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Research Article

DEVELOPMENT AND IN-VITRO EVALUATION OF NICOTINE TROCHES FOR SMOKING CESSATION

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ABSTRACT

Objective: Nicotine replacement therapy is a way of getting nicotine into bloodstream without smoking. The present investigation aims to design, prepare and evaluate compressed tablet lozenges or troches of nicotine 2mg for low dependent smokers and, 4mg for high dependent smokers, sugar free troches. The benefits of these prepared lozenges are increased bioavailability, reduction in gastric irritation by reducing first pass metabolism.

Method: The lozenges were prepared by wet granulation method.

Results and discussion: All the formulations prepared were subjected to various physico-chemical parameters like hardness, content uniformity, friability, weight variation etc.The prepared formulations have a hardness of 9-12 Kg. /cm^2. Sugar free troches with kyron T 114 (1:4 molar ratio) for 2mg and (1:6 molar ratio) for 4mg showed decreased burning after taste and pungent odor and provided good taste. Stability study of selected formulations was also carried out at 37ºC for a period of six months. Selected formulations were tested for drug excipient interactions subjecting to FTIR Spectral analysis. In-vitro drug dissolution studies showed 100% for optimized formulations.

Conclusions: Sugar free troches are useful for diabetic smokers. Troches can provide an attractive alternative formulation in the Nicotine replacement therapy.

Keywords: Nicotine; Troches; Lozenges; Hydroxyl Propyl Methyl Cellulose

INTRODUCTION

Nicotine is a drug that is inhaled from the tobacco in cigarettes. It gets into the bloodstream and stimulates the brain. Most regular smokers are addicted to nicotine.

In a regular smoker, if the blood level of nicotine falls, he usually develops withdrawal symptoms such as restlessness, increased appetite, inability to concentrate, irritability, dizziness, constipation, nicotine craving, or just feeling awful. These symptoms begin within a few hours after having the last cigarette. If they are not relieved by the next cigarette, withdrawal symptoms get worse. If he does not smoke any more, the withdrawal symptoms peak after about 24 hours, and then gradually ease over about 2-4 weeks. So, most smokers smoke regularly to feel 'normal', and to prevent withdrawal symptoms. About 2 in 3 smokers want to stop smoking but, without help, many fail to succeed. The main reason why so few smokers succeed, even though they want to stop smoking, is because nicotine addiction is strong and difficult to break. This is where NRT can help. Nicotine replacement therapy (NRT) is a way of getting nicotine into the bloodstream without smoking

Lozenges are solid preparations that contain one or more medicaments, usually in a flavored, sweetened base, and that are intended to dissolve or disintegrate slowly in the mouth. They can be prepared by molding (gelatin and/or fused sucrose and sorbitol base) or by compression of sugar-based tablets. Molded lozenges are sometimes referred to as pastilles, whereas compressed lozenges may be referred to as troches. They are intended to be allowed to dissolve on the back surface of the tongue to provide drug delivery locally to the mouth, tongue, throat, etc., to minimize systemic and maximize local drug activity.

MATERIALS AND METHODS

Materials

Nicotine was obtained as gift sample from Merck schuchardt, Germany. Hydroxy propyl methyl cellulose (HPMC) K4m, K15 M, HPMC 100 cps, PVP K90 were gift samples from Dr. Reddy's laboratories, Hyderabad. Mannitol, Aspartame, Sucrose were purchased from SD Fine chemicals. PEG 4000, PEG 6000, Propylene glycol were purchased from, Merck Ltd,Mumbai.

Method of preparation for Nicotine troches

Required amounts of ingredients were weighed as shown in table 1-2, and passed through 25- mesh sieve. In the granular Portion the blend of nicotine, polymer, PEG 6000, mannitol, half of the amount of color and aspartame were mixed for 10min and PVP K-90 was added. The mixture was then granulated and the resulting wet mass passed through 18-mesh sieve. The granules were dried at 70°C for approximately 10-15min.Then the dried granules were passed through 25-mesh sieve, blended with magnesium stearate, Aerosil and talc. Flow properties of the dried granules were determined. In the extra Granular portion the blend of sugar, menthol, flavor and half of the amount of color and aspartame were mixed for 10min. then it is blended with magnesium stearate, Aerosil and talc. Now to this extra granular portion, intra granular portion was added and mixed for 10min.The resulted mixture was then compressed into tablets having an average weight of 1250 mg using 16 station rotary tablet compression machine (Riddhi,Ahmadabad,India) fitted with 17 mm punches.

Table 1: Composition of Nicotine compressed Lozenges / Troches. (Nicotine dose=2mg)

Ingredients (mg)	FORMULATION CODE									
	NT1	**NT2**	**NT3**	**NT4**	**NT5**	**NT6**	**NT7**	**NT8**	**NT9**	**NT10**
Nicotine	2	2	2	2	2	2	2	2	2	2
HPMC K4M	3.125	6.25	12.5	25	-	-	-			
HPC	-	-	-	-	12.5	25	50			
HPMC 100Cps	-	-	-	-	-	-	-	12.5	18.75	25
PEG 6000	40	40	40	40	40	40	40	40	40	40
Mannitol	751.38	748.25	742	729.5	738	725.5	700.5	738	719.25	694.25
Sugar	350	350	350	350	350	350	350	350	350	350
PVP K90	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Aspartame	50	50	50	50	50	50	50	50	50	50
Menthol	4	4	4	4	4	4	4	4	4	4
Aerosil	10	10	10	10	10	10	10	10	10	10
Talc	12	12	12	12	12	12	12	12	12	12
Magnesium stearate	12	12	12	12	12	12	12	12	12	12
Orange colour	6	-	6	-	6	-	6	-	6	-
Yellow colour	_	6	_	6	_	6	_	6	_	6
Orange flavor	6	-	6	-	6	-	6	-	6	-
Mango flavor	_	6	_	6	_	6	_	6	_	6
Total weight	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250

Table 2: Composition of Nicotine compressed Lozenges / Troches. (Nicotine dose=4mg)

Ingredients (mg)	FORMULATION CODE									
	NT11	**NT12**	**NT13**	**NT14**	**NT15**	**NT16**	**NT17**	**NT18**	**NT19**	**NT20**
Nicotine	4	4	4	4	4	4	4	4	4	4
HPMC K4M	3.125	6.25	12.5	25	-	-	-	-	-	-
HPC	-	-	-	-	12.5	25	50	-	-	-
HPMC 100Cps	-	-	-	-	-	-	-	12.5	18.75	25
PEG 6000	40	40	40	40	40	40	40	40	40	40
Mannitol	699.375	694.25	690	677.5	686	673.5	648.5	686	667.25	642.25
25# Sugar	400	400	400	400	400	400	400	400	400	400
PVP K90	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Aspartame	75	75	75	75	75	75	75	75	75	75
Menthol	6	6	6	6	6	6	6	6	6	6
Aerosil	10	10	10	10	10	10	10	10	10	10
Talc	12	12	12	12	12	12	12	12	12	12
Magnesium stearate	12	12	12	12	12	12	12	12	12	12
Orange colour	-	-	-	-	_	-	-	_	-	-
Yellow colour	6	6	6	6	6	6	6	6	6	6
Orange flavour	_	-	-	-	_	_	-	_	_	-
Mango flavour	8	8	8	8	8	8	8	8	8	8
Total weight	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250

Table 3: Composition of Nicotine Sugar free Troches

Ingredients	FORMULATION CODE					
	N SF1	**N SF2**	**N SF3**	**N SF4**	**N SF5**	**N SF6**
Nicotine	2	2	2	4	4	4
HPMC K4M	3.125	_	_	3.125	_	_
HPC	-	50	_	_	50	-
HPMC 100Cps	_	-	12.5	_	_	12.5
PEG 6000	40	40	40	40	40	40
MCC	837.375	800.5	838	785.375	748.5	786
PVP K90	7.5	7.5	7.5	7.5	7.5	7.5
Aspartame	300	300	300	350	350	350
Menthol	4	4	4	6	6	6
Aerosil	10	10	10	10	10	10
Talc	12	12	12	12	12	12
Magnesium stearate	12	12	12	12	12	12
Orange colour	6	6	6	_	-	-
Yellow colour	_	_	_	6	6	6
Orange flavour	6	6	6	_	_	-
Mango flavour	_	_	_	8	8	8
Total weight	1250	1250	1250	1250	1250	1250

Method of preparation for sugar free nicotine troches

Required amounts of ingredients were weighed as shown in table 3 and passed through 25- mesh sieve. The blend of nicotine, polymer, PEG 6000, color and aspartame were mixed for 10min and PVP K-90 was added. The mixture was then granulated and the resulting

Wet mass was passed through 18-mesh sieve.The granules were dried at 70°C for approximately 15-20min. Then the dried granules were passed through 25-mesh sieve, blended with magnesium stearate, Aerosil, menthol, flavour and talc. Flow properties of the dried granules were determined. The dried granules were then compressed into tablets having an average weight of 1250 mg using 16 station rotary tablet compression machine (Riddhi, Ahmadabad, India) fitted with 17 mm punches.

Method of preparation for nicotine sugar free troches with Kyron T 114

Required amounts of ingredients were weighed as shown in table 4 and passed through 25- mesh sieve. The blend of nicotine, Kyron T 114, polymer, PEG 6000, colour and aspartame were mixed for 10min and PVP K-90 was added. The mixture was then granulated and the resulting wet mass passed through 18-mesh sieve.The granules were dried at 70°C for approximately 15-20min. Then the dried granules were passed through 25-mesh sieve, blended with magnesium stearate, Aerosil , menthol, flavour and talc. Flow properties of the dried granules were determined. The dried granules were then compressed into tablets having an average weight of 1250 mg using 16 station rotary tablet compression machine (Riddhi, Ahmadabad, India) fitted with 17 mm punches

Table 4: Composition of Nicotine sugar free Troches with Kyron T 114

Ingredients (mg)	Formulation code N SF7	N SF8	N SF9	N SF10	N SF11	N SF12
Nicotine	2	2	2	4	4	4
HPMC K4M	3.125	_	_	3.125	_	_
HPC	-	50	_	_	50	-
HPMC 100Cps	_	-	12.5	_	_	12.5
Kyron T 114	16	16	16	40	40	40
PEG 6000	40	40	40	40	40	40
MCC	821.5	784.5	822	745.375	708.5	746
PVP K90	7.5	7.5	7.5	7.5	7.5	7.5
Aspartame	300	300	300	350	350	350
Menthol	4	4	4	6	6	6
Aerosil	10	10	10	10	10	10
Talc	12	12	12	12	12	12
Magnesium stearate	12	12	12	12	12	12
Orange colour	6	6	6	_	-	-
Yellow colour	_	_	_	6	6	6
Orange flavor	6	6	6	_	_	-
Mango flavor	_	_	_	8	8	8
Total weight	1250	1250	1250	1250	1250	1250

Evaluation of the developed formulations

The prepared Nicotine lozenges were studied for their physicochemical properties like weight variation, hardness, thickness, friability and drug content.

Weight variation test

Twenty lozenges were taken and their weight was determined individually and collectively on a digital weighing balance. The average weight of one lozenge was determined from the collective weight. The weight variation test would be a satisfactory method of determining the drug content uniformity. The percent deviation was calculated using the following formula (Sandip et al., 2003).

% Deviation = (Individual weight – Average weight / Average weight) × 100

Lozenge hardness

Hardness of lozenge is defined as the force applied across the diameter of the tablet in order to break the tablet. The resistance of the tablet to chipping, abrasion or breakage under condition of storage transformation and handling before usage depends on its hardness. For each formulation, the hardness of 6 tablets was determined using pfizer hardness tester and the average was calculated and presented with standard deviation.

Lozenge thickness

Lozenge thickness is an important characteristic in reproducing appearance. Twenty tablets were taken and their thickness was recorded using Digital Micrometer (Digital Caliper, Aerospace, India). The average thickness for troches is calculated and presented with standard deviation.

Friability

It is a measure of mechanical strength of tablets. Roche friabilator (Electrolab, Mumbai, India) was used to determine the friability by following procedure. Pre-weighed troches (20 troches) were placed in the friabilator. The troches were rotated at 25 rpm for 4 minutes (100 rotations). At the end of test, the troches were re-weighed; loss in the weight of troches is the measure of friability and is expressed as:

% Friability = $[(W_1 – W_2) / W_1] \times 100$

Where **W_1 = Initial weight of 20 lozenges**
W_2 = Weight of the 20 lozenges after testing

Determination of drug content

Twenty lozenges were finely powdered; quantities of the powder equivalent to 40mg of nicotine were accurately weighed, transferred to a 100 ml volumetric flask containing 50 ml of distilled water and allowed to stand for 30min with intermittent sonication to ensure complete solubility of the drug. The mixture was made up to volume with distilled water. The solution was suitably diluted and the absorption was determined by UV-Visible spectrophotometer at λ_{max} 262nm. The drug concentration was calculated from the standard curve.

In vitro drug release studies

Dissolution conditions:

- Apparatus : USP I apparatus
- Dissolution medium : 500ml of pH 6.7 Phosphate buffer
- Temperature : 37±0.5^0 C
- Rotating speed of the paddle: 25 rpm
- Sample time intervals : 5, 10,15,20,25,30 minutes
- Detection : UV-VIS spectrophotometer at λ_{max} 262 nm

The samples were withdrawn at predetermined time points, diluted appropriately and were analyzed spectrophotometrically at 262 nm.

Taste evaluation of Nicotine hard candy lozenges.

Taste assessment studies were conducted according to the approved protocol (with human ethical committee approval letter number UCPSc/KU/BA/2011-10/B) on 5 low dependent smokers and 5 high dependent smokers. All the volunteers signed an informed consent form. Nicotine troches 2mg, 4mg with HPMC K4M 0.25% (NT1, NT11), HPC 1% (NT5, NT15), HPMC 100Cps 1% (NT8, NT18) with and without sweetener were provided randomly to 5 low dependent smokers and 5 high dependent smokers respectively. Nicotine sugar free troches 2mg, 4mg with HPMC K4M 0.25% (NSF7, NSF10), HPC 1% (NSF8, NSF11), HPMC 100Cps 1% (NSF9, NSF12) with and without sweetener were provided randomly to 5 low dependent Diabetic smokers and 5 high dependent diabetic smokers respectively. Subjects scored the intensity of bitterness, mouth feel and after taste by placing the given formulation on the tongue, tasting it for one minute, and thoroughly rinsing their mouths with water after each sample evaluation. After the taste evaluation, urge to smoke was decreased or not also reported in the volunteer evaluation sheet.

Each volunteer judged the above given parameters of the formulation using a score involving a five point scale which ranged from + to +++++. Guide for taste evaluation was presented in the table 7.

Table 7: Guide for taste assessment studies of Nicotine lozenges.

Parameter	Product Elegance		Taste		Decrease of urge to smoke	Mouth feel		After taste
1	Bad	+	Bitter	+	yes	Bad	+	yes
2	Acceptable	++	Slightly bitter	++		Unpleasant	++	
3	Good	+++	Tolerable	+++		Tolerable	+++	
4	Very Good	++++	Acceptable	++++	No	Good	++++	No
5	Excellent	+++++	Good	+++++		Pleasant	+++++	

RESULTS AND DISCUSSIONS

Preformulation studies

Drug-Excipient compatibility studies by physical observation:

Nicotine mixed with various proportions of excipients showed no color change at the end of two months, proving no drug-excipient interactions.

Drug-Excipient compatibility studies by FT-IR

The FT-IR spectra of pure drug nicotine is shown in the figure 1. The characteristic

Peaks of nicotine are well retained in the spectrum even in final formulations.

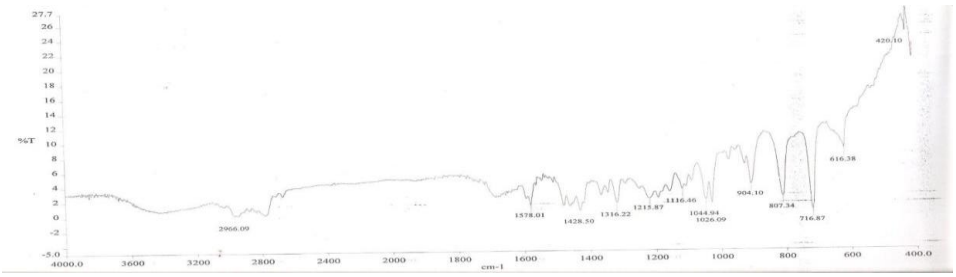

Fig.1: FT-IR spectra of Nicotine pure drug

The FT-IR spectra of Nicotine Troches containing HPMC K4M are shown in the figure 2. The characteristic peaks of nicotine are well retained in the spectrum representing that there is no significant interaction between drug and excipients.

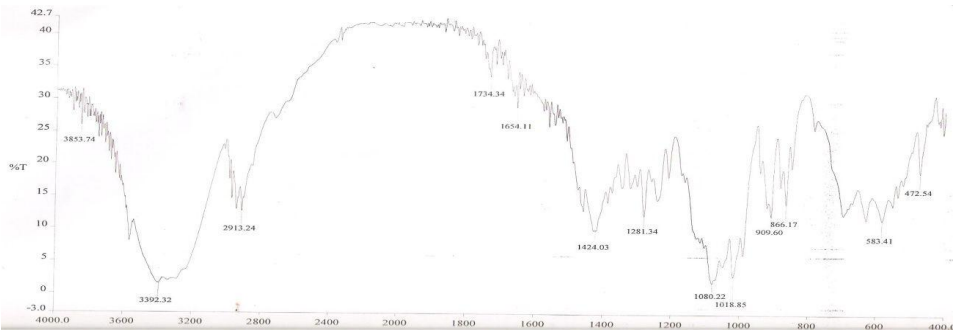

Fig.2: FT-IR spectra of Nicotine Troches containing HPMC K4M

The FT-IR spectra of Nicotine sugar free Troches containing HPMC 100Cps are shown in the figure 3. The characteristic peaks of Nicotine is well retained in the spectrum representing that there is no significant interaction between drug and excipients.

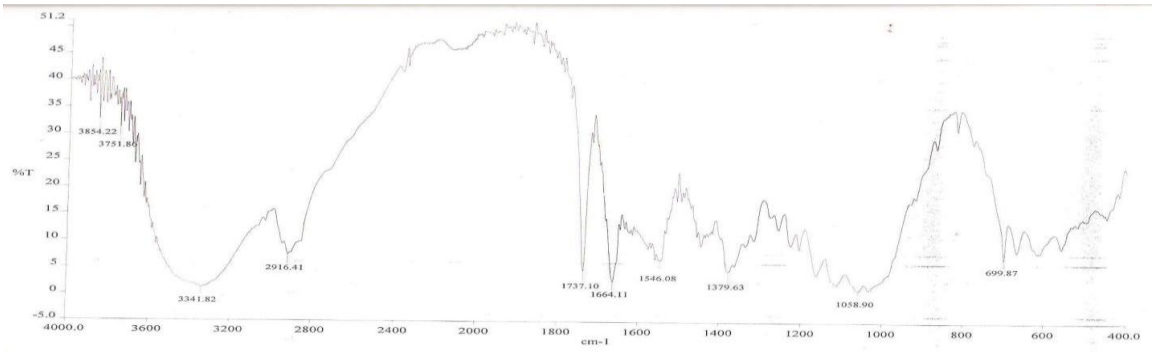

Fig. 3: FT-IR spectra of Nicotine sugar free troches containing HPMC 100Cps.

The FT-IR spectra of Nicotine sugar free Troches containing kyron T 114 are shown in the figure 4. The characteristic peaks of nicotine are well retained in the spectrum representing that there is no significant interaction between drug and excipients.

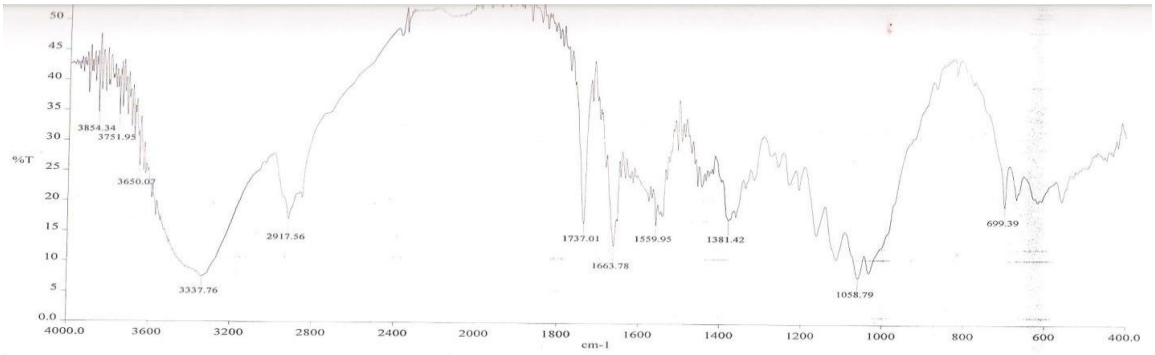

Fig.4: FT-IR spectra of Nicotine sugar free Troches containing Kyron T 114

Standard graph of nicotine in 6.7 pH phosphate buffer

Standard stock solutions of pure drug containing 100 mg of nicotine /100 ml were prepared in pH 6.7 phosphate buffer. The working standard solutions were obtained by dilution of the stock solution in pH 6.7 phosphate buffer. The calibration curves (Figure 5) for nicotine were prepared in the concentration range of 0.2-10 µg/ml at the selected wavelength 262 nm. Their absorptivity values were used to determine the linearity. Solutions were scanned and Beer Lamberts law was obeying the range of 0-16ug/ml.

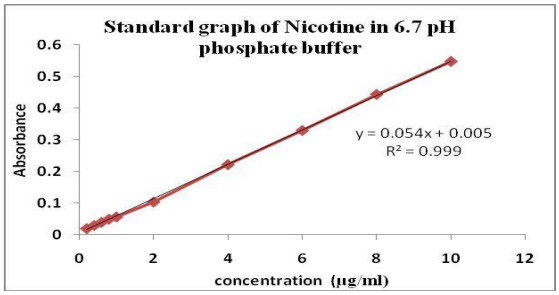

Fig.5: Standard graph of nicotine in pH 6.7 phosphate buffer

Table 5: Flow properties of granules of various formulations

Formulation	Bulk density (g/cm³)	Tap density (g/cm³)	C.I (%)	H.R	Angle of repose
NT1	0.52	0.56	7.14	0.92	21.80
NT2	0.49	0.53	7.54	0.92	23.26
NT3	0.50	0.56	10.71	0.89	20.80
NT4	0.51	0.55	7.27	0.92	22.78
NT5	0.48	0.53	9.43	0.90	25.86
NT6	0.52	0.57	8.77	0.91	26.31
NT7	0.51	0.55	7.27	0.92	23.99
NT8	0.49	0.54	9.25	0.90	27.97
NT9	0.50	0.56	10.71	0.89	22.39
NT10	0.51	0.56	8.92	0.91	23.21
NT11	0.50	0.57	12.28	0.87	26.32
NT12	0.48	0.54	11.11	0.88	25.24
NT13	0.53	0.58	8.62	0.91	26.45
NT14	0.49	0.53	7.54	0.92	23.49
NT15	0.52	0.57	8.77	0.91	28.92

Evaluation of process parameters

Determination of flow properties of granules

Various properties of granules such as bulk density, tap density, Carr's Index, Hausner's Ratio and angle of repose were determined and the results are shown in the table 5,6. The results of the physical tests of the blends were found to be within the limits and the granules were found to be freely flowing.

Table 6: Flow properties of granules of various formulations.

Formulation	Bulk density (g/cm³)	Tap density (g/cm³)	C.I (%)	H.R	Angle of repose
NT16	0.52	0.56	7.14	0.92	21.80
NT17	0.49	0.53	7.54	0.92	23.26
NT18	0.50	0.56	10.71	0.89	20.80
NT19	0.51	0.55	7.27	0.92	22.78
NT20	0.48	0.53	9.43	0.90	25.86
N SF1	0.52	0.57	8.77	0.91	26.31
N SF2	0.51	0.55	7.27	0.92	23.99
N SF3	0.49	0.54	9.25	0.90	27.97
N SF4	0.50	0.56	10.71	0.89	22.39
N SF5	0.51	0.56	8.92	0.91	23.21
N SF6	0.50	0.57	12.28	0.87	26.32
N SF7	0.48	0.54	11.11	0.88	25.24
N SF8	0.53	0.58	8.62	0.91	26.45
N SF9	0.49	0.53	7.54	0.92	23.49
N SF10	0.52	0.57	8.77	0.91	28.92
N SF 11	0.50	0.57	12.28	0.87	26.32
N SF12	0.48	0.54	11.11	0.88	25.24

Evaluation of developed troches

All 32 formulations were tested for Physical parameters like Hardness, thickness, Weight Variation, Friability and found to be within the Pharmacopeia limits. The drug content of all the formulations was determined and was found to be within the permissible limit. This study indicated that all the prepared formulations were acceptable. The results of the physical tests of the formulations were within the limits and comply with the standards.

In-vitro drug release profile

The cumulative percentage drug release profiles from various formulations of Nicotine troches with a dose of 2mg, 4mg containing HPMC K4M, HPC, and HPMC 100Cps are represented in figures 6-13. The cumulative percentage drug release profiles from the formulations NT1, NT2, NT3, NT4 (nicotine dose is 2mg), NT11, NT12, NT13, NT14 (nicotine dose is 4mg) containing HPMCK4M in 0.25%, 0.5%, 1%, 2% concentrations respectively is shown in figures 6, 9 respectively. NT1, NT11 containing HPMC K4M (0.25%) showed 100% drug release in 30minutes. The cumulative percentage drug release profiles from the formulations NT5, NT6, NT7 (Nicotine dose is 2mg), NT15, NT16, NT17 (Nicotine dose is 4mg) containing HPC 1%, 2%, 4% respectively showed in figures 7, 10 respectively. NT5, NT15 containing HPC 1% showed 98.34%, 99.345% drug release in 30minutes. The cumulative percentage drug release profiles from the formulations NT8, NT9, NT710 (Nicotine dose is 2mg), NT18, NT19, NT20 (Nicotine dose is 4mg) containing HPMC 100Cps 1%, 1.5%, 2% respectively showed in figures 8, 11 respectively. NT8, NT18 containing HPMC 100Cps 1% showed 99.72%, 96.786% drug release in 40minutes.

The optimized formulations containing HPMC K4M (0.25%), HPC (1%), HPMC 100Cps (1%) were formulated into sugar free troches. The cumulative percentage drug release of optimized formulations NSF1, NSF2, NSF3 (Nicotine dose is 2mg), NSF4, NSF5, NSF6 (Nicotine dose is 4mg) are represented in figures 12, 13.

From the drug release kinetics of the optimized formulations, the R^2 values of zero order kinetic models is very near to 1. Thus it can be said that the drug release follows zero order kinetics.

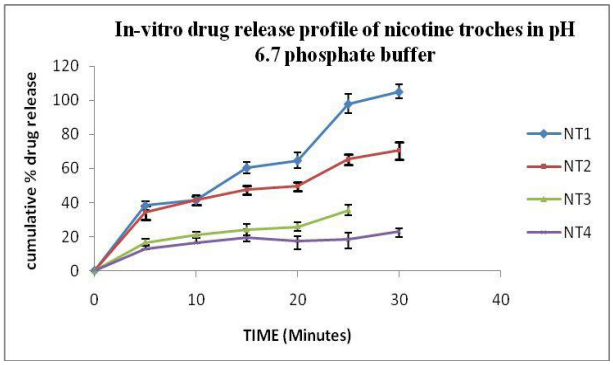

Fig.6: In-vitro drug release profile of nicotine troches containing HPMC K4M in pH 6.7 phosphate buffer.

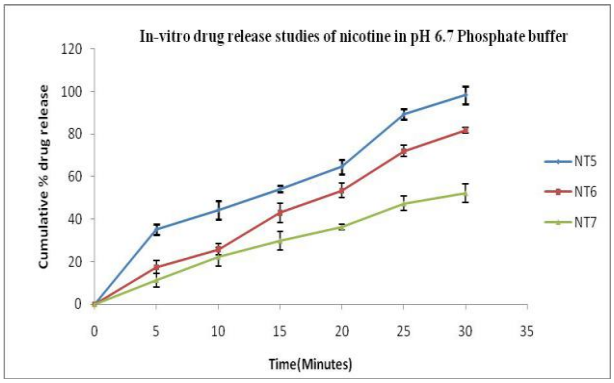

Fig.7; In-vitro drug release profile of nicotine troches containing HPC in pH 6.7 phosphate buffer.

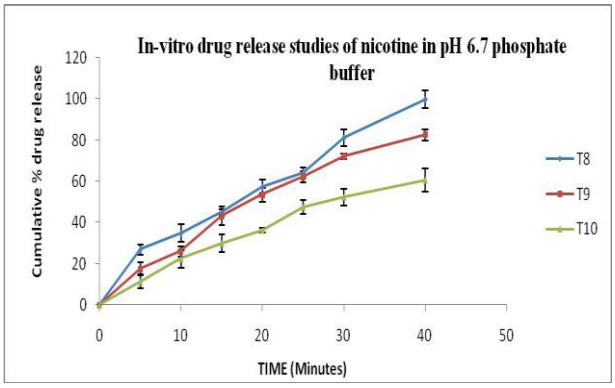

Fig.8: In-vitro drug release profile of nicotine troches containing HPMC 100Cps in pH 6.7 phosphate buffer

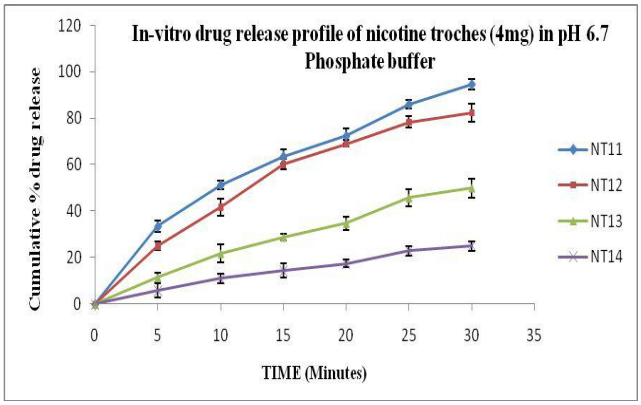

Fig.9: In-vitro drug release profile of nicotine troches containing HPMC K4M in pH 6.7 phosphate buffer.

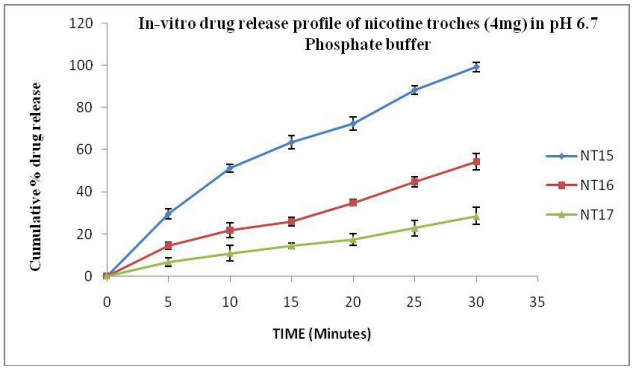

Fig.10: In-vitro drug release profile of nicotine troches (dose 4mg) containing HPC in pH 6.7 phosphate buffer.

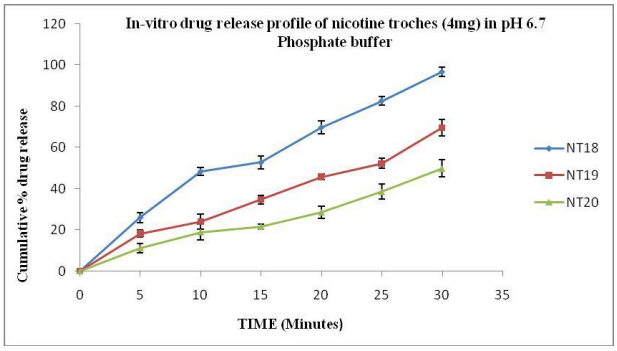

Fig.11: In-vitro drug release profile of nicotine troches containing HPMC 100Cps in pH 6.7 phosphate buffer.

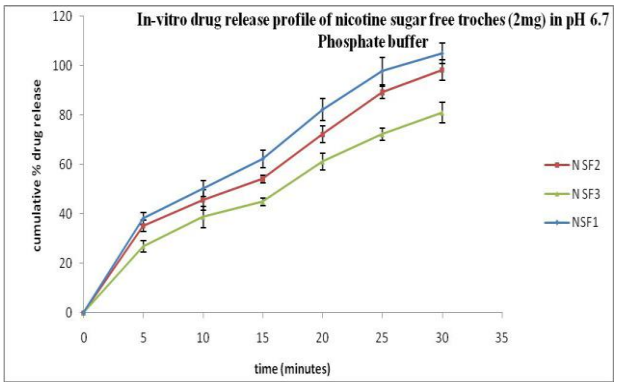

Fig.12: In-vitro drug release profile of nicotine sugar free troches (dose 2mg) containing HPMC K4M, HPC and HPMC 100 Cps in pH 6.7 phosphate buffer respectively.

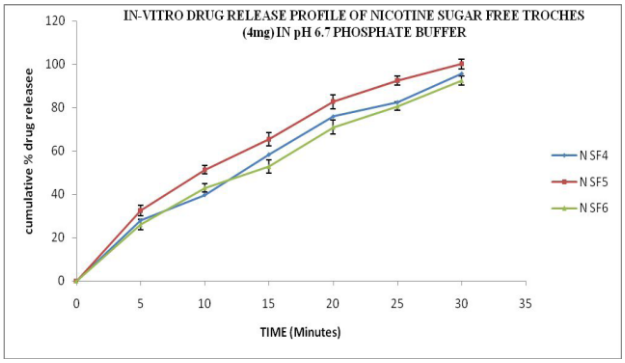

Fig.13: In-vitro drug release profile of nicotine sugar free troches (dose 4mg) containing HPMC K4M, HPC and HPMC 100 Cps in pH 6.7 phosphate buffer respectively.

Taste Assessment studies

Taste evaluation results for optimized formulations with and without sweetener were given in Table 8. Formulations having no sweetener were bitter to most of the volunteers. Seven out of ten volunteers rated the lozenges pleasant while the others reported an acceptable taste for optimized formulations (Table 8). A smooth and low grittiness was also reported which could be due to the water soluble excipients. On comparison of the results for the taste evaluation of Nicotine troches, it was concluded that the addition of sweetener to Lozenges further suppressed the pungent odor and burning after taste and provided a pleasant sweet taste. Effective taste-masking was achieved for nicotine troches with aspartame without any after taste effect. Aspartame itself couldn't mask the taste of nicotine in sugar free troches so we incorporated Kyron T114 in sugar free troches and effective taste-masking was achieved for nicotine sugar free troches with Kyron T114 without any pungent odor and burning after taste effect. A pleasant mouth feel was also reported by the volunteers due to the presence of peppermint flavor.

Table 8: Taste assessment studies

Optimized Formulations	Taste	Mouth feel	After taste	Urge to smoke
Without sweetener	+	+	+ +++	decreased
With sweetener	++++	++++	+	decreased

CONCLUSIONS

Nicotine troches and sugar free troches with a dose of 2mg; 4mg were developed and evaluated. Drug excipient compatibility studies by FTIR showed there was no incompatibility between drug and excipients. Developed nicotine troches were evaluated for various physico-chemical evaluation parameters and were found to be within the standard limits. Nicotine troches 2mg, 4mg with HPMC K4M 0.25% (NT1, NT11), HPC 1% (NT5,NT15), HPMC 100Cps 1% (NT8, NT18) were optimized. The optimized formulations showed 100% release within 30minutes. From the drug release kinetics all the optimized formulations followed zero order release kinetics. Nicotine sugar free troches were developed for the diabetic smokers. But the pungent odor and burning after taste of nicotine was not masked in sugar free troches so in order to mask the taste, Kyron T 114 (Taste masking agent) was included in the sugar free troches and optimized concentration of taste masking agent for both nicotine 2mg and 4mg sugar free troches are 1:4 Molar ratio of drug: kyron T 114(NSF 7,8,9 formulations) and (1:6 Molar ratio of drug: kyron T 114 (NSF 10,11,12 formulations) respectively. Smoking cessation and taste evaluation of nicotine troches, sugar free troches were conducted in smokers. From the taste assessment studies it was concluded that formulations containing aspartame in Nicotine troches and kyron T 114 in Nicotine sugar free troches showed good taste and acceptable mouth feel. At last it was concluded that Nicotine troches are attractive alternative dosage form in nicotine replacement therapy.

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