Safflower and Glycyrrhiza: Preparation of Herbal Cough Syrup

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Abstract

Carthamus tinctorius L (Safflower) and *Glycyrrhiza glabra* L. syrup was studied for anti-coughing properties adopted from basic gso-ba-ri-pa formulary. The extracts obtained at 50 degree and 90 degree Celsius temperature at 0.5, 1.0, 2.0, and 3.0 hours time was evaluated for absorbance at 325 nm using UV spectrophotometer. The optimum extraction condition in this study was at 90 degree Celsius at 0.5 (half) hour time yielding high content and good physical stability for 14 days. The syrup was prepared by using 5 types of sugar (white sugar, rock sugar, brown sugar, coconut sugar and palm sugar). The syrups when examined under UV spectrophotometer at 325 nm gave higher absorbance value due to browning reaction. Microorganism growths were found in all preparation with least growth appearance in the rock sugar syrup. The content of 50% sugar in the syrup could not act as self preservative and preservative should be added in the preparation. The shelf-life of the syrup was not determined due to microbial growths. However, the best storage condition was found to be cool (3ºC temperature) dry place protected from light.

Keywords: Safflower; Glycyrrhiza; Herbal cough syrup; Preparation.

1. Introduction

Syrup is concentrated solutions of sugar such as sucrose in water or other aqueous liquid. When purified water alone is used in making the solution of sucrose, the preparation is known as syrup or simple syrup. In addition to sucrose, certain other polyols, such as glycerin or sorbitol, may be added to retard crystallization of sucrose or to increase the solubility of added ingredients. Alcohol often is included as a preservative and also as a solvent for flavors; further resistance to microbial attack can be enhanced by incorporating antimicrobial agent. When the aqueous preparation contains some added-medicinal substance, the syrup is called medicated syrup. Flavored syrup is the one which usually is not medicated, but which contains various aromatic or pleasantly flavored substances and is intended to be used as a vehicle or flavor for prescriptions.

Flavored syrups offer unusual opportunities as vehicles in extemporaneous compounding and are accepted readily by both children and adults. Because they contain no or very little alcohol they are vehicles of choice for many of the drugs that are prescribed by pediatricians. This lack of alcohol also makes them superior solvent for water-soluble substances. However, sucrose-base medicines continuously administered to children apparently cause an increase in dental caries and gingivitis. Consequently, alternate formulations of the drugs either unsweetened or sweetened with non-carcinogenic substances should be considered. Knowledge of the sugar content of liquid medicines is useful for patients who are on a restricted caloric intake.

Syrups possess remarkable masking properties for bitter or saline drugs. Glycyrrhiza syrup has been recommended for disguising the salty taste of bromides, iodides and chlorides. This has been attributed to its colloidal character and its double sweetness, the immediate sweetness of the sugar and the lingering sweetness of the glycyrrhizin. This syrup can also mask the bitterness in the preparations containing Vitamin B complex.

In manufacturing syrups, the sucrose must be selected carefully and the purified water to be used should be free from foreign substances. For products to be stable care must be taken to avoid contamination.

It is important that the concentration of sucrose approach but not quite reach the saturation point. In dilute solutions sucrose provides excellent nutrients for molds, yeasts, and other microorganisms. In concentrations of 65% by weight or more, the solutions will retard the growth of such microorganisms. However, a saturated solution may lead to crystallization of part of the sucrose under changing conditions of temperature.

The formulation of cough syrup in gso-ba-rig-pa is usually composed of extracts from *Bambusa textiles* and *Carthamus tinctorius* L. (Safflower). However, use of *Glycyrrhiza glabra* L. will be studied instead of *B. textiles* in the preparation of this syrup.

There was uncertainty whether the extraction process in open steam jacket for 8 hours fully extracts the material or not due to variations in the temperature. In addition to this, the appearance of final solution was likely to be affected due to poor flirtation technique using muslin cloth and usage of tap water. Because the bottling and filling are carried out manually, stability of the preparation will be studied to determine appropriate sterilization methods including incorporation of preservatives. The syrup preparation and contamination control procedures are not fully validated because of lack of techniques for evaluation. Thus this project was to provide some ideas to solve those problems encountered in syrup preparation at the Pharmaceutical and Research Unit (PRU).

This paper presents the findings on preparation of medicated herbal cough syrup using extracts from *C. tinctorus* and *G. glabra*.

2. Methodology

Following methodologies was used to evaluate the effect of temperature, formulation development studies using different types of sugar and the stability of the syrup.

2.1. To study the temperature effect on extraction

1 gram of Safflower and 1.5 grams of Glycyrrhiza was weighed and extracted with water (hot/room temperature) in the beaker. The extraction time was varied to study the effect of time. The extract was filtered using filter paper or cloth and content of the compound determined using UV Spectrophotometer. The extracts of differing temperature and time were also compared and evaluated.

2.2. To study the formulation development by using different types of sugar

1.5 grams of sugar was added into the syrup formulation at room temperature or at high temperature and the mixture was stirred until clear solution was obtained. The physical

appearance of was evaluated by observing changes in color of the solution. Comparison in the content and amount of compound was made using UV Spectrophotometer.

2.3 To study the expiration date of syrup

The syrup prepared using above methods was stored at different temperature and its stability evaluated at different time interval. The data gathered after each time interval was used to plot Vant Hoff curve for determining an expiration date of the syrup. The major component derived at constant wavelength of UV Spectrophotometer was the color of safflower.

2.4. Materials and syrups prepared

For the purpose of this research following types of syrups were prepared. (Table 1)

Table 1 – Types of sugar used and its physical description

Types of sugar	**Physical Description**
White sugar	White granules
Brown sugar	Brown granules
Coconut sugar	Yellowish granules
Rock sugar	Pieces
Palm sugar	Light yellowish granules

3. Results and Discussion

3.1 Evaluation of physical characteristics of extracted solution

The λ 325 nm was selected since highest peak was recorded from UV scan. The color of extracts for both 50^{o}C and 90^{o}C extraction temperature was clear light yellowish with no precipitation and pH value of 6.

3.2 Effects of time and temperature

i) Extractions at 50^{o}C temperature - After extraction at 50^{o}C temperature, the extracts were kept in refrigerator for one night and UV absorbance was recorded the next day. The extract at 1 hour time has lower absorbance reading than extracts obtained at 2 hours and 3 hours (Fig.1). Extraction at 3 hours time was better than 1 and 2 hours due to high absorbance at 325 nm.

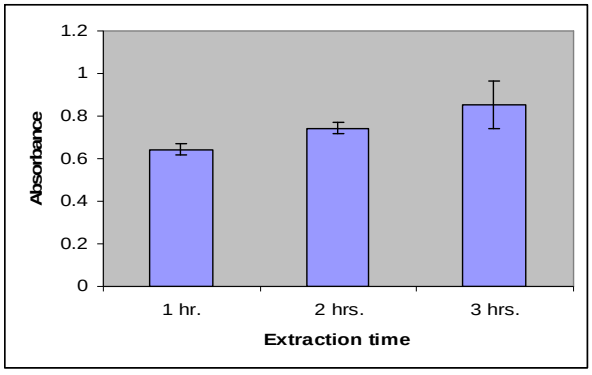

Fig. 1 - Graph of the extracts at 50^{o}C at 1hr, 2hrs, and 3hrs extraction time

ii) Extractions at 90°C temperature-After extraction at 90°C temperature, the extracts were kept in refrigerator for one night and UV absorbance was recorded the next day. The absorbance of extract at 0.5 hours was much better than 1 hour and 2 hours extraction time. Therefore, 0.5 hour and 90°C are best time and temperature for extraction. (Figure 2)

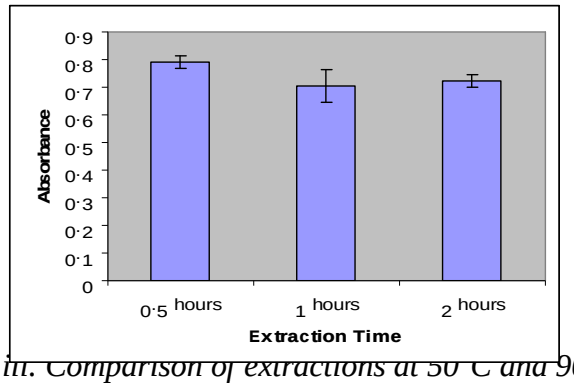

Figure 2 - Graph of the extracts at 90°C for 0.5 hr, 1hr and 2hrs extraction time

iii. Comparison of extractions at 50°C and 90°C temperature-The absorbance of 1 hour extract at 50°C was less than half hour (0.5) extract at 90°C, but 2 hours and 3 hours extracts at 50°C had higher absorbance value than 1 hour and 2 hours extracts at 90°C respectively. Considering time and energy of 3 hours extraction at 50°C though absorbance was little bit higher, half hour (0.5) extraction at 90°C was preferable due to high absorbance at short time. (Fig. 3)

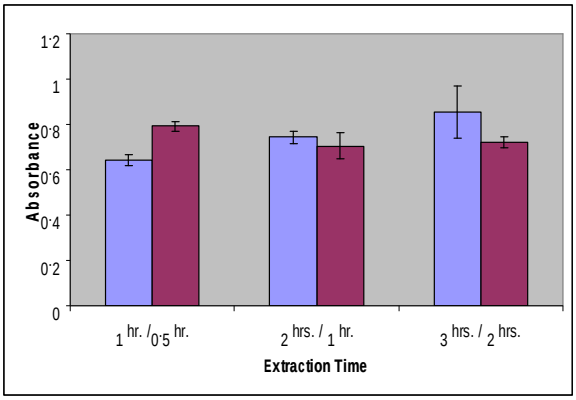

Fig.3 - Graph comparing the extracts at 50°C and 90°C temperature

3.3 Stability evaluation of extract solutions

i. Stability of solutions extracted at 50°C-All the extracts were kept in the light and dark room for 14 days. It was noted that for solutions extracted after 1 hour, the absorbance was slightly decreased regardless of storage in light or dark room, whereas for 2 and 3 hours extraction there was slight increase in absorbance for those stored under light. The precipitation was also observed indicating growth of microorganisms. (Fig.4)

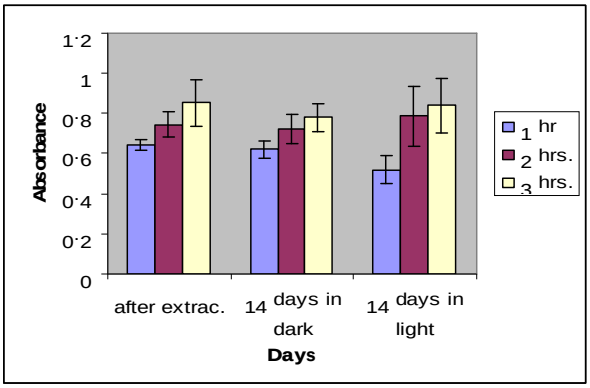

Fig. 4 - Graph comparing absorbance of extracts at 50°C when stored in light and dark room for 14 days

ii. Stability of solutions extracted at 90°C – The absorbance of all extracts after storage in the light and dark room for 10 days was higher than the absorbance of solutions immediately after extraction. (Fig.5)

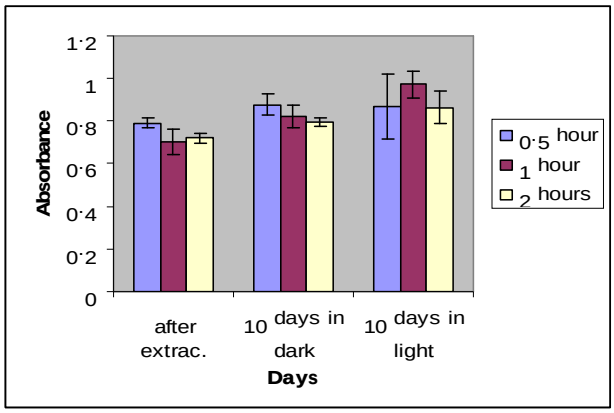

Fig. 5 - Graph comparing absorbance of extracts at 90°C when stored in light and dark room for 10 days

3.4. Effect of sugar types on syrup

i. White sugar syrup - After preparing white sugar syrups using solutions extracted at 0.5 hour and 90°C temperature, the syrups were divided into three portions and kept in room temperature, refrigerator and in the oven for one night. The absorbance reading for syrups under room, refrigeration and in the oven are 0.417, 0.431 and 0.428 respectively. The syrups showed no significant difference in the absorbance and noted same physical properties of light yellowish color with pH of 6 without any precipitation.

ii. Brown sugar syrup - The absorbance value of brown sugar syrups after one day of storage in room, refrigerator and oven were 0.116, 0.00 and 0.05 respectively. The syrup stored in refrigerator showed drastic decrease in absorbance**.** The physical properties of brown sugar syrup were dark brown in color, pH of 6 without precipitation.

iii. Coconut sugar syrup - Coconut sugar syrup after one day of storage in room conditions recorded more absorbance than in refrigerator and oven. The physical properties of coconut sugar syrup were light yellowish in color with pH of 6 without precipitation.

iv. Rock sugar syrup **–** Rock sugar syrup which was stored in room and refrigerator recorded same absorbance while oven stored syrup showed slightly higher absorbance than the room and refrigerator stored. The physical properties were light yellowish in color, pH of 6 without precipitation.

iv. *Palm sugar syrup* - Palm sugar syrup which was stored in oven had slightly higher absorbance than the room and refrigerator stored. The color of the syrup was light yellowish with pH value of 6 and no precipitation.

3.5 Stability of syrup

i. White sugar syrup – There was increase in absorbance when stored for 7 days in different conditions of room, refrigerator and oven but after 12 days of storage the absorbance had decline and some microorganism growths are visible. (Fig. 6)

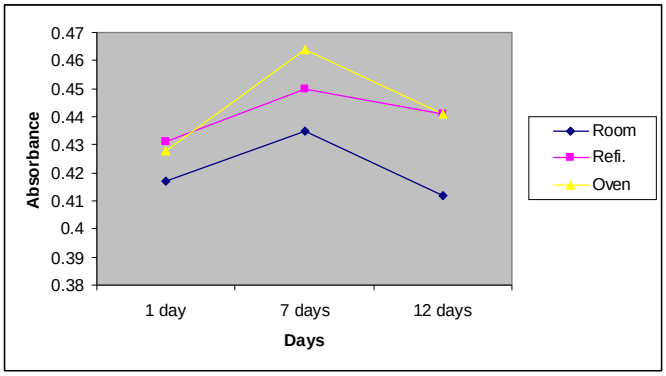

Fig.6-Absorbance of white sugar syrup when stored under different conditions for 7 and 12 days.

ii. Brown sugar syrup – The absorbance value of syrup after storing for 7 days in the room had decreased while those stored in refrigerator and oven showed zero values. When evaluated after 12 days of storage in the room, refrigerator and oven, the absorbance value had all decreased to zero. Some microbial growths are also visible after 7 days of storage in the room conditions. (Fig 7)

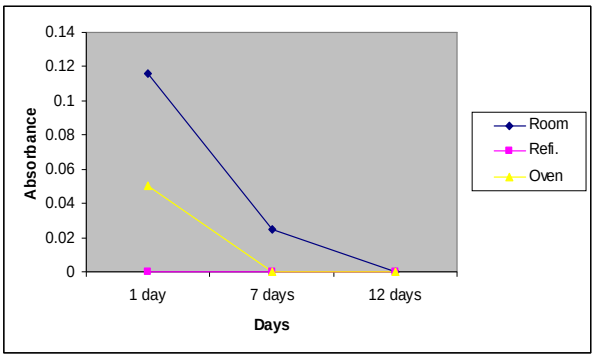

Fig.7 - Comparing absorbance of brown sugar syrup when stored under different conditions of room, refrigerator and oven for 7 and 12 days.

iii. Coconut sugar syrup – The absorbance value of syrup stored in room for 7 days had decreased while those in refrigerator and oven had slightly increased. When evaluated after 12 days of storage, the absorbance of syrup stored in room had remained unchanged whereas those in refrigerator and oven had slightly increased and decreased absorbance respectively. Microorganism growths were also visible for those stored in room for 7 days and in the oven for 12 days. (Fig.8)

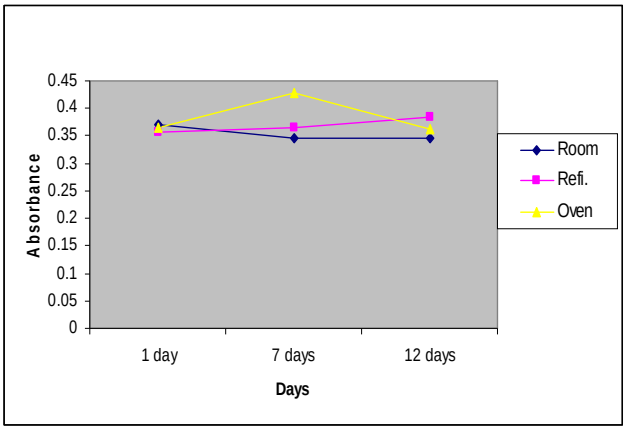

Fig.8 - Absorbance of coconut sugar syrup when stored under different conditions of room, refrigerator and oven for 7 and 12 days.

iv. Rock sugar syrup – The absorbance of syrups stored in room and refrigerator were decreased, whereas those stored in oven were slightly increased when evaluated after 7 days. After 12 days, the absorbance of syrups stored in room and refrigerator were slightly increased while those in oven are slightly decreased. No microbial growths are visible in blank syrups when stored up to 12 days irrespective of storage conditions. However, microbial growths are visible for those syrups stored for 7 and 12 days in the room. (Fig. 9)

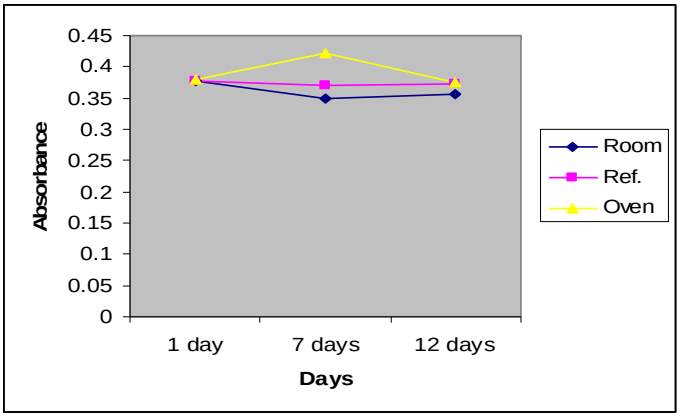

Fig.9 -Absorbance of rock sugar syrup when stored under different conditions for 7 and 12 days.

v. Palm sugar syrup – All the palm sugar syrups when evaluated after 7 days of storage in room, refrigerator, and oven had slightly increased absorbance while those stored for 12 days in the same conditions showed decreased absorbance value. Growths of microorganisms are visible for both blank and prepared syrups after 7 days of storage in room conditions. (Fig.10)

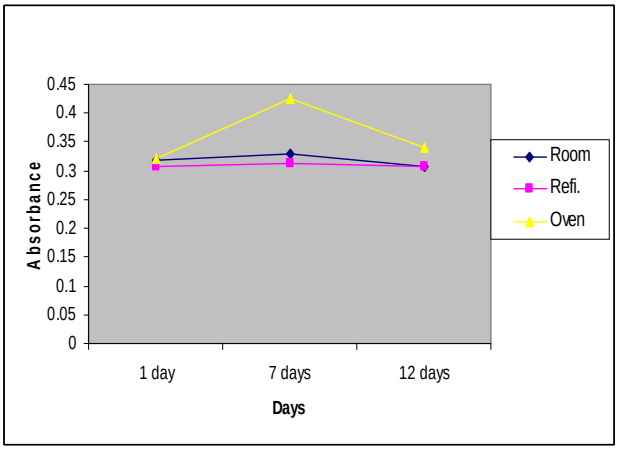

Fig.10 - Absorbance of palm sugar syrup when stored under different conditions for 7 and 12 days.

As evident from the experiments above, the rock sugar syrup preparation was found to be more stable as there was not much change in the absorbance reading of the syrups kept in the room, refrigerator and oven for 7 and 12 days (Table 2). The syrup also showed only little microbial growth and the blank rock sugar syrup showed no growth at all even after 12 days of storage indicating that rock sugar is more suitable for syrup preparation than other sugars.

Table 2 - Absorbance value of Rock sugar syrup

Storage	1 day	7 days	12 days
Room	0.377	0.349	0.356
Refrigerator	0.377	0.370	0.372
Oven	0.379	0.423	0.376

4. Conclusion

Among different extraction time and temperature, 0.5 (half) hour extraction at 90^{o}C was selected for further studies based on suitability of UV absorbance reading. The stability of extracts at this time and temperature was also good when stored in light and dark for 14 days. The syrup prepared with rock sugar gave the best stability in terms of UV absorbance compared to other types of sugar. However, it tends to turn dark and some microbial growths are visible over the time. Thus to improve stability of the preparation, preservatives should be added and appropriate shelf-life determined. Based on the above findings, it is recommended that the syrup should be prepared using rock sugar and must be kept in cool dry place protected from light.

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