A STUDY OF THE EMODIN-BEARING GROUP OF CATHARTICS. AROMATIC FLUIDEXTRACT OF CASCARA. PART II.

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The purpose of this article is to show the composition of U. S. P. Aromatic Fluidextract of Cascara and to apply the usual methods of analysis which were outlined in detail in Part I[1] of this series of articles.

Although the same amount of ground cascara is used in its manufacture, the color readings of this preparation are much less than were obtained on regular U. S. P. Fluidextract of Cascara. This pleasant form of cascara is very extensively used; probably it is the most popular of all of the preparations of the emodin-bearing group. From the fact that 1000 Gm. of this cascara are used in the manufacture of this preparation, the same as are used for ordinary Fluidextract of Cascara, and the dosage is given as 30 minims, while the regular Fluidextract of Cascara is only 15 minims, it would seem that the cathartic value is considered only about one-half as strong in the aromatic cascara as in the ordinary Fluidextract of Cascara. One thing is quite certain, that the aromatic preparation is much more palatable.

The U. S. P. VII (1890), does not list the Aromatic Fluidextract of Cascara. In the U. S. P. VIII, Cascara Aromatic first appears and differs from the regular Fluidextract of Cascara in that 1000 Gm. of the drug are mixed with 1000 Gm. of ground glycyrrhiza of No. 30 powder and 125 Gm. of magnesium oxide. With this are added glycerin and compound spirit of orange. The U. S. P. IX requires the same amount of ground bark and the same amount of magnesium oxide as U. S. P. VIII, but an extract of licorice is used and a larger assortment of flavoring oils. The U. S. P. X specifies 1000 Gm. of the dry bark but with 60 Gm. of magnesium oxide and 60 Gm. of lime. There is obviously some important change due to the lime because when some of the same batch of ground bark is made into U. S. P. Fluidextract Cascara Aromatic U. S. P. IX, and another portion into U. S. P. Aromatic X, there is a much darker red color produced in the drug mass before percolation when lime is used. Evidently a substantial amount of the emodin or its derivatives is being released or destroyed by this treatment. It may be that the action of the base $Ca(OH)_2$ reacts with emodin or frangulic acid, forming the calcium salt which is insoluble in water, thus removing most of the free emodin.

In this study there will appear the analyses of numerous fluidextracts consisting of old Fluidextract Aromatic Cascara U. S. P., which has been in this laboratory for several years, securely stoppered, and Fluidextract Aromatic Cascara U. S. P., of less age, and some recently manufactured cascara furnished directly from several large drug houses, which was furnished by them from their research department; also some very recently purchased fluidextracts from wholesale drug houses, and of several Aromatic Fluidextracts of Cascara which have been manufactured in this laboratory. These aromatic cascaras manufactured here are from batches of bark which have also been used to make the straight Fluidextract of Cascara; also Fluidextract Aromatic Cascara made by U. S. P. IX, and U. S. P. X, for the purpose

[1] Part I, JOUR. A. PH. A., 19 (1930), 235–238.

of determining just what analytical differences there are between the different preparations.

Out of this data it is hoped we may outline specifications as to just how a preparation containing the different quantities of Fluidextract of Cascara Aromatic must run. Each of these fluidextracts mentioned above has been made into preparations containing from 20% to 25% alcohol and containing in each fluid-ounce exactly 30 minims of this Aromatic Cascara. A search of the literature has not furnished a very definite reason why the Fluidextract of Cascara Aromatic is considered only one-half the strength of bitter Fluidextract of Cascara and it is hoped that the following determinations will throw some light upon this problem. It would seem that there is some uncertainty in the minds of those responsible for the addition of magnesium oxide and calcium oxide as to just what its function is and why it is necessary to add lime in the U. S. P. X in addition to the magnesium oxide.

It was shown by E. O. Eaton (1), that the process of making Aromatic Cascara did not entirely destroy the reaction from emodin but in some cases it would be necessary to boil the preparation in acid so as to produce the test. In all of the Fluidextract of Cascara Aromatic that has ever been tested in this laboratory there has been a large reduction in free emodin over what we might expect from the amount of cascara used in its manufacture. In some instances, however, all of the free emodin is not destroyed or rendered inactive but in most instances it has been very materially reduced. The amount of the combined emodin is also greatly effected particularly by the use of lime. F. W. Nitardy (2) says:

> "It is known that the use of magnesium oxide as a de-bittering agent in the manufacture of Aromatic Fluid Extract of Cascara reduces the activity of this preparation to a considerable extent."

In the same publication Mr. Nitardy offers some theories as to just what has happened. Milford Harris and Edward D. Davy (3) state:

> "Aromatic Fluidextract of Cascara is less active than the Fluidextract because of the formation of a water-insoluble compound of the active agent, presumably the glucoside."

According to Warren (4), it was the late Prof. W. M. Searby of San Francisco and former president of the AMERICAN PHARMACEUTICAL ASSOCIATION, who was the first to introduce cascara debitterized with magnesium. Possibly the treatment removes free emodin. He also states that besides lime and magnesium oxide that zinc oxide had been used.

In the first table there are 35 fluidextracts. All of the same manufacturer are brought together in small groups for ease of comparison. All were alleged to be U. S. P. or its equivalent, although 15, 16, 17 and 36 had already been declared by the analyst to be substandard, and to these may be properly added at least three others of low readings.

In this table will be found the alcohol, solids, ash, calcium and magnesium oxide content all determined by the A. O. A. C. methods, and the colorimetric emodin readings determined as follows:

Method for Color Reading—before Hydrolysis (Free Emodin).—Extract 25 cc. of the preparation, made acid with 2 cc. $N/10$ H_2SO_4, extract by continuous shaking 5 minutes with 50 cc. of ordinary sulphuric ether in a separatory funnel; draw off aqueous liquor several times as it settles and

take 10 cc. of the yellow ether extract and 10 cc. of strong ammonia and place in a colorimetric tube (Nessler), mix, allow to stand until some of the remainder of the yellow ether extract is read in $^1/_{16}$-inch cell, then make the mixture in the Nessler tube up to 50 cc. volume with water. Flick off the ether which rises to the top and read the red color in a $^1/_8$-inch cell.

Method for Color Reading—after Hydrolysis (Total Emodin).—The cascara preparation contained in each fluidounce 15 minims of fluidextract and 30 minims per fluidounce of Aromatic Cascara; 25 cc. of each preparation was treated in an Erlenmeyer flask with 2 cc. of concentrated sulphuric acid, shaken thoroughly and allowed to stand over night; reflux over a steam-bath for 30 minutes using a tube condenser. Transfer the material into a separatory funnel. Shake with 50 cc. of ordinary ether for exactly 5 minutes, allow to settle; draw off aqueous layer, shake and again allow to settle. Again draw off the remaining aqueous material. Repeat this process until all the aqueous liquor is stripped out as completely as possible.

Take 10 cc. of the yellow ether extract and 10 cc. of strong ammonia and place in a colorimetric tube (Nessler), mix, allow to stand until some of the remainder of the yellow color is read in $^1/_{16}$-inch cell, then make the mixture in the Nessler tube up to 50 cc. volume with water, allow to settle, flick off the ether which rises to the top and read the red color in $^1/_8$-inch cell.

TABLE I.—FLUIDEXTRACT OF CASCARA SAGRADA AROMATIC.

Samples Made up 30 Minims per Fluidounce except Where Indicated.

Laboratory no.	Per cent alcohol by volume.	Solids.	Grams per 100 cc. of Ash.	CaO.	MgO.	Before Hydrolysis. Yellow eth. ext. $^1/_{16}$" cell.	Red alkaline sol. $^1/_8$" cell.	After Hydrolysis. Yellow eth. ext. $^1/_{16}$" cell.	Red alkaline sol. $^1/_8$" cell.
15 (97705)	24.41	2.79	0.260	0.0594	0.0660	0.6	0.4 R 0.3 Y	1.6	0.6 R 0.6 Y
16 (97706)	24.43	2.66	0.256	0.0358	0.0739	0.6	0.4 R 0.3 Y	1.6	0.6 R 0.6 Y
17 (97707)	24.40	2.68	0.230	0.0426	0.0327	0.5	0.3 R 0.2 Y	1.5	0.5 R 0.5 Y
18 (98384) Del. (Burrough)	24.78	3.06	0.120	0.0596	0.0356	2.2	1.6 R 0.6 Y	7.0	3.5 R 1.5 Y
28 (99250) 304411130	25.56	3.53	0.382	0.0448	0.0650	1.00	0.5 R 0.3 Y	3.4	1.7 R 1.3 Y
36 Purchased from Gilman 306630	25.11	2.36	0.208	0.0412	0.0775	0.6	0.2 R 0.1 Y	1.5	0.7 R 0.7 Y
33 Made in lab. Burrough Bark, U. S. P. IX	25.6	3.3	0.175	0.0252	0.0859	1.5	1.2 R 0.3 Y	11.5	5.5 R 2.8 Y
34 ditto except U. S. P. X	25.18	3.46	0.27	0.1330	0.0422	0.9	0.7 R 0.4 Y	5.6	3.7 R 2.4 Y
37 Straight fluidextract 15 min. per fluidoz.	25.79	0.91	0.02	0.0056	0.0088	1.5	1.15 R 0.4 Y	5.6	3.7 R 2.2 Y
1 75024		2.40	0.26	0.1444	0.1353	1.6	0.4 R 0.3 Y	4.4	1.5 R 2.0 Y
2–FO 7486	24.56	2.83	0.33	0.1812	0.1347	0.9	0.2 R 0.3 Y	3.0	1.7 R 1.1 Y
12–9G 4057	24.67	3.24	0.23	0.1436	0.0714	1.3	0.6 R 0.4 Y	4.2	2.2 R 1.9 Y
29 OK 2677	24.12	3.66	0 19	0.1072	0.0601	1.1	0.5 R 0.4 Y	4.6	2.4 R 2.5 Y
30 OG 1364	24.92	3.59	0.18	0.0647	0.0980	1.6	0.5 R 0.4 Y	4.2	2.1 R 2.5 Y
39 OE 5959	24.93	3.97	0.40	0.0748	0.1182	1.7	0.7 R 0.6 Y	3.2	2.0 R 2.2 Y
7 02066X832806		1.73	0.24	0.0595	0.1061	0.7	0.2 R 0.3 Y	3.0	1.6 R 2.7 Y

13 72509–645692		2.04	0.14	0.0692	0.0468	0.6	0.4 R 0.3 Y	2.2	1.6 R 1.7 Y
19 7076 845514	24.60	1.82	0.216	0.1442	0.0470	0.7	0.3 R 0.4 Y	3.5	1.7 R 2.2 Y
20 7102 848105	23.56	2.02	0.200	0.1338	0.0635	0.8	0.3 R 0.4 Y	3.6	2.2 R 2.4 Y
27 4085 837269	25.28	3.15	0.200	0.1039	0.0576	1.0	0.3 R 0.3 Y	4.6	2.8 R 3.3 Y
3 4010AD–41932		3.02	0.17	0.0240	0.0842	0.6	0.2 R 0.3 Y	3.1	1.6 R 2.7 Y
4 4010AD–41932	24.68	3.04	0.14	0.0171	0.0516	0.6	0.2 R 0.3 Y	2.8	1.6 R 2.6 Y
9–3505 GM–31585		3.22	0.148	0.0549	0.0801	0.8	0.4 R 0.3 Y	3.6	1.8 R 1.9 Y
10 4110 LK 39748	25.26	2.83	0.150	0.0114	0.0802	0.8	0.5 R 0.3 Y	6.0	3.6 R 2.0 Y
23 44D7LB 48502	24.52	2.84	0.156	0.0174	0.0631	0.7	0.3 R 0.3 Y	3.5	2.8 R 2.6 Y
38 1170784	24.86	3.03	0.286	0.0160	0.0613	0.2	0.1 R	1.7	1.0 R 1.6 Y
25 78261 (Na_2HCO_3)	24.80	2.19	0.130	0.0036	0.0098	1.9	1.0 R 0.3 Y	4.4	2.7 R 1.3 Y
5 2812566		1.62	0.09	0.0070	0.0403	0.5	0.0	1.4	0.7 R 1.0 Y
11 2450117		1.81	0.09	0.0314	0.0320	0.6	0.3 R 0.3 Y	3.4	2.1 R 0.8 Y
22–2919654	24.84	1.70	0.116	0.0076	0.0562	0.5	No R	2.0	1.2 R 1.5 Y
8 571486A	24.44	1.61	0.14	0.0756	0.0803	0.6	0.2 R 0.1 Y	2.5	1.2 R 1.0 Y
14–11183878	25.11	2.86	0.213	0.1221	0.0442	0.6	0.4 R 0.3 Y	3.4	1.9 R 1.5 Y
21–A 631949	24.80	2.956	0.236	0.0938	0.0216	0.7	0.4 R 0.3 Y	3.7	2.2 R 2.0 Y
24–En. & G. BBrk, IX	25.40	3.186	0.180	0.0216	0.0846	1.6	1.0 R 0.3 Y	12.5	5.5 R 3.2 Y
31–En. & G. Bark, X	24.76	3.30	0.23	0.1380	0.0331	0.9	0.52 R 0.4 Y	6.4	3. 9R 3.0 Y
32–En. & G. Bark (15 min.), X St. F. E.	25.60	0.80	0.025	0.0031	0.0080	2.4	1.2 R 0.3 Y	7.0	4.0 R 1.8 Y
33–Burrough Bark, IX	25.6	3.3	0.175	0.0252	0.0859	1.5	1.15 R 0.3 Y	11.5	5.5 R 2.8 Y
34–Burrough Bark, X	25.18	3.46	0.27	0.1330	0.0422	0.9	0.7 R 0.4 Y	5.6	3.7 R 2.4 Y
37 Burrough Bark (15 min.), X St. F. E.	25.79	0.91	0.020	0.0056	0.0088	1.5	1.15 R 0.4 Y	5.6	3.7 R 2.2 Y
43 Aromatics only		0.869	0.034	0.00067	0.00329	Neg.	Neg.	Neg.	Neg.
26 (85969)	25.92	3.734	0.200	0.0795	0.0790	0.9	0.3 R	2.6	1.2 R 1.4 Y
35 (266409)	25.10	3.03	0.280	0.1352	0.0209	0.9	0.5 R 0.3 Y	4.8	2.4 R 2.0 Y

There were also made determinations of all the preparations listed in the first table by a method suggested by H. C. Fuller (5) for the assay of cascara and submitted by him at one time to the A. O. A. C. The method is as follows:

Introduce 5 Gm. of the powdered drug or 5 cc. of the fluidextract or 25 cc. of a tonic containing as medication, Fluidextract of Cascara or Fluidextract of Aromatic Cascara into an Erlenmeyer flask of 500 cc. capacity; add 200 cc. of chloroform and 50 cc. of 25% sulphuric acid (70 cc. of sulphuric acid in water q. s. 500 cc.); attach to a reflux condenser (water cooled) using cork stopper covered with tin foil. Apply low heat of Bunsen flame and allow the chloroform to boil for two and one-half hours. At the end of that time allow to cool and then transfer to separatory funnel, washing out flask with a little fresh chloroform.

Draw off the chloroform into another separatory funnel. Add 50 cc. chloroform to the acid mixture, agitate and after separation has taken place, run chloroform into that previously collected. Repeat the procedure three times for bark and fluidextract and twice for preparations. Discard the acid mixture.

Collect the chloroform shake-outs in an Erlenmeyer or distilling flask, recover about $^2/_3$ of the solvent by distillation and pour the balance into a separatory funnel, washing thoroughly to remove final traces of anthraquinones; (use foil on all stoppers when recovering chloroform during distillation) agitate the chloroform with 25 cc. of 10% sodium hydroxide; draw off chloroform and subject to another treatment with 10% sodium hydroxide. Repeat again; draw off chloroform and wash with 25 cc. of water three times. (Two washings are sufficient with preparations containing one or two doses of cascara.)

Unite the alkaline solutions and washings, add excess of hydrochloric acid (15 cc. of conc. HCl is usually sufficient) and shake out five times with chloroform. (Three times are sufficient with tonic preparations.) Discard the acid and wash the chloroform solution by shaking with 50 cc. of water; repeat, washing with 50 cc. of water; let settle completely, filter chloroform through cotton in stem of funnel into a distilling flask or Erlenmeyer flask and recover a portion of the solvent. Then pour the balance into a weighing dish, washing out distilling flask with chloroform; evaporate the solvent and dry at not over 100 degrees centigrade for 30 minutes, cool in desiccator and weigh. The weight represents the total anthraquinone bodies in the drug. Preserve the residue for the method described below. (If the residue should show any visible trace of white crystalline material wash again with water.)

COLORIMETRIC DETERMINATION.

Treat the residue of anthraquinone derivative obtained by the gravimetric assay described above with 10 cc. of 10% potassium hydroxide, wash into a 100-cc. graduated flask with distilled water and make up to volume. Ten cc. of this solution is then diluted with water to 50 cc., a portion introduced into a one-eighth-inch cell of a Lovibond tintometer and matched against the red slides. Note depth of color and report degrees observed.

Transfer 20 cc. of the alkaline liquid by means of pipette to a separatory funnel, add an excess of hydrochloric acid and extract with 25- and 15-cc. portions of ether. Collect the ether solution in a 50-cc. graduated flask and make up to volume with ether. Introduce a portion of this ether solution into a $^1/_{16}$-inch cell of a Lovibond tintometer; match against the yellow slides; note depth of color and report degrees observed.

TABLE II.—TOTAL EMODIN DETERMINED BY THE EXTRACTION METHODS.

No.	(Proposed A. O. A. C. Cascara Assay.) Substance.	25 cc. Used of a Preparation Containing 30 ♏ to Oz. of Aromatic Fluidextract Cascara. Wt. of residue.	Emodin Reading. Yellow 1/16″ cell.	Red 1/8″ cell.
1	Flext. Cascara Aromatic 30 ♏ to oz.	0.024	0.6	0.4 R
2	" " " " " " "	0.028	0.5	0.4 R
3	" " " " " " "	0.040	0.5	0.5 R 0.3 Y
4	" " " " " " "	0.040	0.6	0.8 R 0.3 Y
5	" " " " " " "	0.024	0.8	0.7 R 0.4 Y
6	" " " " " " "	0.022	0.6	0.6 R 0.5 Y

7	"	"	"	"	"	"	"	0.022	0.8	0.6 Y 0.5 R
8	"	"	"	"	"	"	"	0.019	0.4	0.4 R 0.3 Y
9	"	"	"	"	"	"	"	0.027	0.5	0.8 R 0.4 Y
10	"	"	"	"	"	"	"	0.028	0.8	0.9 R 0.4 Y
11	"	"	"	"	"	"	"	0.014	0.6	0.6 R 0.3 Y
12	"	"	"	"	"	"	"	0.032	0.8	0.9 R 0.4 Y
13	"	"	"	"	"	"	"	0.014	0.4	0.2 R
14	"	"	"	"	"	"	"	0.021	0.4	0.2 R
15	"	"	"	"	"	"	"	0.025	0.1	0.1 R
16	"	"	"	"	"	"	"	0.017	0.2	0.2 R
17	"	"	"	"	"	"	"	0.009	0.2	0.12 R
18	"	"	"	"	"	"	"	0.0185	1.10	1.2 R 0.2 Y
19	"	"	"	"	"	"	"	0.024	0.6	0.52 R 0.2 Y
20	"	"	"	"	"	"	"	0.026	0.6	0.68 R 0.3 Y
21	"	"	"	"	"	"	"	0.014	0.3	0.4 R 0.2 Y
22	"	"	"	"	"	"	"	0.0121	0.40	0.28 R
23	"	"	"	"	"	"	"	0.0235	0.70	0.52 R 0.30 Y
25	"	"	"	"	"	"	"	0.0210	0.60	0.42 R 0.20 Y
26	"	"	"	"	"	"	"	0.0190	0.30	0.20 R
27	"	"	"	"	"	"	"	0.0350	1.3	1.20 R 0.10 Y
28	"	"	"	"	"	"	"	0.0228	0.40	0.40 R
29	"	"	"	"	"	"	"	0.0285	0.40	0.40 R
30	"	"	"	"	"	"	"	0.0283	0.40	0.40 R
35	"	"	"	"	"	"	"	0.0130	0.50	0.40 R
36	"	"	"	"	"	"	"	0.0035	0.20	0.10 R
38	"	"	"	"	"	"	"	0.0085	0.40	0.40 R
39	"	"	"	"	"	"	"	0.0140	0.40	0.40 R

TABLE II.—*Continued.*

TOTAL EMODIN DETERMINATION BY THE EXTRACTION METHOD.

(Proposed A. O. A. C. Cascara Assay.)			Five Grams Bark or 5 cc. of Fluidextract or 25 cc. of a Preparation. Emodin Reading.		
No.	Substance.	A. O. A. C. wt. residue.	Yellow 1/16" cell.	Red 1/8" cell.	Description and source of material.
24	Aromatic Flext. Cascara U. S. P. IX	0.1090	3.2	4.7 R 1.0 Y	Made in lab. from Engelhardt and G.-L. Co. Mixed bark, over 4-year old bark
31	Aromatic Flext. Cascara U. S. P. X	0.1125	2.5	3.7 R 0.9 Y	"
32	U. S. P. Flext. Cascara	0.0757	4.4	5.4 R 1.0 Y	"

33	Aromatic Flext. Cascara U. S. P. IX	0.1074	4.0	4.0 R 1.2 Y	Made in lab. from Burrough Bros. bark over 4 years old
34	Aromatic Flext. Cascara U. S. P. X	0.1221	2.8	3.5 R 1.0 Y	"
37	U. S. P. Flext. Cascara	0.0920	4.8	5.0 R 1.6 Y	"
24	Preparation (30 ℥ per oz.)	0.0415	1.1	1.0 R 0.2 Y	Made from Arom. Flext., No. 24—Engelhardt and G.-L. bark, U. S. P. IX
31	"	0.0555	1.0	1.0 R 0.4 Y	Same as above except U. S. P. X
33	"	0.0605	1.5	1.0 R 0.3 Y	Made from Arom. Flext., No. 33, Burrough Bros. bark, U. S. P. IX
34	"	0.0785	1.0	0.8 R 0.4 Y	Same as above except U. S. P. X
32	Preparation (15 ℥ per oz.)	0.0330	1.4	1.0 R 0.4 Y	Made from the straight U. S. P. Flext. from Engelhardt and G.-L. bark
37	"	0.0285	1.0	0.8 R 0.4 Y	Same as above except from Burrough Bros. bark
41	Burrough bark alone. Five grams used	0.2365	6.0 (0.2 R)	5.7 R 2.7 Y	Original Burrough Bros. bark from which standard above Flexts. were made
42	Engelhardt and G.-L. bark alone. Five grams used	0.2160	5.2 (0.2 R)	5.2 R 1.4 Y	Original Engelhardt and G.-L. bark from which standard Flexts. were made
43	Aromatics as in mfg. of Flext. Arom. Cascara	0.0250	Neg.	Neg.	Prepared to see what effect if any the aromatics alone would produce without Cascara (5 cc. of Flext. minus bark)

EMODIN LOSS DUE TO ALKALI.

A special experiment was conducted with two batches of ground cascara bark.

(A) Furnished by late Dr. Engelhardt, mixed with some purchased from Gilpin-Langdon & Co. These two sets of bark were thoroughly mixed and 3 following preparations were made.

(24) Aromatic Fluidextract of Cascara Aromatic U. S. P. IX.

(31) Aromatic Fluidextract of Cascara Aromatic U. S. P. X.

(32) Straight Fluidextract of Cascara U. S. P. X.

(B) Cascara bark furnished by Burrough Bros., Baltimore, Md. This ground cascara bark was carefully mixed and the following preparations were made from it.

(33) Aromatic Fluidextract Cascara Aromatic U. S. P. IX.

(34) Aromatic Fluidextract Cascara Aromatic U. S. P. X.

(37) Straight Fluidextract of Cascara U. S. P. X.

The usual extractions and color readings were made on preparations made from these fluidextracts. The aromatic fluidextracts were made into preparations containing in each fluidounce 30 minims and the straight fluidextract, into preparations containing 15 minims per fluidounce (25 cc. used for analysis).

	Free Emodin.		Total Emodin.	
Engelhardt and Gilpin-L. & Co.	Yellow 1/16" cell.	Red 1/8" cell.	Yellow 1/16" cell.	Red 1/8 cell.
No. 24 Aromatic U. S. P. IX		1.0 R		5.5 R
30 ♏ to fluidounce	1.6	0.3 Y	12.5	3.2 Y
No. 31 Aromatic U. S. P. X		0.52 R		3.9 R
30 ♏ to fluidounce	0 9	0.44 Y	6.4	3.0 Y
No. 32 Straight (15 ♏ to	2.4	1.20 R		4.0 R
fluidounce		0.30 Y	7.0	1.8 Y
No. 33 Burrough bark 30 ♏ to		1.15 R		5.5 R
Aromatic U. S. P. IX (fluidounce)	1.15	0.30 Y	11.5	2.8 Y
No. 34 Aromatic U. S. P. X	0.9	0.7 R		3.7 R
30 ♏ to fluidounce		0.44 Y	5.6	2.4 Y
No. 37 Straight	1.5	1.15 R		3.7 R
15 ♏ to fluidounce		0.44 Y	5.6	2.2 Y

The above table shows that 4-year old bark is same as 2-year old and it shows U. S. P. IX Aromatic 50% better color readings than U. S. P. X aromatic.

It shows use of MgO only, reduces free emodin 50% and reduces combined emodin 14.7% and total emodin 25.7%; shows use of MgO plus CaO, reduces free emodin 70% and reduces combined emodin 41% and total emodin 50%.

Above according to red readings only on Burrough bark.

Engelhardt and Gilpin & Langdon (4-year bark)

Shows use of MgO only, reduces free emodin 58% and reduces combined emodin 20.0% and total emodin 31%.

Shows use of MgO plus CaO, reduces free emodin 78% and reduces combined emodin 40.0% and total emodin 51.2%.

AMOUNT OF REDUCTION OF EMODINS OF THE 2 BARKS.

	Engelhardt and Gilpin-Langdon Co.		Burrough.	
Reduction.	MgO.	MgO plus CaO.	MgO.	MgO plus CaO
Free	58.0%	78.0%	50.0%	70.0%
Combined	20.0%	40.0%	14.7%	41.0%
Total	31.0%	51.2%	25.7%	50.0%

From the above it would seem that the more alkaline lime causes a severe change on the color reading of cascara, about twice the effect of magnesium. It is likely that it also follows that the laxative action is also reduced in proportion.

It may be shown that lime is not only unnecessary for debitterizing purposes but very detrimental to the product. Lime yields a product which has a different taste from that in which magnesium alone is used, and it is not as palatable.

It would seem to those working in this laboratory on this problem that lime in the manufacture of Fluidextract Cascara Aromatic has only one virtue, that of cheapness.

COLOR READINGS OF BARK EQUIVALENT.

It seemed desirable to run the colorimetric emodin analysis both before and after hydrolysis on the equivalent weight of ground bark which corresponded to the fluidextract on a preparation containing 15 minims of the fluidextract per fluidounce of preparation and using 25 cc. of such preparation for the analysis.

Accordingly 0.822 Gm. of Burrough bark and the same weight of the mixed G.-L. & Co. and Engelhardt barks were used; 0.822 Gm. of bark placed in a separatory funnel, 25 cc. distilled H_2O and 2 cc. N/H_2SO_4 added, then 50 cc. ether and whole shaken for 5 minutes for the free emodin analysis. 0.822 Gm. of bark placed in a 250-cc. Erlenmeyer flask, 25 cc. distilled H_2O and 2 cc. concentrated H_2SO_4 added and allowed to stand over night; then refluxed with air condenser on steam-bath for $1/2$ hour; cooled, placed in separatory funnel, 50 cc. ether added and whole shaken for 5 minutes for total emodin analysis.

Sample.	Free Emodin. Yellow 1/16" cell.	Red 1/8" cell.	Total Emodin. Yellow 1/16" cell.	Red 1/8" cell.
Burrough Bros.	3.5	1.9 R	6.8	3.7 R
Bark		0.7 Y		1.5 Y
G.-L. & Co. and	3.3	1.75 R	6.8	3.24 R
Engelhardt bark		0.50 Y		1.10 Y

CONCLUSIONS.

Between the colorimetric and gravimetric methods outlined above the first is simpler and more reliable and the determinations listed in Table I are all that are necessary to determine the amount of aromatic cascara in a preparation or the strength of a U. S. P. Aromatic Cascara or one that is claimed to be equivalent thereto.

The second method, results shown in Table II and called for convenience the "Proposed A. O. A. C. assay," can also be used in addition to the determinations made and listed in Table I, but it is more involved and requires more time. In this method using a weaker acid concentration for digestion failed to improve the result. Responsible persons may secure the names of the manufacturers of these products by addressing the author, Room 422, Treasury Building.

A great deal of the above analytical work was done by Geo. E. Mallory, W. H. Frazier and Loren Burritt.

REFERENCES.

(1) E. O. Eaton, JOUR. A. PH. A., 11 (1922), 21.
(2) F. W. Nitardy, *Ibid.*, 12 (1923), 495.
(3) Harris and Davy, *Ibid.*, 19 (1930), 28.
(4) Warren, *Ibid.*, 13 (1924), 256.
(5) Fuller, *J. Assoc. Official Agr. Chem.*, 5 (1922), 577; 7 (1920).

PERMIT PROCEDURE RELATING TO INDUSTRIAL ALCOHOL AND OTHER NON-BEVERAGE LIQUORS.

Commissioner James M. Doran has issued a publication on above, which should be obtained by those interested and to the latter belong more than 177,000 individuals.

In the consideration of an application for a permit Bureau officers, by careful inspection and investigation, seek to establish definitely these four important points:

1. Fitness of the applicant and others connected with the enterprise to carry on the business for which permit is requested;

2. Sufficiency of bond and integrity of all individuals connected with the financing of the project or those who intend to manage and operate the business;

3. Premises, plant, buildings and apparatus to be used are in accord with regulations and are suitable for the business;

4. Adequacy of evidence offered by applicant as to the legitimate disposition of the product and the standing of those who, it may be claimed, will purchase the finished product.

Permit control procedure includes active supervision over business operations by Government officers, regular examination and audit of accounts and records, and other pre-cautionary checks to insure lawful compliance with permit conditions.