

STUDIES UPON PRECIPITATION IN FLUIDEXTRACT OF SENNA. II.*
THE EFFECTS OF VARIOUS PHYSICAL AND CHEMICAL FACTORS UPON PRECIPITATION
IN FLUIDEXTRACT OF SENNA.¹

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In our previous paper we reported a comparative study of precipitation in all of the official fluidextracts of senna and other formulas. Some were slower to precipitate than others but after a period of several months all of them appeared to have about the same amounts of sediment.

This paper is one of a series of brief accounts of devious attempts to find some means of controlling the apparently inevitable precipitation in fluidextract of senna. The results which were obtained, though not often conclusive, frequently pointed the way for future study.

THE EFFECTS OF TIME, LIGHT AND OTHER FACTORS.

A sample of fluidextract of senna was divided into sixteen four-ounce portions, and treated as indicated in Table III. These were examined at intervals for precipitation. The amount of precipitate observed has been recorded by the same system of plus signs as used in our previous paper. The storage of these samples was at room temperature except when otherwise indicated.

TABLE III.

No.	Treatment.	Con- tainer as to Color.	Storage as to Light.	Amounts of Precipitates at Age Indicated in Days by Column.				
				31.	64.	95.	267.	488.
1	Decanted only	Amber	Dark	—	+	+	++++	+++++
2	Decanted only	Clear	Dark	—	+	++	+++	+++++
3	Decanted only	Amber	Diffused light	—	++	++	+++	+++++
4	Decanted only	Clear	Diffused light	+	++	++	+++	+++++
5	Decanted and filtered	Amber	Dark	—	+	++	+++	+++++
6	Decanted and filtered	Clear	Dark	—	++	++	+++	+++++
7	Decanted and filtered	Amber	Diffused light	+	+	++	+++	+++++
8	Decanted and filtered	Clear	Diffused light	+	+	++	+++	+++++
9	Decanted and centri- fuged ¹	Amber	Dark	—	+	+	++	+++++
10	Decanted and centri- fuged	Clear	Dark	—	+	+	++	+++++
11	Decanted and centri- fuged	Amber	Diffused light	—	+	+	++	+++++
12	Decanted and centri- fuged	Clear	Diffused light	+	+	+	++	+++++
13	Decanted and filtered ²	Amber	Dark	++++	+++++	} 41 days ³	}	}
14	Decanted and filtered ²	Clear	Dark	++++	+++++			
15	Decanted and filtered ⁴	Amber	Diffused light	+	++	+++	++++	} 105 days
16	Decanted and filtered ⁴	Clear	Diffused light	+	++	+++	++++	

¹ Centrifuged for 5 minutes at 1400 r. p. m., the sample deposited 0.15 to 0.20 cc. of sludgy sediment for each 25 cc. of the fluidextract.

² Due to an unusually large amount of material that had deposited, numbers 13 and 14 were filtered at the end of two months. ³ Stored at 1–3° C. ⁴ Stored at 30° C.

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¹ Based upon a thesis submitted to the Faculty of Purdue University by Karl L. Kaufman, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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From this study, we have come to the following conclusions:

1. Precipitation in fluidextract of senna is unaffected by the color of the container.
2. Filtering the fluidextract does not affect the rate of precipitation.
3. The fluidextract should be stored at about the same temperature as that at which it was made.
4. Observations upon the precipitation in fluidextract of senna, to be of much value should be continued over a period of not less than three to four months.

ULTRACENTRIFUGATION OF THE FLUIDEXTRACT.

A sample of fluidextract of senna was centrifuged for eight minutes, at 35,000 r. p. m. in a Sharples apparatus. The treatment did not hinder precipitation. Other samples were treated with an alumina cream having an acid reaction. In these samples, stratification of the precipitate was marked.

ULTRAVIOLET LIGHT AND X-RAYS.

Irradiation of fluidextract of senna by means of ultraviolet light and X-rays did not have any marked effect upon the amount of precipitate formed. The irradiation was carried out in stoppered Vitreosil flasks, and the X-ray treatments were made with the samples in clear, soft glass bottles.

After 300 days, the only observable differences between the sediments in the treated and untreated samples was that the X-rayed portions showed a tendency to stratify.

HEAT-TREATMENT OF THE DRUG.

There was the question of enzymes as a possible cause of precipitation in this preparation. To study this, fluidextracts were made from senna which had been previously heated.

Three batches of 750 Gm. each of the drug were heated in an oven at a temperature of 85–100° for 30 minutes. One batch was heated dry. A second was heated after having been moistened with 150 cc. of the official menstruum and a third batch was mixed with magnesium carbonate, 10 Gm. per 750 Gm. of the drug, then moistened with the menstruum and heated.

The fluidextracts made from these three batches exhibited about the same amount of precipitate as the controls after eight months. The one from the magnesium carbonate treatment showed slightly less precipitate and there was a tendency toward stratification in all of those made from the heated drug.

REFRIGERATION.

It was observed that a chilled fluidextract of senna showed an increased amount of precipitate as compared with the control at room temperature. To check this observation more carefully eight samples were refrigerated from one to five days at temperatures ranging from 2° to -20° C.

These samples were filtered and replaced in the refrigerator for further chilling. This was done repeatedly for several days and each time the filtered, chilled samples showed the presence of precipitate. It should be stated, however, that the character of the precipitate was changed. It became increasingly lighter in color and more scaly in appearance. The persistence with which the precipitate continued to reappear in the chilled samples caused us to abandon the treatment as a means of producing a clarified fluidextract of senna.

ALCOHOL CONTENT OF THE MENSTRUUMS.

The effects of varying percentages of alcohol in the menstruum were studied by preparing four fluidextracts with 15%, 25%, 33% and 40% alcohol, respectively, as the menstruums. Our observations upon these fluidextracts are given in Table IV.

TABLE IV.

Sample.	Menstruum.	pH 23° C.	Amount of Precipitate.	
			162 Days.	378 Days.
111-a	33% alcohol	5.75	++++	++++
112-a	25% "	5.53	++++	++++
113-a	15% "	5.38	+++	+++++
114-a	40% "	5.65	+++	++++

It will be noted that the p_H is lowest in those fluidextracts made with menstruums of the lower alcoholic content. It is suggested that this may be due to the presence of increased amounts of the water-soluble organic acids as reported by Kubly (1).

ELECTRODIALYSIS.

The presence of inorganic ions in the precipitate from fluidextract of senna suggested a possible cause for the flocculation of the colloidal material which was undoubtedly present.

To test this assumption the fluidextract was subjected to electro dialysis using the Holmes and Elder (2) "moving-film" type of cell. Parchment membranes were used, and the samples dialyzed against the U. S. P. menstruum, to which had been added 1/10% borax. The reason for the use of borax will be indicated in a later paper.

The fluidextracts which were dialyzed for about four hours showed about as much precipitate at the end of 166 days as did the control sample.

THE EFFECTS OF VARIOUS CHEMICAL AGENTS.

Strong acids or alkalis, in amounts of 5 to 10 minims per 125 cc. of fluidextract, produced slight increases in the rate of precipitation. They also caused the precipitates to stratify.

Numerous elemental substances failed to reduce precipitation in fluidextract of senna, with the possible exception of lead. Samples treated with magnesium showed gas formation, and assumed the odor of manure and a bromine color.

To 50-cc. samples of fluidextract of senna were added 2.0 Gm. each of nineteen chemical compounds. After about two months, the samples were all filtered and set aside. The reagents and the observations are briefly recorded in Table V.

TABLE V.

Reagent.	Age in Days.	Amount of Precipitate.	Other Observations.
KClO ₃	66	Heavy	Terebinthinate odor
KMnO ₄ (0.5 Gm.)	"	"	.....
Pb(C ₂ H ₃ O ₂) ₂	"	"	.....
AgNO ₃	"	.....	Silver mirror
KI	"	Heavy	.....
Ba(C ₂ H ₃ O ₂) ₂ ¹	216	"	.....
Na ₂ B ₄ O ₆ · 10H ₂ O	"	+	.....
CaO (anhydrous)	"	+++	.....
MgSO ₄	"	++++	.....
NaHSO ₄	"	++++	.....
NaAl(SO ₄) ₂	"	++++	.....
NaHCO ₃	"	++++	Marked evolution of gas
H ₂ SO ₄ 7%, (5 cc.)	"	++++	.....
FePO ₄ (soluble)	"	++++	.....
(COOH) ₂ ²	"	++++	.....
PbO	"	++++	.....
CuSO ₄ (anhydrous)	"	++++	.....
BaCl ₂	"	++++	.....
HgCl	"	++++	.....

¹ Treated with dilute sulfuric acid before the first filtering.

² Neutralized with NH₄OH before filtering.

SUMMARY AND CONCLUSIONS.

1. The color of the container in no way affects the character and quantity of the precipitate formation in fluidextract of senna.
2. Observations upon precipitation in fluidextract of senna, to be of value, should be continued over a period of not less than three to four months.
3. Filtering the fluidextract does not seem to affect the rate of precipitation.
4. Precipitation in fluidextract of senna is evidently not due to enzyme activity, as shown by,
 - (a) Heat-treating the drug.
 - (b) The effects of most of the chemical reagents.
5. Fluidextracts of senna with decreasing percentages of alcohol in the menstrua tend to show comparable decreases in p_H , over a certain range.
6. Of the chemical compounds tried, borax was the only one which materially reduced the amount of the precipitate which forms in fluidextract of senna.
7. Fluidextract of senna seemed to show reducing properties.

REFERENCES.

- (1) Kubly, Dissertation, Dorpat (1865); through *Drug. Circ.*, 10, 138 (1866).
- (2) Holmes, H., and Elder, W., *J. Phys. Chem.*, 35, 1351 (1931).

CHRYSOPSIS GRAMINIFOLIA, NUTT.—A PRELIMINARY STUDY.*,^{1,2}

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The genus *Chrysopsis* of the *Compositæ* consists of biennial or perennial caulescent herbs, usually conspicuously pubescent. The leaves are alternate; blades very narrow or sometimes broad, entire and sessile or somewhat toothed and petioled near the base of the stem. The heads are showy, radiate or rarely discoid, typically in corymbs. The involucre are many flowered with bracts narrow, several series; the inner ones successively longer. The receptacle is pitted. Ray-flowers are several, pistillate and the disk-flowers mostly perfect. Corollas are yellow. Stigmas with linear or subulate appendages; achenes flattened. The pappus is double with the outer series of small scales or bristles; the inner of numerous rough hair-like bristles (1).

Chrysopsis graminifolia, Nutt. has silvery-silky foliage with long closely pressed hairs. The stems are 3-9 dm. tall, corymbosely branched. The leaves are various, the basal with narrowly linear blades 1-4 dm. long, many times longer than the upper. The stem-leaves do not clothe the stem, with linear-lanceolate, linear or linear-subulate blades, the upper erect. The involucre are cylindric, 10-12 mm. high, 5 mm. thick. The bracts are linear-subulate, glabrate or glandular-pubescent on the back. The ray-flowers have narrow ligules, 8-12 mm. long (1). The herb flowers from July to October and is found growing profusely in dry sandy soil from New Jersey and Delaware to Kentucky and southward to Florida. It has been known variously as "Golden Aster," "Blue-grass" and "Fever-grass" and has been stated to be of medicinal value especially as a poultice for sprains (2).

A review of literature revealed that no studies have been made on this plant, and because of its reputed medicinal value and since it grows so profusely in the Carolinas it was decided to make a study of it to ascertain, if possible, any therapeutically active substances.

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¹ An abstract from a thesis to be submitted in partial fulfilment of the requirements for the degree of Master of Science in Pharmaceutical Chemistry.

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