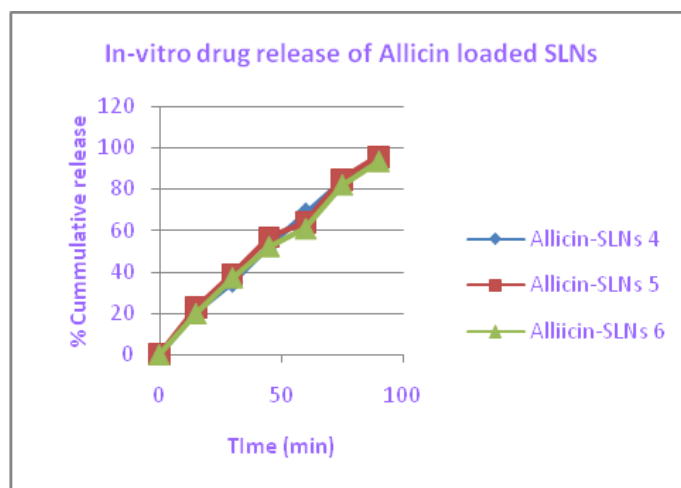**Figure 4: In-vitro Drug Release of Allicin-SLNs Formulation 1, 2, 3**

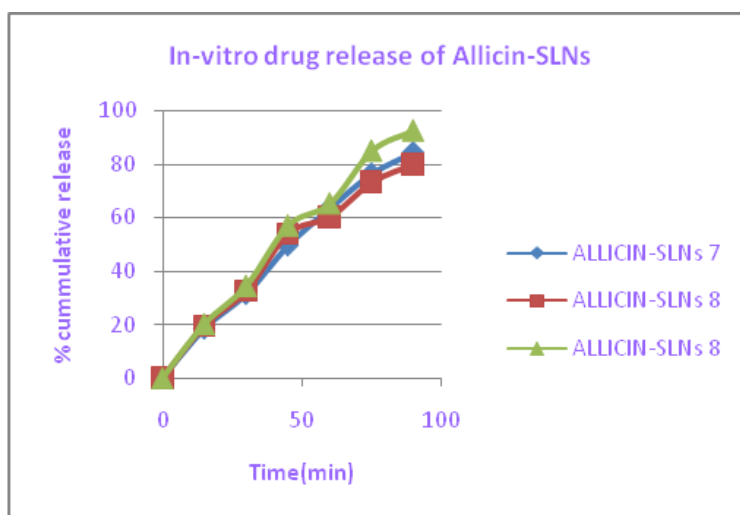**Figure 5: In-vitro drug release of Allicin-SLNs formulation 4, 5, 6**

Figure 6: In-vitro drug release of Allicin-SLNs formulation 7, 8, 9

Evaluation of Allicin Loaded Solid lipid nanoparticles:

Appearance The Appearance of herbal Antidandruff shampoo was visually observed and found to be fade in colour and gelly in nature to pink in colour but more gelly in nature and better result was found to be pink colour, liquid in nature shown on **Table 9**

Table 9: Physical Appearance

S.No	Batches	Physical Appearances
1	SH-SLNs 1	Fade in colour and gelly in nature
2	SH-SLNs 2	Fade in colour and sticky in nature
3	SH-SLNs 3	Pink in colour ,but more sticky in nature
4	SH-SLNs 4	Pink colour but more viscous
5	SH-SLNs 5	Pink Colour, Liquid In Nature
6	SH-SLNs 6	Pink colour, but slightly gelly in nature
7	SH-SLNs 7	Pink colour but more viscous in nature
8	SH-SLNs 8	Pink colour but gel formed
9	SH-SLNs 9	Pink colour but more gelly in nature.

Viscosity

The viscosity of herbal antidandruff shampoo was found to be 1010-1710 cps and better result was 1599 cps shown on table no:10

pH test:

The pH of herbal antidandruff shampoo was found to be 3.6-7.2 and better result was 6.6 shown on table no 10

%spread by weight= [(w1-w2)/w1]*100

W1=3.252

W2=1.74

= (3.252-1.74)/3.252*100

=1.512/3.252*100

=0.464*100

=46.4%

2. Determining percent spread by area:

This method is not exact as weighed method. To determining percent spread by area,

Calculate as follows: A1=πr^2

=3.14*9.6*9.6

=289.38

A2=3.14*7**7

=153.86

%spread by area=(A2/A1)/100

=(153.86/289.38)*100

=0.531*100

=53.1%

Foamability test:

The Foamability of formulation was found to be 157 ml and shown on table no 10

Calculation: -V1=209 Ml

After 5 Minutes   V1 =148

V2 =   50 Ml

=V1-V2

=207-50

=157ml

Spreadibility

The spreadibility of herbal antidandruff shampoo was found to be 46.4% and53.1% and shown on table no 10

Calculation:

1. Determining percent spread by weight:

Firstly the dry filter paper was weighed and eliminates any variables like liquid, viscosity or evaporative rate

Table 10: Viscosity, pH, Foaming Property and Spreadibility

S.NO	BATCHES	VISCOSITY(cps)	pH	FOAMING PROPERTY	SPREADIBILITY
1	SH-SLNs 1	1010cps	3.7		
2	SH-SLNs 2	1040cps	4.6		
3	SH-SLNs 3	1210cps	5.3		%spread by
4	SH-SLNs 4	1430cps	5.6	157ml	weight=46.4%
5	SH-SLNs 5	1599 cps	6.6		Spread by
6	SH-SLNs 6	1610cps	6.4		area=53.1%
7	SH-SLNs 7	1640cps	6.5		
8	SH-SLNs 8	1690cps	6.8		
9	SH-SLNs 9	1710cps	7.2		

In-vitro release of the drug herbal Antidandruff shampoo:

The In-vitro release of the drug herbal Antidandruff shampoo of formulations SH-

SLNs were performed and shown on table no 11and figure 7,8,9.

Table 11: In-Vitro Release of the Drug Herbal Antidandruff Shampoo of Formulations

| Time (min)	SHSLNs 1	SH-SLNs2	SH-SLNs3	SH-SLNs 4	SH-SLNs 5	SH- SLNs 6	SH- SLNs 7	SH-SLNs 8	SH-SLNs9
				%Cumulative release of formulation					
0	0	0	0	0	0	0	0	0	0
15	27.24	26.41	27.77	24.32	31.22	29.42	23.41	28.34	26.1
30	37.94	38.72	41.22	45.21	48.94	47.85	42.64	46.45	45.31
45	45.22	43.64	45.15	67.25	68.77	59.34	63.84	66.96	52.15
60	66.2	62.74	63.24	76.41	79.24	69.82	73.52	72.34	63.44
75	75.33	73.12	75.1	89.45	89.87	71.35	86.33	80.11	73.19
90	79.26	83.41	85.11	91.21	94.66	93.25	90	91.43	80.4
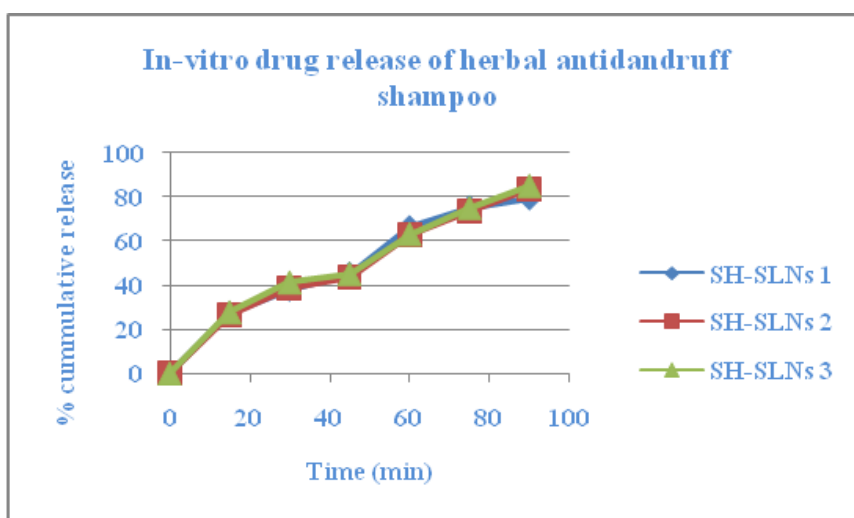
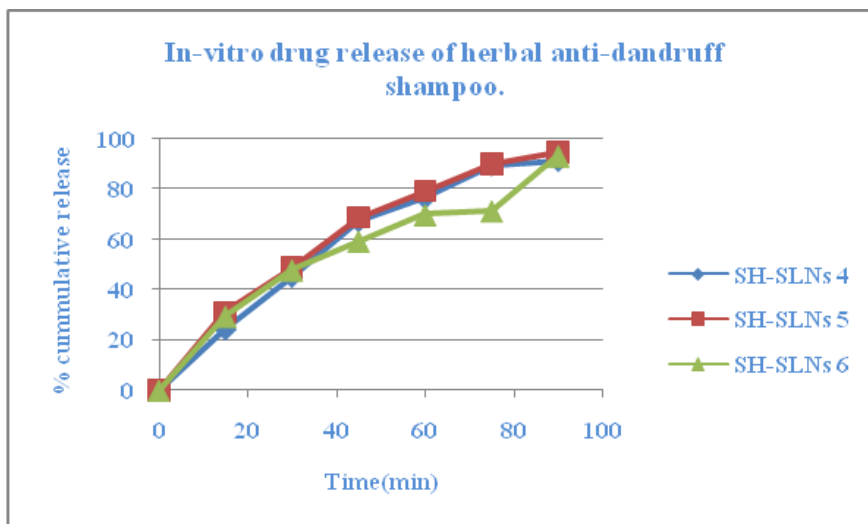**Figure 7: In-Vitro Release of the Drug Herbal Antidandruff Shampoo of Formulation 1,2,3**

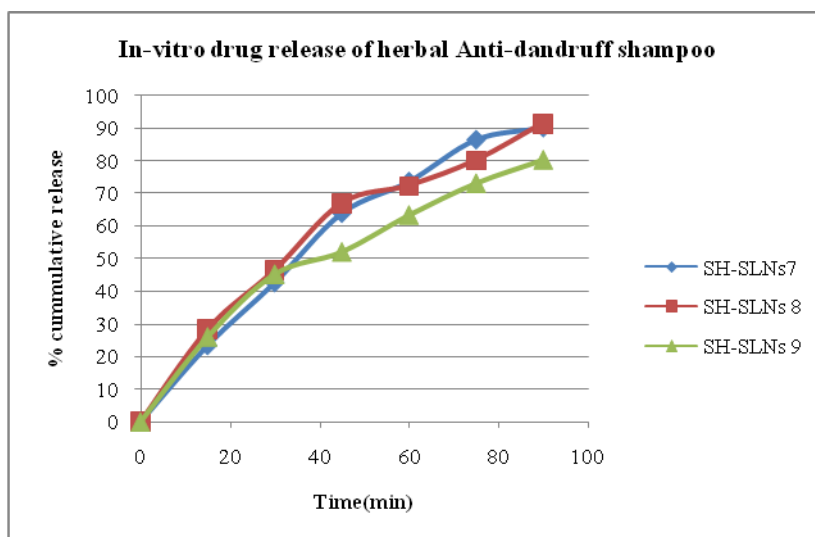**Figure 8: In-Vitro Release of The Drug Herbal Antidandruff Shampoo of Formulation 4,5,6**

Figure 9: In-Vitro Release of the Drug Herbal Antidandruff Shampoo of Formulation 7, 8, 9

CONCLUSION

Allicin (which is extracted from garlic) contain antifungal activity and it is generally used in a home-made preparation. While using the garlic for long term use it inhibited the fungal infection/dandruff. Here the formulation of antidandruff shampoo, firstly prepared the allicin loaded solid lipid nanoparticles. SLNs were prepared by using hot homogenization method for better control release over the kinetics, very long term stability and actual amount of drug to be encapsulated. Here the formulation of allicin loaded SLNs prepared by using the soy lecithin, tween 80, drug and some organic solvent. Soy lecithin is used as a phospholipids, Tween 80 as a surfactant. Surfactant can act as a wetting agent and lowering the surface tension of solution. Then it was evaluated by using zeta potential, particle size, SEM and drug loaded capacity to achieve desired SLNs. Now, Antidandruff shampoo were prepared by homogenization method, by using the drug, EDTA, CMC, saturated solution of Nacl solution, sodium lauryl sulphate, peppermint oil, lemon oil etc. sodium lauryl sulphate is used as a n anionic surfactant. Lemon oil is also act as a anti- dandruff agent and also act as a perfume. At different concentration of SLS were used for the evaluation parameter the batches were concluded and optimized. Allicin loaded SLNs herbal Antidandruff shampoo was prepared successfully.

REFERENCES

1. Saint D L., The history of dandruff and dandruff in history, A HOMAGE TO RAYMOND SABOURAUD ANN DERMATOL VENEREOL, 1990; 117: 23- 27.
2. Gupta A K, Batra R, Bluhm R, Boekhout T, Dawson TL Jr. Skin disease associated with Malassezia species .JOURNAL AM ACAD DERMATOL 2004;51:785-98.
3. Pitard C F, Xhauflaire E U, Pitard G.E,Revisiting dandruff, INTERNATIONAL JOURNAL OF COSMETIC SCIENCE 2006;28: 311-318.
4. Pitard C F, Pitard G E, Klingman A, Seasonal modulation of the sebum excreation, DERMATOLIGICA 1990;181:21-22
5. Vijayanthi G, Kulkarni C, Abraham A, Kolhapure SA. Evaluation of antidandruff activity and safety of polyherbal hair oil, AN OPEN PILOT CLINICAL TRIAL, THE ANTISEPTIC 2004;101(9):368-372.
6. Amdt K A, Hsu J T. MANNUAL OF DERMATOLOGIC THERAPEUTICS. LIPPINCOTT WILLIAMS AND WILKINS PHILADELPHIA PA, 2007,7;180-184.
7. Saint DL, Klingman AM, Stoudemeyer T J, The Role of resident micro flora in the pathogenesis of dandruff, JOURNAL OF SOC. COSMETIC CHEMI. 1988; 40:109-117.
8. The medicinal uses of garlic/natural holistic health blog."NATURAL- HOLISTIC- HEALTH .COM. 2009;06-02.

9. Michael D. Triplett, Enabling Solid Lipid Nanoparticles Drug Delivery Technology by Investigating Improved Production Techniques, 2004.
10. Melike U, Gulgun Y, INT. J. NANOMEDICINE, 2(3), 289-300 (2007).
11. Kaur IP , Bhandari,R., Bhandari S.,and Kakkur. J. CONT. REL., 127, 97-109 (2008).
12. Houli Li, Xiaobin Zhao, Yukun Ma and Guangxi Zhai, Ling Bing Li and Hong Xiang, Lou. J. CONT. RELEASE, 133, 238-244 (2009).
13. Mithal B.M. and Saha R.N. A Handbook of Cosmetic Vallabh Prakashan, New Delhi, First edition,2002, 110-120.
14. Thatipamula RP., Palem CR., Gannu R., Mudragada S.,Yamsani MR. formulation and in vitro characterization of domperidone laded solid lipid nanopaticle and nanostructured lipid carriers:jouranls tumesac ir. 2011;(19):23-32
15. Griffin j .j.,Corcoran R,F,Akana K.K.,JOURNAL OF CHEMISTRY, 54 th ,1977;553-554.
16. Sagarin E (editor). Cosmetic science and technology. Sydney interscience publishers;1957.p.205-218.
17. Butler H(editor). Poucher's perfume, cosmetics and soaps.10, kluwer academic publishers.p.289-306, 555-601
18. klevin k .,cosmetics and toiletries magazine :2004;119(10):32-35.
19. Jain D.K, Darwhekar G, Duttswami K.M, Development and evaluation of anti dandruff hair styling gel containing fluconazole and zinc pyrithione, PHARAMTUTO R,2012:1-5.