International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.6, pp 847-851, 2015

# Rheological properties of *Thaleesadhi churnam* dispersion in honey

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**Abstract:** In *Siddha*, a traditional Indian system of medicine, drugs are administered with various vehicles for enhancement in their therapeutic effect. According to *Siddha* literature dried drug powder is called *Churnam*. The rheological property of *Thaleesadhi churnam* dispersion in honey was studied in this work. Pure honey at room temperature was observed to exhibit Newtonian behaviour. The increase in relative viscosity with increasing concentration of dispersion was observed to be exponential with a 10 fold increase in relative viscosity at 20 % concentration. Also, with the increase in concentration the dispersion was observed to exhibit shear thinning behaviour. The dispersion of *Thaleesadhi churnam* in a non- recommended vehicle (milk) showed abrupt increase in viscosity of the dispersion.
**Keywords**: Siddha, *Thaleesadhi Churnam*, vehicles, viscosity, shear thinning.

## Introduction

Pharmaceutical suspensions are dispersions of solid in liquid medium. The performance characteristic of a pharmaceutical suspension depends upon its rheological properties. In the traditional Indian system of medicine (viz. *Ayurveda* & *Siddha*) drugs are made into a suspension using a vehicle (dispersion medium or adjuvants). The commonly used vehicles include milk, honey, ghee, warm water etc. These vehicles can improve the overall therapeutic efficiency of drug in the body by accelerating circulation, absorption and assimilation [1]. In *Siddha* system, several kinds of medicinal preparations exist. Different medicinal preparations like *Churnam* (dried drug powder), *Parpam* (calcined drug powder), *Karuppu* (calcined or burned or ground drug powder that attains a black colour) are mixed with different adjuvants depending on the nature of drug and also according to the disease conditions [1].

Dried powders of drugs are called *Churnam*. It can be a single drug or a combination of multiple drugs powdered separately and then subsequently mixed homogenously to fine powder [1]. Among the various forms of drug preparation, *churnam* is one of the most commonly used medicinal preparation. Therefore a study on the rheological properties of *Churnam* with its adjuvants was designed. A list of various *churnam* formulations commonly used in Siddha system of medicine is shown in Table 1.

**Table 1. Various *Churnam* formulations, its therapeutic uses and dose** [1]

| Formulation | Therapeutic uses | Dose |
|---|---|---|
| *Thaleesadhi Churnam* | Gastritis, colic, gaseous sistension of stomach, excessive thirst, cough, indigestion | 0.5 – 1 g with honey twice a day |
| *Amukkara Churnam* | Colic, hiccup, chloresis, spermatorrhoea, rheumatic diseases, sexual insufficiency, insomnia | 1 – 2 g twice or thrice a day with honey or hot water or milk |

| | | |
|---|---|---|
| *Thriphala Churnam* | Astringent, laxative, anti – bacterial, cough | 1 – 2 g twice daily with water, honey or ghee |
| *Thrikaduku Churnam* | Digestive, carminative, expectorant, indigestion, cough, bronchitis | 1 -2 g twice daily with water, honey or ghee |
| *Yelathi Churnam* | Abscesses, ulcers, leprosy, dysmenorrhoea | 1 – 2 g twice daily with honey |

To study the specific effect of a *churnam* with its vehicle, a *churnam* which has only a single vehicle recommended has to be selected for studying the rheological properties of that *churnam* - vehicle mixture. Therefore, *Thaleesadi churnam* which has a single vehicle recommended (honey) was identified for further studies. Also, the change in properties when a non-recommended vehicle is used was also made part of the study by comparing the rheological properties with a second *churnam* (*Amukkara churnam*). The constituents of two *churnams* used here i.e *Thaleesadi churnam* and *Amukkara churnam* are shown in Table 2 and 3.

**Table 2. Constituents of *Thaleesadhi churnam*** [1]

| **Thaleesadi Churnam** | **Quantity (parts)** |
|---|---|
| Yew leaves | 1 |
| Cinnamon bark | 1 |
| Cardamom | 1 |
| Dry ginger | 1 |
| Liquorice | 1 |
| Asafoetida | 1 |
| Dried fruits of Indian gooseberry | 1 |
| Costus | 1 |
| Long pepper | 1 |
| Nagella seeds | 1 |
| Dill seeds | 1 |
| Cane sugar | 1 |

**Table 3. Constituents of *Amukkara churnam*** [1]

| **Amukkara Churnam** | **Quantity (parts)** |
|---|---|
| Cloves | 1 |
| Cinnamon | 2 |
| Cardomom | 4 |
| Black pepper | 8 |
| Long pepper | 16 |
| Dry ginger | 32 |
| Withania somnifera (Indian ginseng) | 64 |
| Cane sugar | 128 |

## Materials & Methods

### Materials

*Thaleesadi churnam* and *Amukkara churnam* were bought commercially from IMCOPS. Honey and milk were also acquired commercially.

### Preparation of dispersion and measurement of viscosity

The dispersion of *churnam* in honey and milk was prepared by suspending the *churnam* in the vehicles. The preferred dose regimen for *Thaleesadi churnam* is 0.5 – 1 g. Therefore, various concentrations of *Thaleesadi churnam* in honey is prepared viz. 0.25 g in 10 g honey, 0.5 g in 10 g honey, 0.1 g in 10 g honey, 0.15 g in 10 g honey and 2 g in 10 g honey to produce 2.5 %, 5 %, 10 %, 15 % and 20 %, wt/wt respectively.

The dispersion was well mixed using a mechanical stirrer. Similarly a dispersion of *Thaleesadi churnam* and *Amukkara churnam* in milk was prepared by suspending 4 g *churnam* in 20 mL milk. Viscosity of the dispersions were measured using a rotational viscometer (LVDV – II + Pro, Brookfield Engineering, USA) of spindle size S – 64 over shear rates ranging from 0.5 – 100 rpm. All the measurements were carried out at atleast three times and the results were expressed as mean ± standard deviation.

## Results and Discussion

### Effect of concentration of dispersion on viscosity

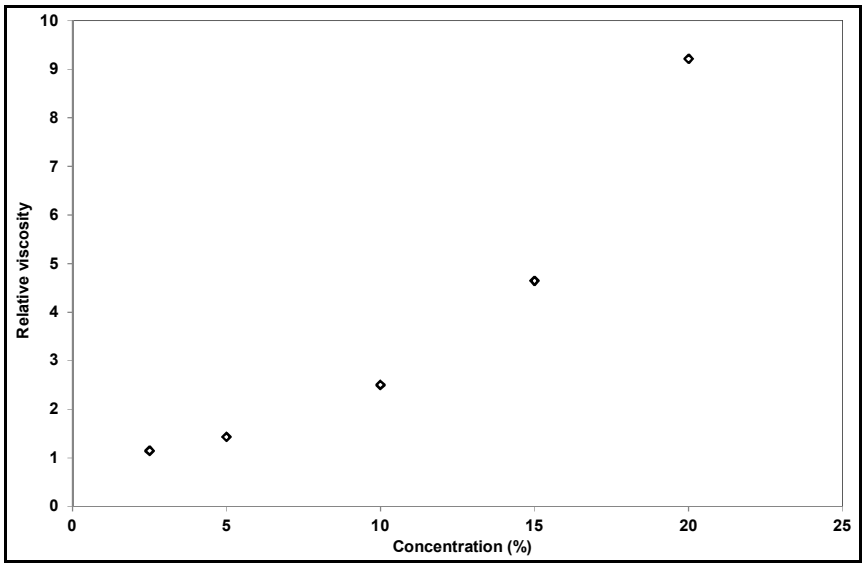


**Fig. 1. Effect of concentration of dispersion on relative viscosity**

Fig. 1 shows the change in relative viscosity of *Thaleesadi churnam* dispersion in honey with varying concentration at room temperature. From Fig. 1 it can be observed that the relative viscosity increases with increase in concentration. It can be noted that the increase is minimal at lower concentrations and then at higher concentrations there is an exponential increase in viscosity. This phenomenon is possibly due to the increasing sugar content at higher concentrations of Thaleesadi Churnam dispersion in honey, as this may set up physical barriers and restricts molecular movement within the admixture [2].

### Effect of shear rate on viscosity

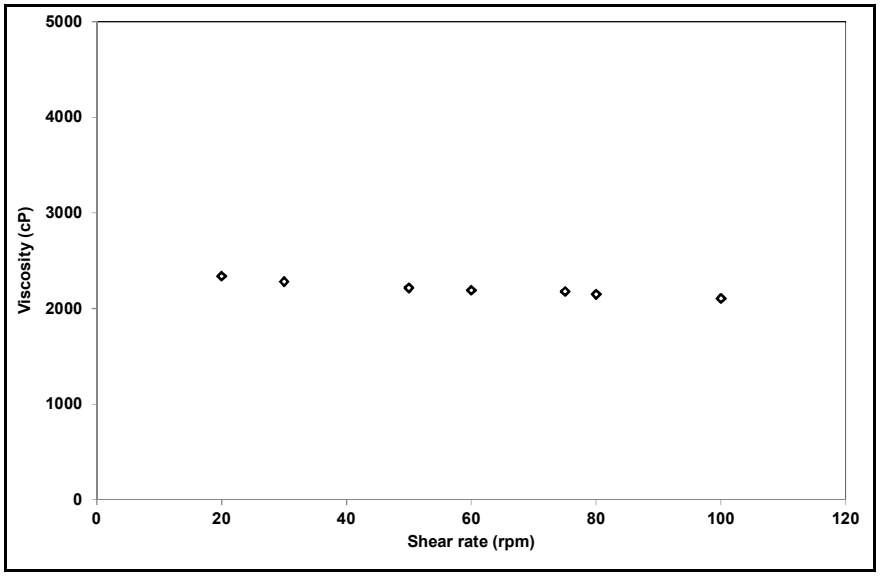


**Fig. 2. Effect of shear rate on viscosity of pure honey**

The effect of shear rate on viscosity of pure honey is shown in Fig. 2. It can be observed that with increasing shear rate the change in viscosity in minimal. This shows the Newtonian nature of pure honey as reported previously by various researchers [3,4]. However, when Thaleesadi churnam is suspended in honey, a marked change can be observed in the rheological properties as shown in Fig. 3.

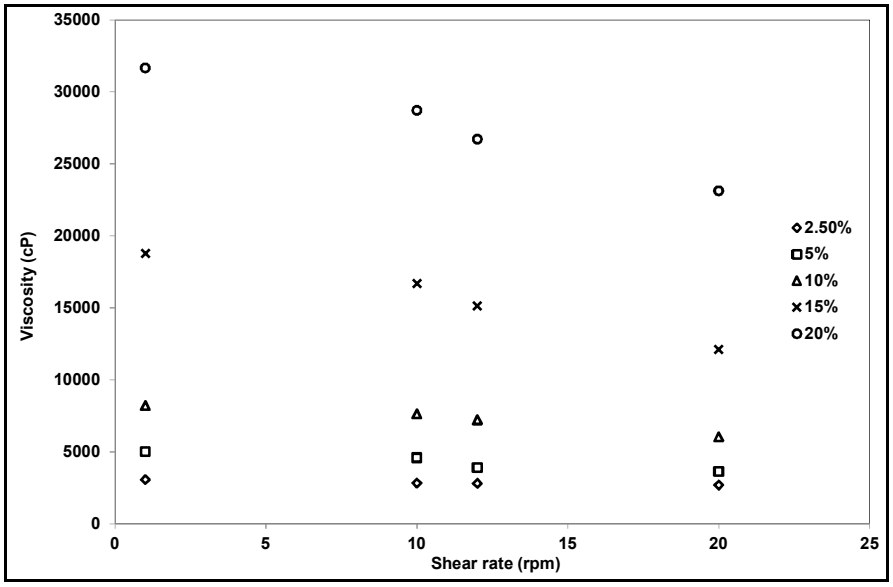


**Fig. 3. Effect of shear rate on viscosity of dispersion at varying concentrations**

The relationship between viscosity of *Thaleesadhi churnam* dispersion in honey and shear rate with varying concentration is shown in Fig. 3. It can be observed that viscosity decreases with increasing shear rate along all concentrations studied. It can also be noted that at higher concentrations the decrease in viscosity was more significant than at lower concentrations. This highlights the shear thinning behaviour of *Thaleesadhi churnam* dispersion in honey and this might be due to the formation of deformable aggregates at higher concentrations. Also, the viscosity shear rate relationship of the dispersion follows power – law relationship with its exponent showing an increase with increasing concentration of dispersion which also suggests the aggregation of *Thaleesadhi churnam* particles in the dispersion. Therefore, a lower concentration of dispersion would be optimal. Various syrups and dispersions were also observed with shear thinning behaviour [5–8].

**Effect of dispersion medium**

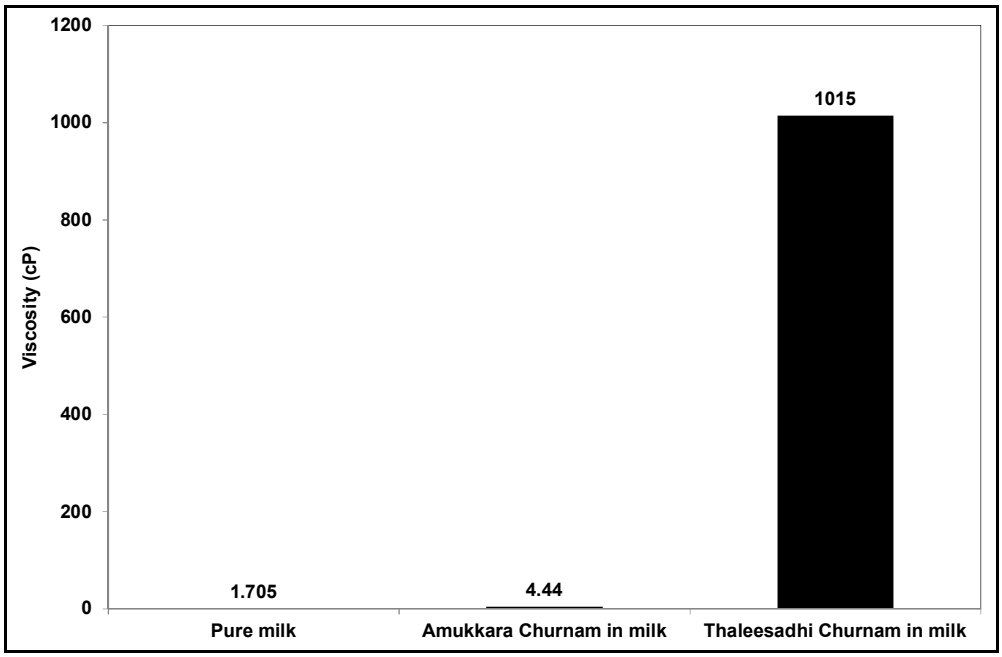


**Fig. 4. Viscosity of pure milk, *Amukkara churnam* dispersion in milk and *Thaleeadhi churnam* dispersion in milk**

Fig. 4 shows the effect of *Amukkara churnam* and *Thaleesadhi churnam* in milk. It can be observed that viscosity of pure milk was 1.705 cP. 20 % of *Amukkara churnam* dispersion in milk showed only a marginal increase in the viscosity of the dispersion. It should be noted that for *Amukkara churnam*, the recommended vehicles included hot water, honey or milk. However when similar concentration of *Thaleesadi churnam* which has recommended vehicle as honey alone is dispersed in milk the viscosity showed three-orders of magnitude increase in viscosity. This abrupt increase in viscosity might be due to the improper *churnam* – vehicle combination leading to severe aggregation.

## Conclusion

The rheological properties of *Thaleeadhi churnam* dispersions in honey were studied. Among the various concentrations studied, 2.5 and 5 % dispersions showed a minimal increase in viscosity compared to the base fluid. Studies with varying shear rates showed that pure honey showed Newtonian behaviour and with increasing concentration of dispersion, a shear thinning behaviour was observed. On studying the effect of *Thaleesadi churnam* with a non – recommended vehicle a very high increase in viscosity was observed compared to the base fluid.

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