3*a*.	Whole Long Buchu, bought in 1918, garbled—8.8 percent stems, leaves freed from stems and powdered to No. 40	3.98	0.30
		3.84	0.59
3*b*.	Stems from sample No. 3*a*, powdered to No. 40	4.16	0.666
		4.19	0.29
3*c*.	Whole Long Buchu, same as sample No. 3*a* but not garbled, powdered to No. 40	4.31	0.21
		4.37	0.33
4*a*.	Whole Long Buchu, in stock, garbled—20 percent stems, leaves freed from stems and powdered to No. 40	4.57	0.30
		4.39	0.34
4*b*.	Stems from sample No. 4*a*, powdered to No. 40	3.14	0.26
		2.99	0.22
5*a*.	Whole Short Buchu, bought in 1919, garbled—powdered to No. 40	3.79	0.21
		3.69	0.19
5*b*.	Stems from sample No. 5*a*, powdered to No. 40	2.96	0.33
		2.96	0.51
5*c*.	Whole Short Buchu, same as sample No. 5*a* but not garbled, powdered to No. 40	3.57	0.46
		3.49	0.42
6.	Whole Long Buchu, bought in 1916, not garbled, powdered to No. 40	4.14	0.47
		3.93	0.29
7.	Whole Short Buchu, bought in 1920, not garbled, powdered to No. 40	3.37	0.18
		3.26	....
8.	Powdered Short Buchu, bought in 1920, fine powder	4.59	0.42
		4.36	0.58
9.	Powdered Short Buchu, bought in 1920, fine powder	3.59	0.50
		3.56	0.32
10.	Powdered Long Buchu, bought in 1918, No. 40 powder	4.27	1.49
		4.54	1.48
11.	Whole Short Buchu, garbled and powdered to No. 40 powder	3.50	0.16
		3.55	....
12.	Powdered Short Buchu, bought in 1911, No. 60 powder	5.17	1.13
		4.99	1.17
13.	Powdered Short Buchu, bought in 1910, No. 60 powder	3.60	1.39
		3.34	....

All of the garbling on above samples was done by hand, 1000 grammes of the sample being used in each case for the test.

PHARMACOGNOSY LABORATORY,
COLLEGE OF PHARMACY,
UNIVERSITY OF MINNESOTA.

TABLETS FOR THE NATIONAL FORMULARY.*

BY CLYDE M. SNOW AND BERNARD FANTUS.

The introduction of tablets into the National Formulary seems demanded by the extensive use of this solid dosage form, and the declaration of principles for admission into the National Formulary, *viz.*, that use should be the determining factor. We face here a curious situation that, while tablets are the popular form of medication with manufacturers, tablet making is as yet *terra incognita* to the

* Read before Section on Practical Pharmacy and Dispensing, A. Ph. A., New Orleans meeting, 1921.

rank and file of the pharmaceutical profession. This is partly due to the comparative cheapness of the manufactured tablet, and partly to the lack of a process suitable for the extemporaneous dispensing of them. The time for drying, whether we employ the tablet triturate process or compression after preliminary granulation, seems to be the outstanding factor. Could a process of direct compression be devised, this difficulty might be removed, and tablet making become one of the routine processes in the drug store. In view of the fact that the National Formulary is devised more especially for the dispensing pharmacist, it seems that a process for extemporaneous preparation should be described, if practicable, though other processes be declared admissible provided each tablet carries the required amount of active medicament. Even though not many retail pharmacists equip themselves to prepare these tablets, the formulas in the National Formulary would also have the advantage of furnishing a standard for the manufacturer as well as the prescriber.

THEORY OF TABLET MAKING.

To make a good tablet, the material to be compressed must be heterogeneous. This heterogeneousness may be physical or chemical. Physical heterogeneousness is obtained by granulation. When we desire to produce good tablets without previous granulating of the powder, the result may be secured by a suitable mixture of powders of different nature in proper proportions. Possibly the explanation for this fact is to be looked for in the domain of electricity. Might it not be that, when we compress a homogeneous powder, the electricity produced by the friction causes the particles to repel each other, hence capping, picking or breaking up of the tablet? It is usually easy to make one or two good tablets from almost any powder. But soon something seems to have happened to give trouble. Might this not be the development of frictional electricity? If this theory be correct, then mixing powders that on friction produce electricity of different potential would overcome this evil, and enable one to continue making tablets after the machine has become electrically charged by manipulation. Furthermore, the electrical attraction of the particles oppositely charged would tend to hold the tablet together. Might not, in this manner, be explained the value of liquid petrolatum and talc in tablet making? They are usually spoken of as "lubricants." It surely cannot be a question of actual production of a film, which is the essence of true lubrication; for the minute amount employed (1%–2%) could hardly apply itself as a film over the surface of the tablet. It is furthermore well known that these so-called lubricants must not be well mixed with the powder, otherwise they lose their efficiency. This observation could be explained, it seems, by the theory of heterogeneousness rather than by lubrication.

It has been shown[1] that the admixture of petrolatum-impregnated starch to sugar enables one to make satisfactory tablets extemporaneously. When liquid petrolatum is mixed with starch, let us say to 25%, which is as much oily material as the starch can well carry, we have a powder that in itself is not suitable for tablet making, even though it has a tendency to form granules. The tablet displays no cohesiveness whatever. When we now add a certain proportion of other powder, such as sugar or sodium bicarbonate, we soon arrive at a mixture that compresses

[1] B. Fantus, "Candy Medication," 1915, C. V. Mosby Co., Publishers, St. Louis.

admirably; and experiments have shown that the addition of from 10 to 30 per-cent petrolatum-starch produces a satisfactory material for tablet making, provided the powder is not triturated too energetically. If more petrolatum-starch is added the tablet is too soft; if less is used the tablets cap, pick or crumble. We might consider 20% of petrolatum-starch a proper average proportion.

Powdered cocoa (Baker's or VanHouten's) acts very much like petrolatum-starch in favoring tablet making. From 10% to 30% might be used. The smaller quantity is not entirely satisfactory; the larger amount is rarely required. Here again 20 percent is usually satisfactory.

The fact that powdered sulphur readily compresses in a tablet machine may seem to annul the theory of heterogeneousness advanced. As it seemed possible that the crystalline structure and the presence of a certain percentage of amorphous sulphur might account for this peculiarity, we tried to remove the amorphous sulphur by means of carbon disulphide, which dissolves the crystalline variety but not the amorphous. We then precipitated the sulphur from its carbon disulphide solution by means of ether, and obtained a crystalline precipitate which still compressed readily into tablets. Even thorough trituration to break down the crystals as much as possible did not suffice to annihilate the tablet-making qualities of this crystalline sulphur. This behavior of sulphur still requires explanation, otherwise the electrical theory just expounded will have to be abandoned, though the necessity of heterogeneousness remains.

FORMULAS FOR TABLETS.

We desire to submit for the purpose of discussion, the following formulas for tablets, some of which might possibly be found suitable for inclusion in the National Formulary.

TABELLAE HYDRARGYRI CHLORIDI MITIS.

Tablets of Mild Mercurous Chloride

Calomel Tablets.

Mild Mercurous Chloride....	0.60 Gm.
Carmine.....	0.05 Gm.
Spirit of Rose, 1%.....	0.40 Cc.
Liquid Petrolatum.....	1.40 Cc.
Starch, powdered.....	4.00 Gm.
Sugar, in fine powder.....	12.00 Gm.

Having thoroughly triturated the mild mercurous chloride with the sugar, add the carmine and the spirit of rose, and triturate again until the pink color is perfectly uniform. In another mortar mix the starch with the liquid petrolatum. Then add the petrolatum-starch to the other powder with gentle trituration. Compress in a tablet machine using 5/16 inch die and punches to make one hundred 0.18 Gm. tablets.

Average dose: 10 tablets. Tablets containing other dosage than that specified may be made by increasing the amount of mild mercurous chloride and correspondingly decreasing the quantity of powdered sugar.

TABELLAE SANTONINI.

Tablets of Santonin.

(Replacing Troches of Santonin, N. F. IV.)

Santonin, in fine powder.....	3.00 Gm.
Benzosulphinide.....	0.06 Gm.
Tincture of Vanilla.....	1.50 Cc.
Cacao, in fine powder.....	6.00 Gm.
Sugar, in fine powder.....	21.00 Gm.

Mix the benzosulphinide with the tincture of vanilla, add the santonin and permit the alcohol to partially evaporate. Then mix the sugar and the cacao by thorough trituration in a mortar. Compress in a tablet machine, using 3/8 inch die and punches to make one hundred 0.30 Gm. tablets.

Dose: one tablet.

Caution! Because of the pleasantness of these tablets and the possibility of their being mistaken for candy, only a small number of them should be ordered at a time, perhaps not more than three, as 0.13 Gm. of santonin has caused the death of a child.

TABELLAE SANTONINI COMPOSITAE.

Compound Tablets of Santonin.

(Replacing Compound Troches of Santonin, N. F. IV.)

Santonin, in fine powder.....	3.00 Gm.
Mild Mercurous Chloride....	3.00 Gm.
Benzosulphinide, in fine powder	0.06 Gm.
Tincture of Vanilla.....	1.50 Cc.
Cacao, in fine powder.....	6.00 Gm.
Sugar, in fine powder.....	18.00 Gm.

Mix the benzosulphinide and the mild mercurous chloride with the tincture of vanilla, add the santonin and permit the alcohol partly to evaporate. Then mix the sugar and the cacao by thorough trituration in a mortar. Compress in a tablet machine, using 3/8 inch die and punches to make one hundred 0.30 Gm. tablets.

Dose: one tablet.

Caution! See tablets of santonin.

TABELLAE PHENOLPHTHALEINI.

Tablets of Phenolphthalein.

(Replacing Troches of Phenolphthalein, N. F. IV.)

Phenolphthalein, in fine powder	6.00 Gm.
Benzosulphinide.....	0.12 Gm.
Spirit of Cinnamon, 10%....	0.15 Cc.
Cacao, in fine powder.....	6.00 Gm.
Sugar, in fine powder.....	18.00 Gm.

Mix the benzosulphinide with the spirit of cinnamon and add the phenolphthalein. Then incorporate the sugar and the cacao by thorough trituration in a mortar. Compress in a tablet machine using 3/8 inch die and punches to make one hundred 0.30 Gm. tablets.

Dose: one tablet.

TABELLAE SODII BICARBONATIS.

Tablets of Sodium Bicarbonate.

Soda-Mint Tablets.

(Replacing Troches of Sodium Bicarbonate, U. S. P. IX.)

Sodium Bicarbonate.....	25.00 Gm.
Oil of Peppermint.....	0.30 Cc.
Liquid Petrolatum.....	1.00 Cc.
Starch, in fine powder.....	4.00 Gm.

Mix the oil of peppermint and the liquid petrolatum with the starch; add the sodium bicarbonate by gentle trituration. Compress in a tablet machine using 5/16 inch die and punches to make one hundred 0.30 Gm. tablets.

Dose: as required.

TABELLAE SULPHURIS ET POTASSII BITARTRATIS.

Tablets of Sulphur and Potassium Bitartrate.

Tablets of Sulphur and Cream of Tartar.

(Replacing Troches of Sulphur and Potassium Bitartrate, N. F. IV.)

Washed Sulphur.....	20.00 Gm.
Potassium Bitartrate.....	6.00 Gm.
Oil of orange.....	0.30 Cc.
Starch	4.00 Gm.

Triturate the powdered ingredients together until thoroughly mixed, then incorporate the oil. Compress in a tablet machine using 5/16 inch die and punches to make one hundred 0.30 Gm. tablets.

Dose: Several tablets.

TABELLAE CARBONIS.

Tablets of Charcoal.

(Replacing Troches of Charcoal, N. F. IV.)

Animal charcoal, in No. 20 powder...30.00 Gm.

Compress in a tablet machine using 3/8 inch die and punches to make one hundred 0.30 Gm. tablets.

The fact that animal charcoal, by reason of its granular structure, readily compresses into tablets might, it seems, be taken advantage of, as powdered wood charcoal offers one of the worst problems in tablet making. In view of the fact that animal charcoal is a much more efficient adsorbent than vegetable charcoal and the further fact that grave doubts may be entertained regarding the adsorptive value of vegetable charcoal after it has been formed into granules by acacia and the various other means generally employed for this purpose, tablets made from animal charcoal ought to be therapeutically superior.

We suggest that tablets of charcoal, of phenolphthalein, of santonin, the compound tablets of santonin and the tablets of sulphur and potassium bitartrate be introduced instead of the corresponding troches official in the National Formulary. In point of fact these have never become popular, though the tablets of these substances are. The reason for this is not far to seek. Troches, because of their

dissolving slowly, yield maximum effect upon the mouth and throat. While a good administration form for local medication, they are unsuitable for substances intended for action elsewhere.

PHARMACY LABORATORY,
UNIVERSITY OF ILLINOIS.

ABSTRACT OF DISCUSSION.

F. W. Nitardy inquired of the author whether it was the intention to give standards for disintegration and solubility. Professor Snow stated that he did not know whether standards would be provided for, that the tablets as submitted disintegrated quite rapidly. Mr. Nitardy stated that skill was an important factor in tablet manufacture. He also spoke of the absorbent qualities of charcoal, and variation in that respect; an article on the subject had recently appeared in the *Journal of Industrial and Engineering Chemistry;* much information may be obtained on this subject of value to members of Revision Committees by reference to the research work on charcoal in connection with its value in the manufacture of gas masks.

[EDITOR'S NOTE.—For a comprehensive article on Tablet Manufacture, see p. 788, Volume IX, THIS JOURNAL.]

COMPOUND SOLUTION OF SODIUM PHOSPHATE, N. F.*

BY H. M. FASER.

The formula for compound solution of Sodium Phosphate, N. F. is as follows:

Sodium Phosphate, in uneffloresced crystals	1000 Gm.
Citric Acid	130 Gm.
Glycerin	150 mils
Distilled Water, a sufficient quantity to make	1000 mils

Heat the mixture of sodium phosphate and citric acid in a glass or porcelain vessel on a water-bath until liquefied. Filter the solution while hot into a vessel which has just previously been rinsed with boiling water. Finally add the glycerin and sufficient distilled water, just previously boiled, to make the product measure one thousand milliliters.

Keep the solution in well-stoppered bottles, in a moderately warm place.

The formula states:

"It is important that uneffloresced crystals of sodium phosphate be used in making this solution, as it is nearly saturated. Should an effloresced salt be employed with its greater percentage of anhydrous sodium phosphate, the solution is likely to crystallize."

It also states:

"Should sodium phosphate in partly effloresced form be used, the salt should be first covered or thoroughly washed with distilled water, and, when the efflorescence has disappeared, the clear crystals should be removed from the water and air dried; or a small quantity of the sample may be dried with heat, as directed under Sodii Phosphas Exsiccatus (U. S. P.) and the percentage of moisture determined. When the amount of water present is known, a proportionately smaller quantity of the effloresced salt may be taken."

In the first place, when this preparation is made from the salt in uneffloresced crystals, by the formula as laid down, which states to heat the sodium phosphate and citric acid until liquefied and filter while hot, we will find that it is almost impossible to filter unless a hot water funnel is used, and again it would crystallize before it passed through due to the fact that the sodium phosphate employed had dried out to a certain extent and a greater percentage of sodium was used than

* Read before Section on Practical Pharmacy and Dispensing, A. Ph. A., New Orleans meeting, 1921.