SECTION ON PRACTICAL PHARMACY AND DISPENSING, AMERICAN PHARMACEUTICAL ASSOCIATION

GENERAL FORMULAS IN U. S. P. IX.*

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Among the 24 General Principles to be Followed in the Ninth Revision in the Abstracts of the Proceedings of the Ninth Decennial Convention, 1910, published in U. S. P. IX, I find on p. xxxii the following:

7. *General Formulæ.*—It is recommended that general formulæ be introduced, as far as the particular nature of the several drugs will permit, for fluidextracts, tinctures and such other preparations as are made by identical processes, and that the general formula to be followed in each case be merely indicated by reference.

In the Preface to U. S. P. IX, I find under the new features the following on p. xxxvii:

General Formulas.—This term is used to define a plan to save space and to avoid repetition by printing a typical formula for galenical preparations. It will be seen that there are four type processes for fluidextracts designated by the letters A, B, C and D; two type processes are provided for tinctures, P and M, and also a type process for medicated waters. The Convention recommended the introduction of this plan (as pointed out above).

The object of this paper is to explain these *General Formulas* or *Type Processes* for the benefit of pharmacists and students as well. Why were they introduced? The answer is: "To save space and to avoid the useless repetition, for which our Pharmacopœia has been criticized so often."

AQUÆ AROMATICÆ.

Aromatic Waters.

The General Process is placed at the end of the chapter, on page 60, and therefore not in strict alphabetical order, and is as follows:

Volatile Oil	2 mils
Purified Talc	15 Gm.
Distilled Water, recently boiled	1000 mils

Triturate the volatile oil with the purified talc, add the recently boiled distilled water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Aromatic Water is perfectly clear.

The U. S. P. VIII contains a chapter, but no General Process for Aquæ or Medicated Waters, which term has been properly replaced by Aromatic Waters. The General Process in U. S. P. IX is the same as the process for most of the Aromatic Waters in U. S. P. VIII with one single, but important, difference, namely, that now the distilled water is ordered to be *recently boiled.* To many this may seem unnecessary, inasmuch as distilled water has already been boiled. We should, however, remember that distilled water upon keeping will not remain germ-free, especially when kept in a five-gallon bottle of which the cork is missing, thus permitting not only dust and germs to enter but also insect life. "Distilled Water, recently boiled" has been adopted by the Revision Committee as a safeguard and is quite appropriate in this age of sanitation.

* Read before section on Practical Pharmacy and Dispensing, A. Ph. A., Atlantic City meeting, 1916.

The following 5 waters are made by this General Process: Anise, Cinnamon, Fennel, Peppermint and Spearmint.

The alternative methods are the same as in U. S. P. VIII, namely, the use of pulped filter paper, direct solution of oil in recently boiled distilled water and distillation of the drug or volatile oil with water. In addition the U. S. P. IX also sanctions the use of Purified Silicious Earth, or Purified Kieselguhr or Purified Infusorial Earth, which is official under the title of Terra Silicea Purificata. Quite an innovation is the statement at the end of the chapter in U. S. P. IX, namely: "Aromatic Waters should not be permitted to freeze." The writer is somewhat responsible for this, owing to his experience of the freezing of a ten-liter bottle of French Rose Water, which upon thawing had completely lost its fragrant odor. After all, experience is the best teacher, and this incident proved that freezing destroys the aromatic properties.

Just one word of caution before leaving this subject, and that is, Aromatic Waters from volatile oils should never be made in too large quantities. They do not improve by age. Many pharmacists no doubt have noticed that in Cinnamon Water, after a time, there is formed a flocculent precipitate and that the aromatic odor decreases. What happens? The cinnamic aldehyde of the oil of cinnamon is oxidized or hydrolyzed to cinnamic acid, which is odorless.

FLUIDEXTRACTA.

Fluidextracts.

Here a valuable saving of space is achieved, as can be seen from the following figures:

U. S. P. VIII contains 85 Fluidextracts described on 55 pages.

U. S. P. IX contains 49 Fluidextracts described on 21 pages.

After a definition of Fluidextracts an outline of the 4 Type Processes is given, followed by a description in detail. These processes are based upon the menstrua used for the extraction of the drugs.

Type Process A for menstrua of alcohol or alcohol and water: The usual process of percolation is followed. 1000 Gms. of powdered drug is moistened with sufficient menstruum and is macerated in a tightly covered container for six hours, and is then packed in a cylindrical percolator. Sufficient menstruum is added to have a stratum above the drug, and a forty-eight-hour maceration follows. Percolation is then allowed to proceed, at the rate of 10 drops per minute, until 850 mils are obtained, which is reserved. Add sufficient menstruum in percolator until the drug is completely exhausted, regulating the flow to 20 drops per minute. The alcohol is regained from this second percolate, and the residue is concentrated at a temperature not exceeding 60° C. to a soft extract, which is dissolved in the reserved portion. Finally sufficient menstruum is added to make 1000 mils, or the volume determined by calculation from the assay.

The primary moistening and maceration for six hours is necessary so the menstruum will penetrate and soften the drug and at the same time swell same. The secondary macero-percolation is intended to extract the drug. The concentration of the second percolate to a soft extract is done at the temperature not exceeding 60° C. (against 50° C. in U. S. P. VIII) in order not to injure the active principles.

Fluidextracts prepared by Type Process A: Belladonna Root, Buchu, Cannabis, Cimicifuga, Digitalis, Eriodictyon, Eucalyptus, Gelsemium, Gentian, Grindelia, Guarana, Hyoscyamus, Nux Vomica, Pilocarpus, Podophyllum, Rhubarb, Sabal, Sarsaparilla, Senna, Spigelia, Staphisagria, Stillingia, Sumbul, Veratrum Viride, Viburnum Prunifolium, Xanthoxylum and Ginger (27).

Type Process B for menstrua containing glycerin or an acid: In this class two menstrua are used. Menstruum I contains the glycerin or acid and Menstruum II is composed of alcohol and water. No. I is first employed, so as to thoroughly extract the drug, and is followed by No. II to complete the exhaustion. The *modus operandi* itself is the same as in Type Process A.

The addition of glycerin to the menstruum serves 3 purposes: (1) Softening and penetrating; (2) solvent for tannin principles; (3) retarding precipitation.

The addition of acid converts the alkaloids in the drug into soluble salts, as f. i. acetate in Lobelia or hydrochloride in Ergot, Ipecac, and Cinchona. Glycerin is also used in the latter drug, so as to extract the cincho-tannic acid.

Fluidextracts prepared by Type Process B: Aspidosperma, Cinchona, Ergot, Pomegranate, Hydrastis, Ipecac, Lobelia, Rose, Compound Sarsaparilla, Taraxacum and Uva Ursi (11).

Menstruum containing:

Acetic Acid: Lobelia.

Hydrochloric Acid: Ergot and Ipecac.

Hydrochloric Acid and Glycerin: Cinchona.

Glycerin: Aspidosperma, Pomegranate, Hydrastis, Rose, Comp. Sarsaparilla, Taraxacum and Uva Ursi.

Type Process C, better known as Fractional or Divided Percolation: It is especially recommended for drugs containing volatile ingredients, or constituents which are injured by heat. Inasmuch as no heat whatever is used, the resulting products can be termed " Fluidextracts by Cold Process."

The *modus operandi* is as follows:

Divide 1000 Gm. of the ground drug into 3 portions of 500 Gm., 300 Gm. and 200 Gm., which for convenience we will name I, II and III. Moisten, macerate and percolate Portion I in the usual manner. Reserve the first 200 mils and continue percolation, reserving percolates *A, B, C, D* and *E*, of 300 mils each.

Use these additional percolates to moisten, macerate and percolate Portion II. Reserve the first 300 mils and continue percolation, reserving percolates *A, B, C* and *D*, of 200 mils each.

Use these additional percolates to moisten, macerate and percolate Portion III, and, if necessary, some of the original menstruum to percolate and reserve 500 mils.

Mix these reserved percolates of 200, 300 and 500 mils, thus producing 1000 mils of finished fluidextract.

The following table thoroughly explains this process:

		I		II		III		Total
Drug		500 Gm.	plus	300 Gm.	plus	200 Gm.	equals	1000 Gm.
Reserved Percolate		200 mils	plus	300 mils	plus	500 mils	equals	1000 mils
Additional Percolates	*A*	300 mils		200 mils				
	B	300 mils		200 mils				
	C	300 mils		200 mils				
	D	300 mils		200 mils				
	E	300 mils						
Total		1500 mils		800 mils				

Type Process C can also be used as an alternative process in the formulas in which Type Process A is directed. Fractional Percolation is *the* process for excellence by which the retail pharmacist can himself prepare his own fluidextracts, with but very little trouble and without very much loss of alcohol. In fact, the alcohol may be recovered by distillation of the marc of the three Portions I, II, and III.

Fluidextracts prepared by Type Process C: Aconite, Aromatic and Bitter Orange Peel (3).

Type Process D for aqueous menstrua: This process is used when the drug is readily extracted by infusion and percolation with boiling water. One thousand grammes of the ground drug are mixed with 5000 mils of boiling water and allowed to macerate in a covered container for two hours in a warm place. Then transfer to a tinned or enameled metallic percolator and continue percolation with boiling water until the drug is exhausted. Tin is recommended because it is not affected by the organic acids in the drugs. The percolate is evaporated on a water bath or strain bath to the specified volume and the directed amount of alcohol is added to act as a preservative, as the aqueous fluidextract would get sour.

Fluidextracts prepared by Type Process D: Cascara Sagrada, Frangula and Triticum (3).

Several drugs require special manipulation to obtain satisfactory fluidextracts, and for these appropriate formulas are printed in full in the text of the U. S. P. IX.

Fluidextracts prepared by Special Processes: Aromatic Cascara Sagrada, Colchicum Seed, Glycyrrhiza, Squill and Senega (5).

TINCTURÆ.

Tinctures.

The General Chapter in U. S. P. IX gives definitions of tinctures, potent tinctures and assayed tinctures, directions for keeping and a full description of the 2 Type Processes.

Type Process P—Percolation: The drug in proper fineness, as designated by the U. S. P., is moistened with a sufficient quantity of the prescribed menstruum to render it evenly and distinctly damp and is then transferred to a percolator, in which it is allowed to stand, well covered, for six hours. This moistening and maceration has the purpose to soften the drug, and to permit it to swell. For this reason the powder in the percolator is not packed until after the lapse of six hours. A sufficient quantity of menstruum is then added to completely saturate the drug and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice and allow to macerate for twenty-four hours, well covered. During this maceration the menstruum completely penetrates the drug and extracts the soluble principles. It is for this reason that the first percolate, after the twenty-four-hour maceration, is practically so saturated that it resembles a fluidextract. It is an erroneous idea which, I am sorry to state, has found hold on some students and pharmacists, that the first percolate should be poured back into the percolator! Such teaching is a disgrace to pharmacy!

The last step in this process is the addition of menstruum through the percolator to make 1000 mils of finished tincture.

The statement has frequently been made, that some students never learn to percolate properly. My answer to this is that such students should not be allowed to graduate, as they certainly are not fit to be pharmacists.

The General Formula of Type Process P also provides a *Modification for Assayed Tinctures.* In this case only 950 mils, instead of 1000 mils, are percolated. A sample of this is assayed, and from the alkaloidal content thus determined, the amount of alkaloids in the remainder of the liquid is determined. Then sufficient menstruum is added to make the finished tincture conform to the required alkaloidal standard.

Most of the tinctures in the U. S. P., 28 out of 54, are prepared by percolation.

Justly so, as this process, although originated in France, has been perfected by American pharmacists, perfected to such a high degree that percolation has been adopted in the Brussels Agreement, or International Protocol (P. I.), for the preparation of the potent tinctures.

Tinctures prepared by Type Process P: Aconite, Bitter Orange Peel, Belladonna Leaves, Calumba, Cannabis, Capsicum, Cardamom, Cinchona, Compound Cinchona, Cinnamon, Colchicum Seed, Digitalis, Gelsemium, Compound Gentian, Hydrastis, Hyoscyamus, Lobelia, Nux Vomica, Physostigma, Pyrethrum, Quassia, Rhubarb, Aromatic Rhubarb, Stramonium, Valerian, Ammoniated Valerian, Veratrum Viride and Ginger (28).

Type Process M—Maceration: This old process is resorted to, when from its physical character the drug is not suitable for percolation. Such is the case if the drug is a resin (Benzoin) or gum-resin (Asafetida) or balsam (Tolu). Maceration is also used for fresh drugs (Lemon Peel) or when the quantity of drugs is very small (Camphorated Opium).

Type Process M of U. S. P. IX is very simple. Maceration is carried on in a stoppered container, to avoid loss by evaporation, in a moderately warm place, because this facilitates extraction, for about three days with about three-fourths of the menstruum. It is absolutely necessary that agitation and maceration go hand in hand, otherwise the menstruum in contact with the drug becomes saturated, while the liquid above it has no chance to exert any solvent action. After the three days, or when the macerated drug is practically extracted, the mixture is transferred to a filter, and when the liquid has completely drained off, then the residue on filter is gradually washed with enough menstruum to produce the finished tincture.

The "old-timers" in pharmacy will well remember that during their apprenticeship it was their daily duty to agitate the galenicals prepared by maceration. Let the younger generation of pharmacists also remember this!

Tinctures prepared by Type Process M: Aloes, Asafetida, Sweet Orange Peel, Benzoin, Compound Benzoin, Compound Cardamom, Compound Gambir, Guaiac, Ammoniated Guaiac, Compound Lavender, Lemon Peel, Myrrh, Camphorated Opium and Tolu (14).

In a few instances the drugs require special manipulations for the preparation of a satisfactory tincture, and for these the formulas in full are given in the text of U. S. P. IX.

Tinctures prepared by Special Processes: Arnica, Cantharides, Kino, Lactucarium, Musk, Opium, Deodorized Opium, Sanguinaria, Squill and Strophanthus (10).

Two tinctures in U. S. P. IX (as in U. S. P. VIII) are simply alcoholic solutions of chemical substances.

Tinctures prepared by Solution: Ferric Chloride and Iodine (2).

CONCLUSION.

In conclusion, I believe that the General Formulas for Aromatic Waters, Fluidextracts and Tinctures adopted in the U. S. P. IX are to be highly recommended. They have the following advantages:

(1) They save valuable space in the U. S. P.
(2) They avoid useless repetition.
(3) They can be easily remembered by students.
(4) They can be logically explained by teachers.
(5) They can be readily practised by pharmacists.

Let us have more General Formulas!

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