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COMPARATIVE STUDY BETWEEN *CURCUMA LONGA* NANOSUSPENSION AND SUSPENSION

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ABSTRACT

To perform the comparative study between Curcuma longa Nanosuspension and suspension**.** Poor bioavailability is one of the leading causes of compound failure in preclinical and clinical development as reported in literatures Gao (2012). Bioavailability of a compound depends on its solubility or dissolution rate Vyas *et al*. (2013). Dissolution may be the rate determining step for bioavailability and medicinal value, therefore, efforts to increase dissolution rate for water insoluble drug is often needed Sun *et al*. (2012). It has been observed that Nanosuspension formulated for curcuminoids which is hydrophobic in nature enhanced the solubility as well as dissolution of curcuminoids as compared to suspension Chavhan and Sawant (2011)**.** Nanosuspension of curcumin exhibited better dissolution as well as bioavailability as compared to suspension.

INTRODUCTION

The formulation of nano-sized particles can be implemented to all drug compounds belonging biopharmaceutical classification system (BCS) classes II and IV to increase their solubility and hence, partition into gastrointestinal barrier Amidon *et al*. (1995). Micronization is used for class II drugs of (BCS) i.e. drugs having a good permeability and poor solubility Yu *et al*. (2002) and Lennernas and Abrahamsson (2005)**.** Nanosuspension is favoured for compounds that are insoluble in water (but are soluble in oil) with high melting point and high doses. Conventionally the drugs that are insoluble in water but soluble in oil phase system are formulated in liposome, emulsion systems but these lipidic formulation approaches are not applicable to all drugs. In these cases nanosuspensions are preferred. The poor oral bioavailability of the drug may be due to poor solubility, poor permeability or poor stability in the gastrointestinal tract (GIT). Nanosuspensions resolved these twin problems Setler (1999)**.** Curcumin is the principal curcuminoid of the popular Indian spice turmeric. The other two curcuminoids are desmethoxycurcumin and bis-desmethoxycurcumin. The curcuminoids are polyphenols and are responsible for the yellow color of turmeric. Curcumin can exist in at least two tautomeric forms, keto and enol. The enol form is more energetically stable in the solid phase and in solution. It is an orange crystalline powder Hatcher *et al*.(2008)**.**

Family: Zingiberaceae.
Common names: Curcuma, Indian saffron and haldi.
Molecular weight: 368.38.
Melting point : 183°C.
Empirical formula: $C_{21}H_{20}O_6$,
Chemical name: (1E,6E)-1,7-bis (4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione.`

Extraction and purification

Soxhlet extraction

A large filter paper was used instead of a paper thimble. The paper was folded so that it could contain 20 g of turmeric powder and was then placed in the soxhlet apparatus. 200 ml acetone was heated and refluxed for extraction of the “filter paper thimble”. The procedure was monitored until the yellow colour of the extractions faded after 5 h. An advantage with soxhlet extraction was that no further filtration was needed before it was concentrated. The obtained extract gave a crude yield of 2.6 g Revathy *et al*. (2011) which was purified by Preparative TLC Pothitirat and Gritsanapan (2005)**.**

RESULTS AND DISCUSSION

Nanosization of drug powders increasing with the increasing ratio of curcumin and fenugreek polymer form 1:1 to 2:1 , 3:1, 4:1, 5:1 and the release increased as the surface of

particles leading to an increase of the dissolution velocity. Another important aspect is the increase in saturation solubility.

large interfacial area can influence the transport and delivery properties of the incorporated drugs and provide for site-specific targeting.

Table 1. UV Absorption at different ratio of Curcumin and Fenugreek polymer

Time	Abs 1:0	Time	Abs 1:1	Time	Abs 2:1	Time	Abs 3:1	Time	Abs 4:1	Time	Abs 5:1
6:15	0.061	6:25	0.093	6:40	0.106	6:45	0.126	6:50	0.133	6:55	0.137
7:15	0.063	7:25	0.096	7:40	0.105	7:45	0.136	7:50	0.137	7:55	0.141
8:15	0.067	8:25	0.094	8:40	0.107	8:45	0.148	8:50	0.142	8:55	0.143
9:15	0.072	9:25	0.095	9:40	0.108	9:45	0.168	9:50	0.144	9:55	0.149
10:15	0.076	10:25	0.101	10:40	0.113	10:45	0.170	10:50	0.148	10:55	0.153
11:15	0.080	11:25	0.105	11:40	0.117	11:45	0.183	11:50	0.153	11:55	0.155
12:15	0.082	12:25	0.107	12:40	0.121	12:45	0.185	12:50	0.157	12:55	0.161
13:15	0.084	13:25	0.113	13:40	0.126	13:45	0.191	13:50	0.162	13:55	0.168
14:15	0.087	14:25	0.117	14:40	0.132	14:45	0.198	14:50	0.165	14:55	0.177
15:15	0.093	15:25	0.121	15:40	0.135	15:45	0.205	15:50	0.172	15:55	0.185
16:15	0.095	16:25	0.127	16:40	0.141	16:45	0.211	16:50	0.179	16:55	0.192

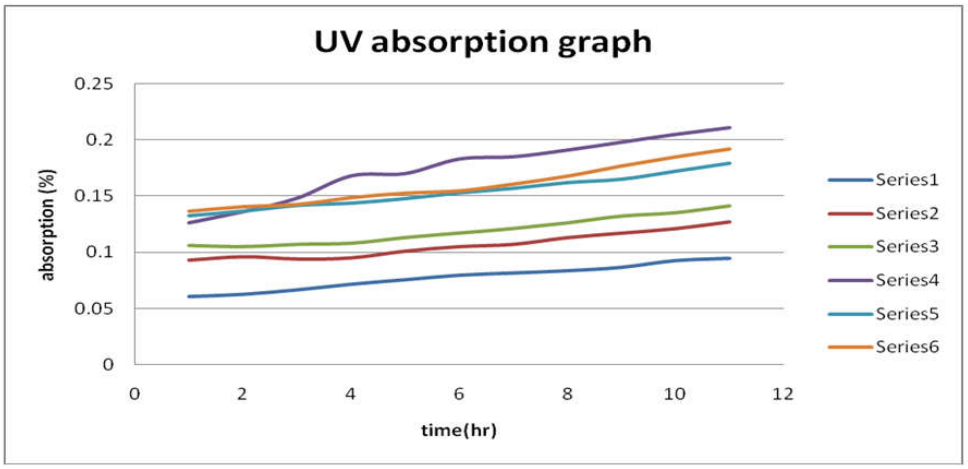

Fig. 1. UV absorption of different ratios of Curcumin and Fenugreek polymer

Dissolution of curcumin increased with the decreasing particle size which could be explained on the basis of Noyes-whitney equation which states that the increase of surface area (A) and saturation solubility (Cs) due to the reduction of radius could enhance dissolution velocity of poorly soluble compounds. By incorporation the nanosuspension into fenugreek polymer, the physical stability of the system was enhanced. Moreover, it also increase gastric resistance time resulting in more efficient system. The enhanced residence time in gastrointestinal tract may decrease the dosing frequency and amount of the drug given which will further improve the patient compliance. As the particle size reduces to the nanosize, the surface energy of the particle will be increased and they tend to agglomerate so fenugreek is used as a stabilizer which will decrease the chances of Ostwald ripening and improving the stability of the suspension by providing a ionic barrier.

Conclusion

Dissolution rate and solubility are the two of several factor that affect oral bioavailability of poorly water soluble compounds. Nanosizing technique have been used to increase dissolution rate which improves the low oral bioavailability. Nanosuspension of curcumin with fenugreek increases the dissolution rate and bioavailability of a poorly water soluble compound curcumin. These nanosized particle with a very

The results clearly indicated the solubility of formulation procedure for preparation of nanosized poorly water soluble drug with significant improvement of the in-vitro dissolution rate thus possibly improve their oral bioavailability.

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