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RESEARCH ARTICLE

Comparison and Evaluation of Bitter Taste Masked Levocetrizine diHCl Using β-Cyclodextrin and Kyron T-114

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ABSTRACT

The purpose of this study was to evaluate the possibility of taste masking of Levocetirizine dihydrochloride (L-CTZ) by means of inclusion complexation and ion exchange resin. Initially an attempt was given to mask the bitter taste of the drug by inclusion complexation with β-Cyclodextrin using kneading method. But from gustatory evaluation, it was found that β-Cyclodextrin was not proven good for effective taste masking. So, another attempt was given to mask bitter taste of Levocetrizine diHCl by Kyron T-114 (weak cation exchange resin). It is a water-insoluble, high molecular weight, cross linked polymer of methacrylic acid. Kyron T-114 is inexpensive and this method is simple, rapid and cost-effective method for taste masking. Ion exchange resin complex was prepared by the batch technique and various parameters viz. resin activation, drug: resin ratio, pH, temperature, swelling time and stirring time were optimized to successfully formulate the tasteless Drug Resin Complex (DRC). Maximum drug loading was obtained when the resin was activated by acid treatment, with 1:3 drug: resin ratio, soaked in water for 90 min. and stirred with the drug for 240 minutes, pH maintained 5.5 and temperature maintained 30°C. Complexation was confirmed by FT-IR and DSC study. The drug resin complex was evaluated for taste *in-vitro* and *in-vivo* evaluation. The volunteers rated the complexes as tasteless and agreeable. Drug release from DRC in salivary pH was insufficient to impart bitter taste. Complete drug release was observed at gastric 0.1 N HCl (pH 1.2). Formulation of drug resin complex was confirmed by FT-IR and DSC studies.

KEYWORDS

Taste Masking, Kyron T-114, Levocetrizine dihydrochloride, Inclusion complex, Drug Resin Complex.

INTRODUCTION

Oral delivery is currently the gold standard in the pharmaceutical industry where it is regarded as the safest, most convenient and most economical method of drug delivery having the highest patient compliance. Orally disintegrating drug delivery systems are a new generation of formulations which combine the advantages of both liquid and conventional tablet formulations and at the same time, offer added advantages over both the traditional dosage forms. However, as a result of the rapid disintegration in mouth, the active substance comes in contact with the taste buds and the need for a pleasant taste becomes a key aspect for patient palatability.[1]

Thus, the taste-masking of bitter active substances is a critical hurdle to overcome for the successful development of oral formulations. In general, oral administration of bitter active substances through oral formulations should provide an improved degree of palatability,

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increased patient compliance and a concomitantly beneficial therapeutic effect.[2]

Levocetrizine dihydrochloride is an orally active and R-enantiomer of cetrizine, is a third generation, non-sedating selective peripheral H_1-receptor antagonist used in seasonal allergic rhinitis, perennial allergic rhinitis and chronic urticaria. Allergy is common problem among all age groups. Levocetrizine dilHCl is rapidly absorbed after oral administration and half life is 8.3 hr makes it suitable for once a day formulation. These diseases require rapid onset of action in order to provide fast relief. Unfortunately, it is accompanied with a very unpleasant bitter taste; however, the source or mechanism behind this bitterness is not clear, but it has been stated that it binds to the membrane receptor present on the apical taste cells, leading to bitterness. Due to this reason it requires taste masking.[3]

MATERIALS AND METHODS

Levocetrizine dihydrochloride and β-Cyclodextrin was gifted from West Coast Pharmaceutical Works Ltd. Ion exchange resin Kyron T-114 and Superdisintegrant Kyron T-314 were kindly gifted from Corel Pharma chem., Ahmedabad. Pearlitol Flash was supplied from Roquette Pharma, Germany. Superdisintegrants Vivasol®GF and Vivastar®P was received from JRS PHARMA GMBH & CO. KG, Germany. Polyplasdone XL-10 (Zydus Cadila) was used as superdisintegrant.

Methods

Taste Masking of Levocetrizine diHCl using β-Cyclodextrin[4, 5, 6]

Development of ODT of Levocetrizine diHCl is challenging due to its very bitter taste. For taste masking of Levocetrizine diHCl inclusion complexation technique was employed using β-Cyclodextrin.

Preparation of Inclusion Complex of Levocetrizine diHCl with β-Cyclodextrin

Method: Kneading Method[7, 8, 9]

Amounts of the Levocetrizine diHCl and β-CD to give 1:0.5, 1:0.75, 1:1 and 1:1.25 molar ratios were weighed and thoroughly mixed then triturated by addition of few drops of water in mortar and pestle. The slurries were kneaded for 60 min to get paste, and dried at 40°C. The dried complex was sieved through 80 # and stored in airtight container.

Characterization of Inclusion Complex[10, 11, 12]

FT-IR Spectroscopic Analysis

Levocetrizine diHCl, β-CD and inclusion complex were subjected for FT-IR studies. Samples were prepared using KBr disc method and spectra were recorded over the range 400 cm^{-1} to 4000 cm^{-1}. Spectra were analyzed for drug- β-CD interactions and functional groups involved in the complexation process.

Differential Scanning Calorimetry (DSC) Analysis

DSC scans of the powdered samples were recorded for confirmation of complexation. The samples were hermetically sealed in aluminum pans and heated over the temperature range 40°C to 350°C at heating rate of 10°C under inert nitrogen dynamic atmosphere (100 ml/min).

% Drug Content

Complex equivalent to 5 mg Levocetrizine diHCl was stirred with 100 ml of 0.1 N HCl for 60 min so as to release the entire Levocetrizine diHCl from inclusion complex. The mixture was filtered and 1 ml of the filtrate was diluted to 10 ml using 0.1 N HCl. The absorbance of this solution was measured at λmax 231.6 nm using 0.1 N HCl as blank and the content of Levocetrizine diHCl was estimated.

In-Vitro Dissolution Study

Complex equivalent to 5 mg Levocetrizine diHCl was subjected to dissolution studies using IP Type I dissolution test apparatus at 37±0.5°C at 50 rpm speed. 900 ml of 0.1 N HCl was used as dissolution medium. Aliquot equal to 5 ml was withdrawn after 5 min. intervals (for total 30 min.) and amount of Levocetrizine diHCl released from inclusion complex was determined at λmax 231.6 nm.

Gustatory Evaluation of Levocetrizine diHCl-β-CD Complex

Each eight healthy human volunteer was given weighed amount of Levocetrizine-β-CD Complex equivalent to 5 mg of Levocetrizine. Before testing, the volunteers were asked to retain the reference solutions in their mouths for 10 sec., and the taste perceived by each volunteer was noted.

Taste Masking by Complexation with Ion Exchange Resin

In recent days, taste masking by complexing the drug with ion exchange resins (IER) is becoming more popular. Release of drug from ion exchange complex is pH dependent. This method does not increase the particle size of the drug and they are stable to compression process. So, selection of taste masking method was primarily focused on complex with ion exchange resin. Preparation of resinate is normally done by two techniques: Batch and Column technique. In present study batch technique was used.

Method: Batch Technique[13]

100 mg of Kyron T-114 was allowed to swell separately in 100 ml of deionized water for 90 min on a magnetic stirrer at moderate speed. 100 mg of Levocetrizine diHCl was added to each of them and stirred for 4 hrs. Slurry was filtered and the residues i.e. resinate or drug resin complex (DRC) was washed again with 75 ml of deionized water and dried at 50°C. Then DRC was evaluated for drug content.

Optimization of Various Conditions for Maximum Drug Loading[14, 15, 16]

Drug loading process was optimized for maximum drug loading considering conditions like effect of resin activation, drug: resin ratio, pH, temperature, resin swelling time and stirring time.

Activation of Resin

Changing the ionic form of IER might occasionally be required to convert a resin from one form to another, if it does not have the desired counter ions. Strongly acidic Cation Exchange Resins are usually marketed in Na^+ form and strongly basic Anion Exchange Resins in Cl^- form. They are generally converted into hydrogen and hydroxide forms, respectively. The conversion can be achieved by soaking the resins with acid or alkali solutions, respectively. After changing the ionic form, the resin is subjected to washing with distilled water until elute becomes neutral in reaction, and finally is dried at 50°C. [13]

The effect of activation of resin on drug loading was studied. 100 mg of resin, placed on a whatmann filter paper in a funnel, was washed with deionized water and subsequently with 1 N HCl (100 ml). The resin was rewashed with deionized water until neutral pH was reached. DRC was prepared in the same way as discussed earlier using 100 mg each of Levocetrizine diHCl and acid activated resin. Similarly, alkali activation of resin was done, replacing 1 N HCl with 1 N NaOH. Finally, Kyron T-114 was also activated with combined treatment of 1 N HCl and 1 N NaOH solutions. Drug loading efficiency in each case was determined.

Optimization of Drug: Resin Ratio

100 mg of Levocetrizine diHCl was added to each of the five beakers containing 100, 200, 300 and 400 mg of resin swelled in 100 ml of deionized water. The mixture was stirred for 4 hrs. DRC was collected by filtration, washed with deionized water and evaluated for drug content.

Optimization of pH

pH was optimized by preparing DRC using 100 mg each of Levocetrizine diHCl and 300 mg resin (optimized ratio 1:3) in 100 ml of deionized water and adjusting pH like 1.2, 2, 3, 4, 5, 5.5, 6 and 7 using standard solutions of HCl and NaOH. Loading efficiency was determined at these conditions.

Optimization of Temperature

Temperature was optimized by preparing DRC using 100 mg Levocetrizine diHCl and 300 mg resin in 100 ml of deionized water and set temperature at 20°C, 30°C, 40°C, 50°C, and 60°C using temperature controlled magnetic stirrer.

Loading efficiency was determined at these conditions.

Optimization of Resin Swelling Time

Optimization of resin swelling time was carried out by keeping 300 mg of resin in each of the beakers containing 100 ml of deionized water for 30, 60, 90 and 120 min respectively on magnetic stirrer. DRC was prepared as described above using 100 mg of Levocetrizine diHCl and percent drug loading was estimated.

Optimization of Stirring Time

For optimizing stirring time, DRC was prepared by stirring 100 mg of Levocetrizine diHCl with 300 mg of resin in 100 ml of deionized water separately for 30, 60, 90, 120, 180, 210, 240 and 300 min and percent drug loading was evaluated.

Characterization of DRC[17, 18, 19]

FT-IR Spectroscopic Analysis

Levocetrizine diHCl, Kyron T-114, and DRC were subjected for FT-IR studies. Samples were prepared using KBr disc method and spectra were recorded over the range 400 cm^{-1} to 4000 cm^{-1}. Spectra were analysed for drug- resin interactions and functional groups involved in the complexation process.

Differential Scanning Calorimetry (DSC) Analysis

DSC scans of the powdered samples were recorded. The samples were hermetically sealed in aluminum pans and heated over the temperature range 40° to 350°C at heating rate of 10°C under inert nitrogen dynamic atmosphere (100 ml/min).

%Drug Content

DRC equivalent to 5 mg Levocetrizine diHCl was stirred with 100 ml of 0.1 N HCl for 60 min., so as to release the entire Levocetrizine diHCl from DRC. The mixture was filtered and 1 ml of the filtrate was diluted to 10 ml using 0.1 N HCl. The absorbance of this solution was measured at λmax 231.6 nm using 0.1 N HCl as blank and the content of Levocetrizine diHCl was estimated. Same procedure was carried out with phosphate buffer pH 6.8 at λmax 231.0 nm.

In-Vitro Dissolution Study

DRC equivalent to 5 mg Levocetrizine diHCl was subjected to dissolution studies using IP Type I dissolution test apparatus at 37±0.5°C at 50 rpm speed. 900 ml of 0.1 N HCl was used as dissolution medium. Aliquot equal to 5 ml was withdrawn at regular intervals (for total 30 min.) and amount of Levocetrizine diHCl released from DRC was determined at λmax 231.6 nm. Same procedure was carried out with phosphate buffer pH 6.8 at λmax 231.0 nm.

Gustatory Evaluation of DRC

Each eight healthy human volunteer was given weighed amount of Drug Resin Complex equivalent to 5mg of Levocetrizine. Before testing, the volunteers were asked to retain the reference solutions in their mouths for 10sec., and the taste perceived by each volunteer was noted.

RESULTS AND DISCUSSION

Taste Masking by Formation of Complexes with β-CD

Different molar ratios of L-CTZ and β-CD were prepared by kneading method.

Characterization of Complex

Confirmation of Complexation by FT-IR Spectroscopic Analysis

A weak absorption peak at 1737.55 cm^{-1}, indicating that there was no interaction between the carbonyl of the L-CTZ molecule and the β-CD molecule. In other words, the hydrophilic –COOH part of L-CTZ apparently could not be enter into the hydrophobic cavity of β-CD. Therefore, it could be concluded that only two parts of L-CTZ, the phenyl ring and chlorophenyl ring, could be included in the cavity of β-CD. The narrowing and shifting of the value of C-H stretch of L-CTZ peak to lower i.e. from 2947.66 cm^{-1} to 2933.2 cm^{-1} in inclusion complex confirms the complexation of the phenyl ring group in the drug with β-CD.

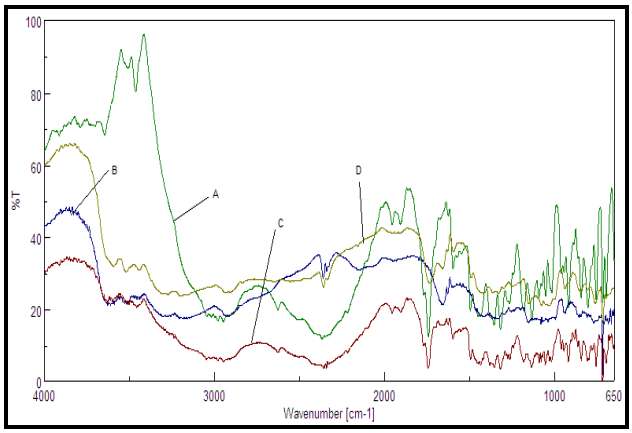

Figure 1: FT-IR spectra of (A) L-CTZ (B) β-CD (C) L-CTZ: β-CD [Physical mixture] (D) L-CTZ: β-CD [1:1 M Complex]

Confirmation of Complexation by DSC Analysis

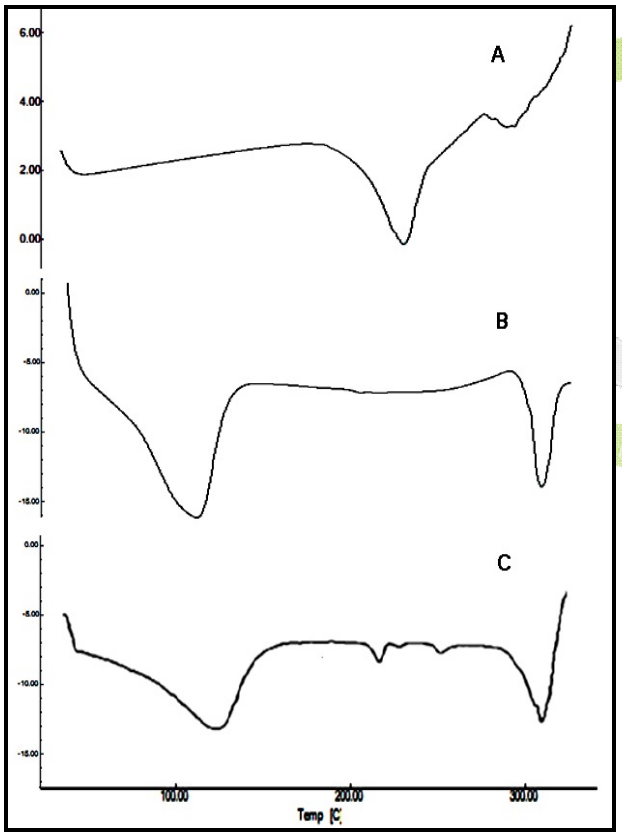

Figure 2: DSC Thermograms of (A) L-CTZ (B) β-CD (C) L-CTZ: β-CD [1:1 M Complex]

DSC thermograms of Levocetrizine diHCl, β-cyclodextrin and inclusion complex (1:1 molar ratio) are illustrated in Figure 2. The thermogram of β-CD showed a broad peak at 115.15°C, attributed to desolvation of water molecules present in β-CD cavity and a relatively sharp peak at 320.54°C corresponding to its melting point. Levocetrizine diHCl exhibited a sharp peak at 219.0°C which corresponds to its melting point. The existence of an interaction between two components can be obtained by thermal analysis (DSC). When guest molecules are included in the β-CD cavity, their melting, boiling and sublimation points usually shift to a different temperature or disappear. On the other hand, no intense peak over the melting range of Levocetrizine diHCl was found in the DSC thermogram of inclusion complex, which clearly indicates that the drug was completely embedded in β-CD cavity and confirmation of complexation.

% Drug Content

Table 1: %Drug Content of Different Molar Ratios

Ratio	%Drug Loading in 0.1 N HCl	%Drug Loading in pH 6.8 buffer
1:0.5 M	88.79 % ± 1.55	90.42 % ± 2.35
1:0.75 M	91.79 % ± 2.75	92.53 % ± 2.15
1:1 M	**95.65 % ± 1.32**	**98.51 % ± 2.36**
1:1.25 M	94.05 % ± 1.09	95.76 % ± 1.42

The % drug loading was determined for different molar ratios of inclusion complexes of L-CTZ and β-CD. It was found that ratio 1:1 gave maximum drug loading of 95.65% ± 1.32% and 98.51% ± 2.36% in 0.1 N HCl and phosphate buffer pH 6.8 respectively.

In-Vitro Drug Release Study

The dissolution profile of inclusion complexes showed that Molar ratio 1:1 gave complete drug release of 98.26% and 97.43% within 10

minutes in 0.1 N HCl and pH 6.8 buffer respectively. Thus, molar ratio 1:1 ratio was optimized.

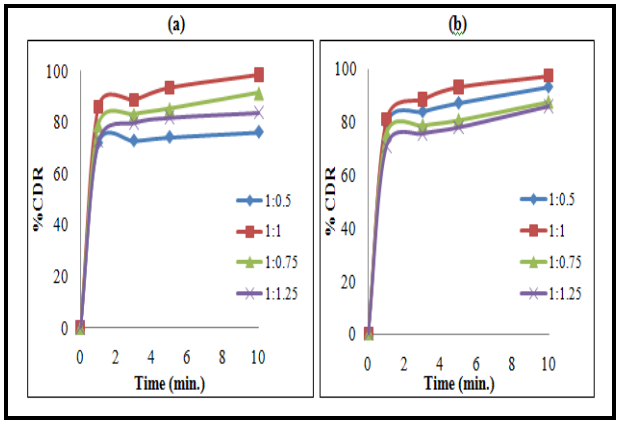

Figure 3: Cumulative % Drug Release of Inclusion Complexes in (a) 0.1 N HCl (b) Phosphate buffer pH 6.8

Gustatory Evaluation of Levocetrizine diHCl - β-CD Complex

Here, in this study complexation of Levocetrizine diHCl with β-CD was carried out in order to mask the bitter taste. So, gustatory evaluation was carried out to determine that whether it masked bitter taste of Levocetrizine diHCl or not.

Table 2: Bitterness Evaluation of Levocetrizine diHCl - β-CD Complex by Panel of 8 Volunteers

Name	Observation of Taste			
	1:0.5M	1:0.75M	1:1M	1:1.25M
1	3	2.5	2.5	2.5
2	3	3	2.5	2
3	3	2.5	2	2.5
4	3	3	2	2.5
5	2.5	3	2	2
6	3	3	2	3
7	3	2.5	2.5	3
8	3	2.5	2	3

Table 3: Scale for Bitterness Evaluation

Scale	Bitterness Value
0	Tasteless
0.5	Very Slightly bitter
1	Slightly bitter
1.5	Slightly to moderately bitter
2	Moderately bitter
2.5	Moderate to strong bitterness
3	Strong bitterness
3+	Very strong bitterness

Seven of eight volunteers sense strong bitter taste in 1:0.5 ratio of L-CTZ-β-CD complex. In case of 1:0.75 molar ratio, four volunteers sense strong bitter taste while others sense moderate to strong bitter taste. Further evaluation of bitterness in case of 1:1, five volunteers sense the moderately bitter taste while three volunteers sense moderate to strong bitterness. With 1:1.25 molar ratio two volunteers feel moderately bitter taste while three volunteers sense moderate to strong bitter taste and rest of them sense strong bitterness. So, 1:1 ratio was optimized based on result of bitterness evaluation but as all of the ratios gave taste above scale 2, that means β-CD was not proven good for taste masking purpose of Levocetrizine diHCl.

Taste Masking by Complexation with Ion Exchange Resin

A drug–resin complex is made from the bitter drug and ion exchange resin. The nature of the complex is such that the average pH of 6.8 and cation concentration at about 40 meq/lit in saliva are not able to break the drug–resin complex but it is weak enough to be broken down by the hydrochloric acid present in the stomach, thus the drug–resin complex is absolutely tasteless and stable, with no aftertaste.

Optimization of Various Conditions for Maximum Drug Loading

Optimization of Resin Activation

Activation of Kyron T-114 was carried out for changing the ionic form of resin for complexation with drug.

Table 4: Effect of Resin Activation on Drug loading

Resin Activation	Drug Resin Ratio	% Drug Loading
Acid	**1:1**	**58.25 %**
Alkali	1:1	39.92 %
Acid-Alkali	1:1	41.69 %

Optimization of Drug-Resin Ratio

Acid treated ratio of 1:1 gave maximum drug loading i.e. 71.59 %. The resin so activated exposed the exchangeable groups producing rapid ion exchange hence highest drug binding. Loading was not significantly increased when resin was used in proportions more than this. When Drug: Resin ratio increased i.e. 1:4, drug loading was decreased.

Table 5: Effect of Drug-Resin Ratio on Drug loading

Drug Resin Complex Ratio	% Drug Loading
1:1	38.08 %
1:2	46.43 %
1:2.5	50.93 %
1:3	**71.59 %**
1:3.5	56.85 %
1:4	36.85 %

Optimization of pH

Levocetrizine diHCl- Kyron T-114 complexation involves the exchange of ionizable drug and hydrogen ions in resin, which in turn depends on the pKa of drug and resin. Such a mode of complexation between basic group of Levocetrizine diHCl and –COO-H^+ functionality of Kyron T-114 can be affected by the pH of the reacting media. pH affects the extent of drug loading process. It was observed that optimum drug loading was achieved at pH 5.5 and was not much increased at pH higher than this.

Table 6: Effect of pH Drug Loading

pH	% Drug Loading
1.2	30.22 %
2	36.04 %
3	55.52 %
4	61.17 %
5	69.18 %
5.5	**81.22 %**
6	76.48 %
7	73.88 %

Optimization of Temperature

The effect of temperature on drug loading on resin was shown in table 6. Efficient drug loading on Kyron T-114 occurred uniformly in the experimental temperature 30ºC.

Table 7: Effect of Temperature on Drug Loading

Temperature(°C)	% Drug Loading
20	72.92 %
30	**85.01 %**
40	81.22 %
50	64.64 %
60	60.39 %

Optimization of Resin Swelling Time

It was noted that the resin requires proper swelling time for maximum drug loading.

Swelling and hydration increases the rate and extent of ion exchange process. In unswollen resin matrix, the exchangeable groups are latent and coiled towards the backbone. Swelling increases the surface area and these groups get oriented towards outside. Loading was considerably increased at 60 minutes can be considered as the optimum swelling time.

Table 8: Effect of Swelling Time on Drug Loading

Drug: Resin Ratio	Swelling Time (min)	%Drug Loading
1:3	30	78.03 %
1:3	**60**	**86.21 %**
1:3	90	85.01 %
1:3	120	84.88 %

Optimization of Resin Stirring Time

Stirring time affects the ion exchange equilibrium process as it is stoichiometric process. This may indicate the significant involvement of Van-der Waals forces or chemisorptions taking place along with drug exchange during complexation. Loading was not considerably increased after 240 minutes and it was considered as the optimum contact time between Levocetrizine diHCl and Kyron T-114.

Table 9: Effect of Stirring Time on Drug Loading

Drug: Resin ratio	Stirring Time (min.)	%Drug Loading
1:3	30	86.21%
1:3	60	88.21%
1:3	90	91.84%
1:3	120	92.60%
1:3	180	95.01%
1:3	210	96.26%
1:3	**240**	**98.52%**
1:3	300	97.19%

Characterization of DRC

FT-IR Spectroscopic Analysis

The absence of L-CTZ peak i.e. –O-H stretch at 2947.66 cm^{-1} in DRC confirms the complexation of drug with resin. The spectrum of Kyron T-114 showed distinct C=O stretch at 1738.43 of the –COOH functional group of the resin, which was not seen in the spectrum of DRC. Numbers of overtone peaks in Kyron T-114 were observed at 2343.1 and 2369.00 cm^{-1}. The functional groups involved in the complexation process were –COOH of Kyron T-114 along with the –O-H of L-CTZ. The absence of other peaks of L-CTZ in the spectrum of DRC indicated that the drug was completely embedded in the resin polymer matrix and thus the complexation was confirmed.

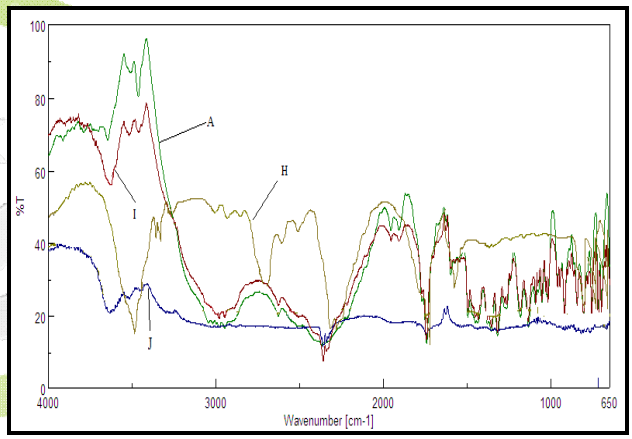

Figure 4: FT-IR Spectra of (A) L-CTZ (H) Kyron T-114 (I) L-CTZ: Kyron [Physical mixture] (J) L-CTZ: Kyron [1:3 Complex]

DSC Study

Thermo grams of pure Levocetrizine diHCl, Kyron T-114 and drug resin complex are shown in Figure 5. In the case of pure Levocetrizine diHCl, a characteristic endotherm was observed at 219.0°C, corresponding to the melting point of Levocetrizine diHCl. While in Kyron T-114 and DRC, endotherm was observed at 257.35°C and 242.68°C respectively, corresponding to the melting point of Kyron T-114 and DRC. In DSC curve of DRC total disappearance of drug melting temperature was occurred, which

indicated that drug was completely embedded in resin.

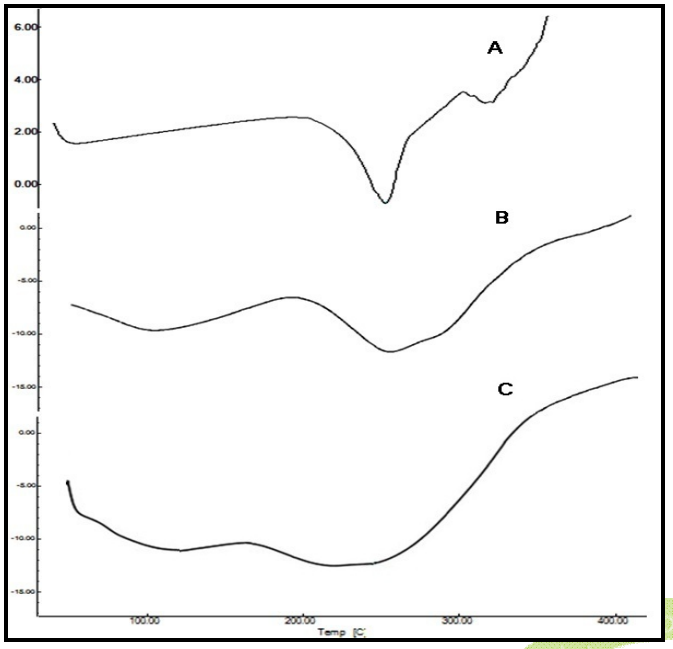

Figure 5: DSC Thermograms of (A) L-CTZ (B) Kyron T-114 (C) L-CTZ: Kyron T-114 [1:3 M Complex]

Gustatory Evaluation of Levocetrizine diHCl – Kyron T-114 Complex

The volunteers did not report any bitterness for DRC throughout the study. Taste evaluation in volunteers confirmed that the taste of Levocetrizine diHCl was masked by complexing with Kyron T-114. The majority of the volunteers found the DRC to be tasteless and agreeable.

Drug Content

When DRC was prepared using all of the optimized parameters for drug loading, the percent drug content was found to be 98.52%.

In-vitro Drug Release Studies

The dissolution profile of DRC showed drug release of 99.17% within 10 minutes in 0.1 N HCl. Thus DRC releases the drug quickly upon contact with acidic environment of stomach although in salivary pH 6.8 DRC showed 0.96% drug release within 1 minute which is very less amount to impart bitter taste. So, successful taste masking was done by using Kyron T-114.

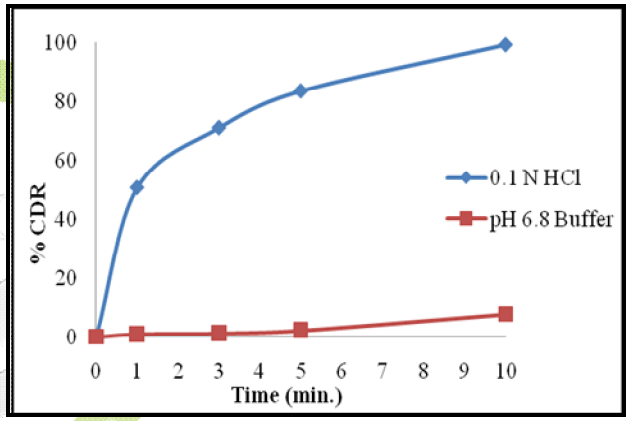

Figure 6: Cumulative % Drug Release of DRC in 0.1 N HCl and pH 6.8 buffer

Table 10: Bitterness Evaluation of DRC by Panel of 8 Volunteers

Volunteer No.	Bitterness Level after					
	0 sec.	5 sec.	10 sec.	15 sec.	20 sec.	30 sec.
1.	0.5	0.5	0	0	0	0
2.	0	0	0	0	0	0
3.	0	0.5	0	0	0	0
4.	0.5	0	0	0	0	0
5.	0	0	0	0	0	0
6.	0	0	0	0	0	0
7.	0	0	0	0	0	0
8.	0	0	0	0	0	0

Scale for bitterness is same as mentioned in inclusion complex.

CONCLUSION

In the present study, an attempt was given to mask bitter taste of Levocetrizine diHCl by β-Cyclodextrin. In the present study, complex of Levocetrizine diHCl with β-cyclodextrin was prepared in different molar ratio from 1:0.5 to 1:1.25M by kneading method. From *in-vitro* drug release study, FTIR and DSC of complex, it was concluded that Levocetrizine diHCl formed complex with β–CD. Among the different molar ratios of complex Levocetrizine diHCl: β- cyclodextrin, 1:1 molar ratio had shown dissolution profile of 98.26% and 97.43% within 10 minutes in 0.1 N HCl and pH 6.8 buffer respectively. Thus, molar ratio 1:1 ratio was optimized. But from gustatory evaluation, it was found that β-Cyclodextrin was not proven good for effective taste masking of Levocetrizine diHCl.

In the present study, an attempt was given to mask bitter taste of Levocetrizine diHCl by Kyron T-114 (cation exchange resin). It is a water-insoluble, high molecular weight; crosslinked Polymer of methacrylic acid. Kyron T-114 is inexpensive and this method is simple, rapid and cost-effective method for taste masking.

The natural variation in pH was used to prepare complexes that remain stable in the mouth without affecting gastric release. Various parameters affecting taste masking like resin activation, drug: resin ratio, pH, temp, swelling time of resin and stirring time were optimized with efficient loading of Levocetrizine diHCl. Maximum drug loading was obtained when the resin activated by acid treatment, 1:3 drug: resin ratio, soaked in water for 90 minutes and stirred with the drug for 240 minutes, pH maintained 5.5 and temperature at 30°C.

The drug resin complex was evaluated for taste *in-vitro* and *in-vivo*. The taste masking was satisfactory as reported by the volunteers and the complex did not release any drug at salivary pH. The volunteers rated the complexes as tasteless and agreeable. Drug release from DRC in salivary pH was insufficient to impart bitter taste. Complete drug release was observed at gastric pH.

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