# CONTRIBUTED AND SELECTED

## PHARMACOPŒIAL STANDARDS FOR WHISKY AND BRANDY.

BY GEORGE M. BERINGER, A.M., PH.M.

The resolutions adopted by the various associations of druggists in favor of the retention of standards for whisky and brandy in the United States Pharmacopœia indicate that this is considered one of the topics in which pharmacists are especially interested.

The question of proper pharmacopœial standards for these distilled liquors has been unnecessarily beclouded by other questions that have been introduced in the discussion.

As the member of the Committee of Revision to whom was referred the subject of standards for whisky and brandy, I am of the opinion that there should be presented, for the benefit of the interests engaged in the discussion, a review of the studies this assignment entailed. Hence I have concluded to publish an abstract of the "Report of the Referee on Whisky and Brandy."

The preparation of a satisfactory monograph on whisky is beset with peculiar difficulties. The referee admits that it has been one of the most perplexing of the many pharmacopœial problems with which he has been personally associated.

Considerable of the literature on the subject has been written in behalf of trade interests engaged in a strenuous effort to obtain commercial advantages, and is so tinctured with partisanship as to becloud the scientific facts necessary for a pharmacopœial standard. The Pharmacopœia *must not become entangled in any such trade controversies.*

The referee believes that it is his duty to present a report that shall be based upon an impartial study of the subject and upon the actual data obtained by examination of commercial products of satisfactory quality. What is needed is a definition, description, and tests that shall correctly define, cover, and include any properly produced whisky that may be dispensed when "Spiritus Frumenti" is *prescribed for medical purposes,* irrespective of which cereals were used in the mash or what form of apparatus was used in the distillation, or the state or country where it was produced. Such a standard, to be satisfactory, must be based upon such facts as are fully established, and not upon academic theories or preconceived views.

The following general observations are initial propositions which have a bearing on this question. These must be given due consideration as having a decided influence on the draft of a pharmacopœial standard. They further serve to illustrate some of the difficulties of the problem.

*Whisky is of such a complex chemical composition that it is difficult to compass it by the ordinary rules of procedure of the Pharmacopœia.* Approximately, about 99 percent of whisky is a mixture of ethyl alcohol and water which our accepted methods enable us to determine with sufficient accuracy. The remaining 1 percent or less consists of non-volatile extractives and numerous volatile constituents of complex and more or less unknown composition and present in ever-varying proportions. The presence of these volatile substances, which in the more recent literature have been named "congeners," in at least a substantial amount is essential to whisky.

The causes of congeneric variation are numerous. The various mixtures and quality of the grains used and the proportion of diastase in the mash, the character of the yeast, the time and temperature of the fermentation, the method of distillation, the distilling apparatus, and even the atmospheric conditions, are factors permitting of innumerable changes and consequently innumerable variations in the amount and character of the congeners present in the product.

*It is difficult to gauge the degree to which rectification and compounding have been carried on or to what extent these should be restricted.* For several centuries the trend of the manufacture of whisky has been toward either the masking of or the elimination of a portion of the congeners. The earlier attempts to render distilled spirits potable were efforts to overcome or drown out the obnoxious odor and taste in the crude distillates of those days by the addition of aromatic and sweetening flavorings in relatively large amounts.

These attempts at masking were soon supplanted by improved methods of manufacture that aimed at the elimination of a large portion of the congeners produced. The first step to be applied in the process of elimination was fractionating the distillate by which the aldehydes and " fusel oil " congeners were largely separated in the rejected fractions. In the whisky industry, as in other industries, marked progress has taken place in the character of apparatus and machinery employed. In modern distilleries the improved column still has generally replaced the older types of stills.

The second step in the process of elimination of " fusel oil " congeners is rectification. Originally this was carried on as a distinct industry in an establishment entirely separate from the distillery. Rectification originally consisted in passing the grain distillates through a series of leaching tubs containing charcoal. Since 1872, the government has sanctioned, by congressional enactment, the use of improved apparatus by which the rectification may be carried on at the distillery as a part of the process of manufacture, thus combining in one completed operation both the distillation and the rectification.

During all of these years the effort has been to eliminate as much of the higher alcohols, " fusel oil," as possible. The tendency of the manufacture of whisky has been gradually but surely toward the production of a " lighter " or milder type of distilled spirit from grain, and the taste of the public has been cultivated in that direction.

The taste of the public has likewise been cultivated toward the modified flavors produced by " blending " in which the art of the compounder is exhibited. It is estimated that probably 90 percent or more of the whisky consumed is blended or mixed grain distillates.

In its standard the United States Pharmacopœia must necessarily recognize the changes that have occurred in the character of the product known as whisky because of improved apparatus and processes, changes in trade conditions, and the demands of cultured palates. Its standard must of necessity define what is actually in the market and what is used in medical practice, and not what was originally known as whisky or the primitive " usquebaugh."

*It is likewise difficult to gauge the changes due to the aging or maturing of whisky and to determine the proper minimum age limit.* It may be considered as universally conceded that the palatability of whisky is improved, if not mainly due, to changes which occur during the period of maturing or storing. To what modification of its components or to the production of which " secondary products " this improvement is due cannot be definitely stated.

The changes that take place during the aging are, as yet, but imperfectly

known. However, we do know something of these and of their effect on the potability of the whisky. The distilled spirit dissolves out of the wood a small amount of tannin, wood extractive, and color, and acquires a distinct woody flavor, detectable by both taste and smell. The color and flavor are materially influenced by the extent of the charring of the interior of the barrel, and the wood extractive is increased by elevating the temperature, by agitating the barrels, and by extending the period of storage. In whisky that has been matured in oak barrels the woody flavor is not only distinctly perceptible in the liquid but persists in the residue left on evaporating a portion on the water-bath. The tannin, wood extractive, and coloring thus acquired are undoubtedly *additions* to the distilled spirit, but by reason of the many years that this practice of storing in wood has been carried on, these have become considered as *essential ingredients*, and the associated woody flavor is accepted as part of the composite flavor of whisky.

The percentage of acid present in whisky at the time of its distillation is variable, depending on the extent to which the fermentation has been carried. During the period of storage the acidity is increased for several years by the gradual oxidation of a portion of the alcohol, and thereafter appears to remain stationary. Esterification is likewise gradually going on during the maturing period, and the acid consumed in this process probably compensates that which is continuously formed by oxidation. The esters formed play an important part in modifying the odor and taste of the product.

Chemists estimate the acids present as acetic acid, and the esters as acetic ether. Nevertheless, it is well known that other acids are present in small amounts and also that a series of higher alcohols, collectively spoken of as " fusel oil," are present in relatively minute quantities, and that these are subject to the same chemical changes as are the acetic acid and the ethyl alcohol; consequently, the production of a number of compound ethers must be conceded. These acids and esters aid materially in rendering the spirit potable by adding the flavor or bouquet thereto, and, although strictly *additions*, they are considered as *essential ingredients* of whisky.

*The Federal laws relating to distilled spirits have been enacted primarily for the purpose of collecting the tax thereon, and only incidentally do they consider the question of standards.* From the viewpoint of the revenue collector, the tendency would be to encourage the production and to broaden the definition of whisky so as to include the widest range of alcoholic distillates that could be used under that title. The pharmacopœial viewpoint is the necessity of fixing a reasonable and practical standard of purity and quality for a product used for medical purposes.

For beverage purposes a wider latitude could with safety be permitted than would be permissible in a standard for a medicinal article. The requirements for whisky as a medicine should be more restricted and exacting, as in such use there is constantly present the necessity for estimating its pharmacodynamic action. With beverages the Pharmacopœia is not concerned, nor does its authority contemplate the control of standards for such purposes. For this reason there should be incorporated in the monographs on whisky and brandy a statement that the standards are applicable to these products when prescribed for medical use.

*The pharmacopœial standard should be correct, reasonable, and practical, and should work no unnecessary hardship on the producer, and should protect the pharmacists from uncalled-for prosecutions.* The manufacture of whisky is a legalized industry commonly conducted on a very large scale and with enormous investments. The quantity of whisky consumed as a medicine bears but a very small ratio to the total production. The pharmacist is limited in his source of

supply, and, even under the most favorable conditions, he can have little or no influence on the quality of the commercial product.

The duty of the Pharmacopœia is to supply a proper standard that will not unnecessarily restrict the pharmacist's supplies and will enable him to form a correct judgment of the purity and quality so as to protect the dealer and consumer from deception. "Such a standard should be sufficiently liberal to enable compliance without becoming burdensome, but at the same time constitute a safeguard against the use (medically) of the compounds commonly sold under the name of whisky."

Accepting the monograph on Spiritus Frumenti of the U. S. P. VIII as the basis for a revised monograph for the U. S. P. IX, a critical examination of the language and statements contained in the article on whisky now official appears to be imperative. Equally important is the confirmation of these statements by the results of examinations of commercial products. Attached to this report is a synopsis of recent examinations of nearly two-score samples of commercial whiskies. This serves to illustrate some of the criticisms presented.

> THE TITLE.—"Spiritus Frumenti," literally "spirit of grain," is appropriate and should be retained.
>
> THE DEFINITION.—"An alcoholic liquid obtained by the distillation of the mash of fermented grain—such as Indian corn, rye, wheat, and barley, or their mixtures."

This is subject to several criticisms. Whisky must be *potable,* and "an alcoholic liquid obtained by distillation" as prescribed is not the whisky contemplated until rendered *potable* by reduction to the proper alcoholic content and matured, and this distinction should properly be included in the definition.

As it is the mash that is fermented, the wording should be changed from "mash of fermented grain" to "*fermented mash of——*"

The minimum period of aging should be a *requirement* of the definition and *not a recommendation* included in the description, and accompanying such a statement in the definition should be added such restrictions on the method of aging as it may be deemed wise to officially require.

> THE DESCRIPTION.—"An amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction."

The statement as to color is probably as clear and descriptive as it can be made, as the varying depths of color or shades of amber permissible cannot be described, and colorless distillates are excluded.

The statement here as to acidity is likewise accepted.

The statement, however, regarding odor and taste is subject to the criticism of being too general and too indefinite a description of the odor and taste of whisky. It might be claimed that the "distinctive odor and taste" is the distinctive odor and taste of ethyl alcohol, which is the predominating ingredient. I would recommend that this be modified to read—"having the odor and taste of diluted alcohol modified by flavors derived from the grain, extractives from the wood, and substances naturally formed during the storage."

> "Its specific gravity should be not more than 0.945 nor less than 0.924 at 15.6° C. (60° F.), corresponding, approximately, to an alcoholic strength of 37 to 47.5 percent by weight or 44 to 55 percent by volume of absolute alcohol."

This statement follows the customary method of determining the alcoholic content of such distilled spirits by taking the specific gravity of the liquid by any of the accepted ways and calculating from the alcohol table the percentage of alcohol present. This ignores the variation introduced by the content of solids and the modifying influences of the other volatile substances present. This error is certainly very slight and, with the restrictions on the solids proposed, will be reduced to a minimum that is negligible, and, as the method has the sanction of governmental and business usage, it can be continued.

The permissible alcoholic content, " 44 to 55 percent by volume," is entirely too wide a range for a medicinal product. A whisky of 110 proof is entirely too strong for consumption, and verges on the border of being non-potable on that account. A number of the samples examined (notably Nos. 13, 14, 15, and 16) were stored goods not yet reduced, and the taste of these showed distinctly the undesirability of such high alcoholic content. The bulk of the whisky is sold to the consumer at 90 to 100 proof (45 to 50 percent alcohol by volume), and the pharmacopœial range of alcohol content should not vary greatly therefrom. From 45 to 51 percent would be a proper limitation.

The present method of stating gravity at the temperature of 15.6° C. is continued in the monograph submitted, although the preference of the referee would be to give such at the official normal temperature.

> TESTS.—" If 100 Cc. of whisky be very slowly evaporated in a tared dish on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor (absence of more than a trace of *fusel oil* from grain); and the residue, when dried at 100° C. (212° F.), should not weigh more than 0.5 Gm. This residue should have no sweet or distinctly spicy taste (absence of *added sugar, glycerin,* and *aromatic substances*), and it should almost completely dissolve in 10 Cc. of cold water, forming a solution which is colored not deeper than light green by a few drops of ferric chloride T. S. diluted with 10 volumes of water (absence of more than traces of *oak tannin* from casks)."

This paragraph contains some misleading statements and merits the most critical scrutiny. The first statement therein is given as a test for the absence of more than traces of fusel oil. This is only one of the organoleptic tests that have been proposed for detecting fusel oil. It is comparable with the evaporation of a portion of the spirits by rubbing on the palm of the hand or evaporation on a piece of bibulous paper, and is unscientific and insufficient for the purpose proposed. Relatively large amounts of fusel oil would escape detection by such a crude method.

If only a qualitative method is to be adopted for the detection of excess of fusel oil, there are several tests which are preferable; for example, either of the following:

1. 20 Cc. of the sample mixed with 50 Cc. of distilled water in an Erlenmeyer flask and heated to 25° C., the contents then violently shaken, and the odor and taste noted.

2. Shake 10 Cc. of the sample with 20 Cc. of water and 10 Cc. of ether. Allow the mixture to stand, separate the ether layer, and evaporate this on a watch crystal. No odor of " fusel oil " should remain after the ether has evaporated.

If it is desirable to retain only one qualitative test for this purpose, I would prefer the latter.

In the Eighth Revision of the United States Pharmacopœia the residue from

100 Cc. of whisky was increased from 0.25 Gm. to 0.5 Gm. The reason for this change is not evident. Properly-made whiskies, even after long storage in wood, do not yield residues approaching this maximum. Blended whiskies and compounded whiskies, to which excesses of coloring and flavoring have been added, may yield a residue of 0.5 Gm. or even greater.

Sample No. 13, which was stored more than six years in wood, yielded only 0.260 Gm., and if reduced to 50 percent alcoholic strength the residue would have fallen below 0.250 Gm.

Sample No. 26, after six years' storing, residue 0.210 Gm.

Sample No. 6, seven years old, residue 0.233 Gm.

Of the blended whiskies, which contained added coloring and flavoring, the residues frequently exceeded 0.5 Gm. This is seen in samples Nos. 19, 20, and 33.

With entire safety the residue from 100 Cc. of whisky can be reduced to 0.3 Gm. or even to the old standard of 0.25 Gm. Any whisky exceeding this limit would show the presence of added foreign materials.

The residue also gives us valuable information as to the character of the whisky. In a whisky consisting entirely of grain distillates aged in wood the residue is brown in color, dry, and scattered over the bottom of the evaporating dish in leaf-like patterns or spotted deposits. Whiskies containing added caramel coloring leave a more or less shining deep-brown residue. If only a small amount of caramel is added it is insufficient to entirely destroy the characteristic appearance of the residue described above, and the residue exhibits in spots the characteristics of both kinds of coloring. If the coloring is entirely caramel, or if the caramel is in excess, then the residue is in the form of a shining, smooth solid extract, more or less pasty and sweet, especially if prune juice or similar material has been used as a flavoring.

The requirement that the " residue should have no sweet or distinctly spicy taste (absence of *added sugar, glycerin,* and *aromatic substances*)" is correct and should be retained.

The next requirement, however, that " it should almost completely dissolve in 10 Cc. of cold water," is not correct. In compounded whiskies, in which the residue is composed largely of added coloring and flavoring, the residue is practically entirely soluble. However, in whiskies in which the residue is due to material absorbed from the wood during storage this is not true. A reference to the appended report will show that in those whiskies which are compounded the insoluble residue is very scant. In the examination of these samples the insoluble portion of the residue was determined in a number of cases. The residue left on evaporation was thoroughly rubbed down with 20 Cc. of distilled water, filtered, and the dish and filter washed with an additional 5 Cc. of water. In a number of these samples the insoluble residue amounted to from *19 to 40 percent* of the residue. This statement must be either eliminated or amended to comply with the facts.

Exception must likewise be taken to the next statement, that the solution of the residue in water " is colored not deeper than light green by a few drops of ferric chloride T. S. diluted with 10 volumes of water." In all whiskies which are aged in wood for four years or more sufficient of the wood tannin is absorbed to give in this test a distinct greenish-black coloration. In compounded whiskies this color is usually brown, with little or no distinct green tint. The pharmacopœial statement, instead of being a negative one, should be a positive one, requiring that the solution of the residue *must yield a green coloration* on the addition of ferric chloride T. S., as an evidence of the proper maturing of the whisky by storage in

wood. The limitation on the amount of residue will eliminate the possibility of an excessive amount of tannic acid.

> "If 50 Cc. of whisky be shaken vigorously in a stoppered flask with 25 Gms. of kaolin, and after standing half an hour, be filtered, the color of the filtrate should not be much lighter than that of the whisky before treatment."

Exception is taken to this test for caramel. If kaolin of proper absorptive test be used in the quantity directed, the result will be a magma from which very little liquid can be filtered. If the test be retained, then it should be changed, directing 5 Gms. kaolin to 50 Cc. of whisky. It is to be noted that a *slight reduction* in the coloring occurs with all samples of whisky.

The color in whisky is due to added coloring, either caramel or that dissolved from the charred barrel. The use of caramel antedates by many years the use of the charred barrels for this purpose. Either of these colorings is harmless, and their use has been sanctioned by Federal statutes and decisions. If the entire residue consisted of coloring, it would not amount to more than from 0.2 to 0.3 percent. Since the amber color is required, it is immaterial if this color be produced by the addition of small quantities of burnt sugar or of a similar coloring substance prepared by charring wood. The quantity of either of these present in whisky answering the pharmacopœial requirement would be exceedingly small. Since both are harmless, and the use of caramel is provided for by laws and regulations of the government, I doubt the wisdom of the Pharmacopœia adopting a provision that would exclude caramel from whisky and raising an issue between its standard and the government enactments. My recommendation is that this paragraph relating to test for caramel be eliminated from the pharmacopœial tests.

> "To render 100 Cc. of whisky distinctly alkaline to litmus, not more than 1.2 Cc. of normal potassium hydroxide V. S. should be required (limit of *free acid*)."

A compounded whisky with practically no acid or an immatured whisky would meet this requirement, as no minimum limitation is fixed. On the other hand, some very good grades of whisky may slightly exceed this percentage of acid. (Note samples Nos. 21, 22, and 23.) It is to be noted that the compounded and blended whiskies are exceedingly low in acid content, as, for example, samples Nos. 32, 33, 37, and 39. A minimum and a maximum limit should be given, and the maximum might with safety be somewhat increased.

The method of applying this test is misleading. On adding solution of potassium hydroxide to whisky the amber color is deepened and it is difficult to note the end reaction. Litmus is not a good indicator for the purpose. I would recommend that in stating this test 100 Cc. of whisky be diluted with 200 Cc. of distilled water and the titration be made with tenth-normal potassium hydroxide V. S., and that phenolphthalein T. S. be used as indicator. The reaction is far more distinct under these conditions than would be possible with the present directions.

To meet the criticisms and comments as submitted above, the following monograph was reported:

### Spiritus Frumenti.

#### WHISKY.

A potable alcoholic liquid obtained by the distillation of the fermented mash or mashes of cereal grains (wholly or in part malted)—such as maize, rye, wheat,

and barley, or their mixtures. Whisky intended for administration as a medicine should have been stored in wood containers for a period of not less than four years before it is used, and should conform to the following characters and tests:

An amber-colored liquid, having the odor and taste of diluted alcohol modified by flavors derived from the grain, substances extracted from the wood or naturally formed during the storage, and a slightly acid reaction.

Its specific gravity should be not more than 0.943 nor less than 0.932 at 15.6° C., corresponding, approximately, to an alcoholic strength of 38 to 43.5 percent by weight or 45 to 51 percent by volume of absolute alcohol (see Appendix, Alcohol Tables, page —).

Shake thoroughly 20 Cc. of whisky, 20 Cc. of distilled water, and 10 Cc. of ether; allow the mixture to stand until separation has taken place. Separate the ether layer and allow it to evaporate spontaneously on a watch crystal; the residue should not have a disagreeable or irritating odor (excess of *fusel oil*).

Evaporate 100 Cc. of whisky in a tared dish on a water-bath and dry the residue at 100° C. to constant weight; it should weigh not more than 0.3 Gm. This residue should not have a distinctly sweet or spicy taste (absence of *added sugar, glycerin,* and *aromatic substances*). If the residue be treated with 10 Cc. of cold distilled water, the filtered solution should give a greenish-black coloration upon the addition of a few drops of diluted ferric chloride T. S. (1 in 10) (*oak tannin* from barrels).

100 Cc. of whisky diluted with 200 Cc. of distilled water should require for neutralization not less than 6 Cc. nor more than 15 Cc. of tenth-normal potassium hydroxide V. S., using phenolphthalein as indicator (limit of *free acid*).

### BRANDY.

The statements in the preceding part of the report, although written on the subject of whisky, apply with almost equal force to the subject of brandy. A few additional comments, however, are necessary upon a proper monograph for brandy.

TITLE.—The pharmacopœial title, "Spiritus Vini Gallici," has been retained in the United States Pharmacopœia and in the British Pharmacopœia. As it is not the intent to restrict the brandy of the Pharmacopœia to French brandy only, "Gallici" should be taken out of the title. For the same reason, the synonym, Cognac, should not be given in the Pharmacopœia. A change in the pharmacopœial title evidently is necessary. The Austrian Pharmacopœia restricts its brandy to the cognac and takes as the title, "Spiritus Vini Cognac." The German Pharmacopœia and the Swiss each take as titles, "Spiritus e Vino," with "Kognac" and "Cognac" as synonyms. Neither of these seems to be acceptable for the United States Pharmacopœia.

It has been suggested that the title be made "Spiritus Vini," but this is very objectionable, because the title, "Spirit of Wine," is commonly applied to alcohol, and its adoption for brandy would lead to serious confusion. Chairman Diehl has suggested as a title, "Spiritus Vini Vites Viniferæ." This title appeals to me, but we are confronted by the fact that the *Vitis Vinifera* and its cultivated varieties are not the only grapes from which brandy is made. The American species, *V. Labrusca* and *V. æstivalis,* and cultivated varieties are also sources from which many wine grapes are now cultivated. For this reason, the validity of the title suggested by Chairman Diehl may be questioned.

Your referee is of the opinion that a distinctive title should be coined for brandy that would designate it as a spirit of grape wine, and would not restrict

brandy to that produced in any one country or district or that from any one grape. This leads to a suggestion that the title be made " Spiritus Vini Vitis."

It is well known that French brandy has always been colored with caramel, and that a special syrup of sugar partly caramelized is used for this purpose. The Austrian Pharmacopœia and the Swedish Pharmacopœia, recognizing this fact, permit in their official brandy, which is cognac, a residue of 1.5 percent. The United States Pharmacopœia of 1890 likewise permitted a residue of 1.5 percent, and none of these pharmacopœias have tests that would exclude the presence of caramel. The U. S. P. VIII reduced the allowable residue to 0.5 Gm. in 100 Cc., and included the kaolin test for the presence of caramel coloring. In the list of additions and deletions promulgated by the Committee of Revision on May 1, 1907, the caramel test was deleted. It is difficult to understand why the U. S. P. VIII should attempt to preclude the use of the finer types of French brandy by restricting the solid content, and likewise why, after having once recognized the error of the caramel test and deleted it from the U. S. P. VIII, it should be proposed to now reincorporate this test in the U. S. P. IX.

The following monograph with the proposed title is respectfully submitted:

## Spiritus Vini Vitis.

### BRANDY.

A potable alcoholic liquid obtained by the distillation of the fermented unmodified juice of fresh grapes. Brandy intended for administration as a medicine should have been stored in wood containers for a period of not less than four years before it is used, and should conform to the following characters and tests:

A pale amber-colored liquid, having the odor and taste of diluted alcohol modified by the flavor derived from the grape wine, substances extracted from the wood or naturally formed during the storage, and a slightly acid reaction.

Its specific gravity should not be more than 0.938 nor less than 0.926 at 15.6° C., corresponding, approximately, to an alcoholic strength of 41 to 46 percent by weight or 48 to 54 percent by volume of absolute alcohol (see Appendix, Alcohol Tables, page —).

Shake thoroughly 20 Cc. of brandy, 20 Cc. of distilled water, and 10 Cc. of ether; allow the mixture to stand until separation has taken place. Separate the ether layer and allow it to evaporate spontaneously on a watch crystal; the residue should not have an unpleasant or irritating odor (excess of *fusel oil*).

Evaporate 100 Cc. of brandy in a tared dish on a water-bath and dry the residue at 100° C. to constant weight; it should weigh not more than 1.5 Gm. Treat this residue with 10 Cc. of distilled water and filter; the solution should give a greenish-black coloration upon the addition of a few drops of diluted ferric chloride T. S. (1 in 10).

100 Cc. of brandy diluted with 200 Cc. of distilled water should require for neutralization not more than 15 Cc. of tenth-normal potassium hydroxide V. S., using phenolphthalein as indicator (limit of *free acid*).

A SYNOPSIS OF SOME RECENT EXAMINATIONS OF DISTILLED SPIRITS.

| Number | Label and locality | Sp. gr. at 15.6° C. | Alcohol, percent by volume | Color | Color after treating with kaolin | Residue from 100 Cc. in Gm. | Character of residue | Residue soluble | Residue insoluble in Gm. | Aqueous solution of residue with $FeCl_3$ | Acidity, 100 Cc. required N/10 KHO in Cc. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Neutral spirit from grain, Cincinnati, Ohio | 0.8113 | 96 1 | Colorless | ..... | 0.005 | ..... | ..... | ..... | ..... | 0.7 |
| 2 | Grain neutral spirit, Peoria, Ill. | 0.8122 | 95.8 | Colorless | ..... | 0.004 | ..... | ..... | ..... | ..... | 0.5 |
| 3 | Grain, neutral spirit, Peoria, Ill. | 0.8099 | 96.5 | Colorless | ..... | 0.004 | ..... | ..... | ..... | ..... | 0.6 |
| 4 | Grain, neutral spirit, New York, N. Y. | 0.8142 | 95.4 | Colorless | ..... | 0.007 | ..... | ..... | ..... | ..... | 0.9 |
| 5 | Whiskies—Blend A, No. 1 Bourbon, Louisville, Ky. | 0.9496 | 41.5 | Amber | Very light amber nearly decolorized | 0.126 | Glossy and spotted, faint woody odor, caramel taste | Almost completely | Scant | brown, scarcely green | 5.5 |
| 6 | R. Co., I. H. Brand, Louisville, Ky., 7 years old | 0.9270 | 53.5 | Amber | Only slight reduction of color | 0.233 | Spotted, dry, brown, woody odor and taste | Only partly | Decided | Green-black | 12.3 |
| 7 | R. Co., I. H. Brand, Louisville, Ky., 5 years old | 0.9245 | 55. | Amber | Only slight reduction of color | 0.183 | Spotted, dry, brown, woody odor and taste | Only partly | Decided | green-black | 11. |
| 8 | R. Co., I. H. Brand, Louisville, Ky., 3 years old | 0.9350 | 49.5 | Amber | Only slight reduction of color | 0.155 | Spotted, dry, brown, woody odor and taste | Only partly | Decided | Green-black | 9.5 |
| 9 | R. Co., I. H. Brand, Louisville, Ky., 2 years old | 0.9320 | 51. | Light amber | Only slight reduction in color | 0.175 | Spotted, dry, brown, woody odor and taste | Only partly | Decided | Green-ish | 10. |
| 10 | A. Rye, B. D. Co., Louisville, Ky. | 0.9430 | 45.5 | Amber | Reduction decided, about ½ | 0.343 | Glossy, gummy, caramel-like, sweet | Nearly entirely | Scant residue | Green-ish-brown | 7.6 |
| 11 | A, Bourbon; B, D. Co., Louisville, Ky. | 0.9422 | 46. | Amber | Reduction decided, about ⅓ | 0.325 | Glossy, taste caramel-like, sweet | Nearly entirely | Residue scant | Green-ish-brown | 6.8 |
| 12 | B, Bourbon; B, D. Co., Louisville, Ky. | 0.9419 | 46. | Amber | Reduction very decided, about ⅔ | 0.335 | Glossy, gummy, caramel-like | Partly | Residue scant | Green-ish-brown | 4.1 |
| 13 | T. Co., double-distilled pure rye whisky, Pittsburgh, Pa., 6 years old | 0.9150 | 59. | Deep amber | Only slight reduction | 0.260 | Spotted, dry, brown, woody odor and taste | Gm. 0.220 | Gm. 0.040 | Green-ish-black | 12.2 |
| 14 | T. Co., double, distilled pure rye whisky, Pittsburgh, Pa., 5 years old | 0.9230 | 55.5 | Amber | Only slight reduction in color | 0.190 | Spotted, dry, brown, woody odor and taste | 0.140 | 0.050 | Green-ish-black | 10.2 |
| 15 | T. Co., double-distilled pure rye whisky, Pittsburgh, Pa., 4 years old | 0.9240 | 55. | Amber | Only slight reduction in color | 0.210 | Spotted, dry, brown, woody odor and taste | 0.146 | 0.064 | Green ish-black | 12. |
| 16 | T. Co., double-distilled pure rye whisky, Pittsburgh, Pa., 3 years old | 0.9242 | 55. | Amber | Only slight reduction in color | 0.190 | Spotted, dry, brown, woody odor and taste | 0.133 | 0.057 | Green-ish-black | 11.7 |
| 17 | T. Co., double-distilled pure rye whisky, Pittsburgh, Pa., 2 years old | 0.9291 | 52.5 | Amber | Only slight reduction in color | 0.135 | Spotted, dry, brown, woody odor and taste | 0.075 | 0.060 | Green-ish-black | 9.3 |
| 18 | T. Co., double-distilled pure rye whisky, Pittsburgh, Pa., 6 months old | 0.9340 | 50. | Amber | Only slight reduction in color | 0.105 | Spotted, dry, brown, woody odor and taste | 0.089 | 0.016 | Green-ish-brown | 9.6 |
| 19 | Blended whisky, C. Co., Baltimore, Md. | 0.9423 | 45.5 | Dark amber | Reduction very marked | 1.700 | Glossy, gummy, sweet, fruity | 1.640 | 0.060 | Brown, only faintly green | 10.6 |
| 20 | Blended whisky, C. Co., Baltimore, Md. | 0.9438 | 45. | Dark amber | Reduction very marked | 1.65 | Glossy, syrupy, fruity | 1.630 | 0.020 | Brown only faintly green | 12. |

A SYNOPSIS OF SOME RECENT EXAMINATIONS OF DISTILLED SPIRITS.—*Continued.*

| Number | Label and locality | Sp. gr. at 15.6° C. | Alcohol, percent by volume | Color | Color after treating with kaolin | Residue from 100 Cc. in Gm. | Character of residue | Residue soluble in Gm. | Residue insoluble in Gm. | Aqueous solution of residue with $FeCl_3$ | Acidity, 100 Cc. required N/10 KHO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Eastern rye, New York, 4½ years old | 0.9203 | 57. | Amber | Reduction only slight | 0.245 | Spotted, dry, brown, woody odor and taste | 0.180 | 0.065 | Green-black | 16.2 |
| 22 | Eastern rye, New York, 3½ years old | 0.9228 | 56. | Amber | Reduction very slight | 0.290 | Spotted, dry, brown, woody odor and taste | 0.220 | 0.070 | Green | 15.6 |
| 23 | Eastern rye, New York, 2½ years old | 0.9294 | 52.5 | Amber | Reduction scarcely noticeable | 0.230 | Spotted, dry, brown, woody odor and taste | 0.175 | 0.055 | Green | 15.2 |
| 24 | Eastern rye, New York, 1½ years old | 0.9280 | 53. | Amber | Reduction scarcely noticeable | 0.167 | Spotted, dry, brown, woody odor and taste | 0.127 | 0.040 | Green | 11.3 |
| 25 | Eastern rye, New York, 6 months old | 0.9323 | 51. | Pale amber | Reduction scarcely noticeable | 0.107 | Spotted, dry, brown, faintly woody odor and taste | 0.082 | 0.025 | Light green | 8. |
| 26 | H, pure rye, Ohio, 6 years old | 0.9114 | 61. | Amber | Reduction very slight | 0.210 | Spotted, dry, brown, woody odor and taste | 0.145 | 0.065 | Green-black | 13.3 |
| 27 | H, pure rye, Ohio, 5 years old | 0.9179 | 58. | Amber | Reduction very slight | 0.202 | Spotted, dry, brown, woody odor and taste | 0.153 | 0.049 | Green | 11.6 |
| 28 | H, pure rye, Ohio, 4 years old | 0.9203 | 37. | Amber | Reduction not appreciable | 0.195 | Spotted, dry, brown, woody odor and taste | 0.139 | 0.056 | Green | 11.2 |
| 29 | H, pure rye, Ohio, 3 years old | 0.9252 | 54.5 | Amber | Reduction not appreciable | 0.150 | Spotted, dry, brown, woody odor and taste | 0.102 | 0.048 | Green | 10.2 |
| 30 | H, pure rye, Ohio, 2 years old | 0.9292 | 52.5 | Amber | Reduction not appreciable | 0.155 | Spotted, dry, brown, woody odor and taste | 0.119 | 0.036 | Green | 9.9 |
| 31 | H, pure rye, Ohio, 1 year old | 0.9297 | 52.25 | Pale amber | Reduction not appreciable | 0.125 | Spotted, dry, brown, woody odor and taste | 0.083 | 0.042 | Green | 10.6 |
| 32 | Blend, S. Co., Cincinnati, O. | 0.9430 | 45.5 | Deep amber | Greatly reduced, approximately ½ | 0.115 | Glossy, brown, odor slightly woody, caramel taste | 0.095 | 0.020 | Greenish-brown | 4. |
| 33 | Blend, S. D. Co., Cincinnati, O. | 0.9387 | 48. | Deep amber | Greatly reduced, approximately ½ | 0.530 | Glossy, only very slightly woody, gummy, sweet, fruity | 0.510 | 0.020 | Dirty brown, faintly green | 5.1 |
| 34 | Blend F, New York | 0.9424 | 45.7 | Dark amber | Greatly reduced, approximately ½ | 0.465 | Glossy, brown, sweet, fruity and caramel-like | 0.440 | 0.025 | Dirty brown, faintly green | 7. |
| 35 | Blend A, No. 1 Bourbon, Louisville, Ky. | 0.9462 | 43.5 | Amber | Greatly reduced, approximately ½ | 0.270 | Glossy, slightly bitter, caramel-like | 0.255 | 0.015 | Brown, scarcely any green tint | 4.3 |
| 36 | Malt, New York | 0.9459 | 44. | Very pale amber | Almost colorless | 0.034 | Almost odorless and tasteless | 0.029 | 0.005 | Pale green, scarcely any precipitate | 1.8 |
| 37 | Rye in bulk, bought from wholesale liquor dealer on druggist's order for whisky, Philadelphia | 0.9445 | 44.5 | Deep amber | Decided reduction, approximately ½ | 0.452 | Glossy, spicy, fruity, sweet | 0.447 | 0.005 | Scarcely any precipitate and only faint trace of green | 2.3 |
| 38 | Rye whisky, 4 years old, supplied by wholesale druggist on a retailer's order, Philadelphia | 0.9395 | 47.7 | Amber | Slight reduction | 0.208 | Brown, part glossy and part spotted | 0.158 | 0.050 | Green-black | 11.5 |

A SYNOPSIS OF SOME RECENT EXAMINATIONS OF DISTILLED SPIRITS.—*Continued.*

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | P, blend, supplied by wholesale druggist on order of retailer, Philadelphia | 0.9410 | 46.5 | Amber | Greatly reduced at least ½ | 0.482 | Glossy, gummy; hygroscopic, fruity | 0.477 | 0.005 | Not green, no distinct change | 3.8 |
| 40 | Philadelphia rye whisky, supplied by a wholesale druggist on order of a retailer | 0.9437 | 45. | Amber | Decided reduction, at least ⅓ | 0.500 | Partly glossy, gummy, faintly woody | 0.460 | 0.040 | Greenish-br'n | 14.1 |

## USE AND ABUSE OF DRUGS.

W. T. Little, M.D., Canon City, Colo., summarizes his paper on the above subject in *Colorado Medicine* as follows: Pharmacology is a branch of medical science second to none other in importance. It is essential to know disease, its cause and its natural history before we can successfully control it; but its prevention and cure is the ultimate purpose of all our efforts. By physical and chemical means we endeavor to restore to their normal function organs damaged by disease, and only when their functions are destroyed should we cut them away. Drugs are of the greatest value in modifying and restoring function, but they should be used with a precision that can come only from an exact knowledge of their action. The pharmacologic laboratories are gradually weeding out those drugs of uncertain value, as the expectorants, the hypophosphites, viburnum, strychnine, etc.; and, hard as it may be to part with old friends, it is our duty to do so if we are to maintain the highest state of medical efficiency. A knowledge of the physiologic action of a drug is essential to its correct use. We should know that our drugs are both active and pure. We should give drugs only when they are clearly indicated. In judging the worth of a remedy always maintain an attitude of scientific skepticism.