chloride in quantity of not less than one-fifth of the amount of zinc chloride used, will insure complete and permanent solution. Camphor water will dissolve a few grains of zinc chloride per ounce. Carbonic acid water may be employed if intended for immediate use. And finally the comparative ease with which a minute quantity of either boric acid or ammonium chloride prevents a precipitate as against the larger quantity needed to redissolve oxychloride once formed may be impressed upon our minds by the wisdom of the maxim: "An ounce of prevention is worth a pound of cure."

THE MANUFACTURE OF ASPIRIN TABLETS.*

BY ROBERT C. WHITE.

The data presented by the author are based on his investigations of Aspirin tablets of American manufacturers, including also the original Aspirin tablet. No report is made on the content of aspirin, but only of the tests involving the physical operation of making the tablets. The author states that manufacturers are constantly improving their product and as the tablets reported on are of different dates of manufacture, no names of manufacturers are given and the tablets are referred to by number. The table following has been prepared from Doctor White's report in order to condense this matter; that which follows thereafter is printed from the original.—EDITOR.

The manufacture of Aspirin tablets may be placed in what is considered by manufacturers the "delicate" group. Many things coming in contact with aspirin can exercise either physical or chemical function, and so either contaminate or break down the aspirin content. In the manufacture of any tablet there are several important features to which the manufacturers give considerable atten-

EXAMINATION OF ASPIRIN TABLETS.

Quality, description and composition.	Sample No. 1. Examined May 1918.	Sample No. 2. From eastern manufacturer Examined May 1918.	Sample No. 3. From eastern manufacturer. Examined June 1918.
Appearance	Poor	Fair	Poor
Color	Good	Fair	Dark
Die	Satisfactory	Poor	Good
Punch	Poorly engraved	Plain	Very poor
Monogram	Indistinct	None	Poor, engraving worn
Carrying Qualities	Very poor	Good	Poor
Disintegration	Good	Good	Fair
Disintegration Agent	Evidently potato starch	Potato starch	Corn starch
Uniformity of Weight	Poor	Average, good	Poor
Maximum Weight	7.3	6.4	7.7
Minimum Weight	4.7	5.7	5.3
Excipient	Weak starch paste	Weak gum solution	Gelatin solution
Other Filler	Corn starch	Corn starch	Corn Starch
Lubricants	Oil, none.	Oil, small amount Talcum, large quantity	Oil, large quantity Talcum " "
Contamination	None	Iron	Bad. Evidently iron stains
Packing	Fair	Poor and loose	Poor

* From a paper read before Pennsylvania Pharmaceutical Association, 1918 meeting.

Quality, description and composition.	Sample No. 4. From eastern manufacturer. Examined June, 1918.	Sample No. 5. From middle-west manufacturer. Examined June, 1918	Sample No. 6.[1] From middle-west manufacturer. Examined June, 1918.
Appearance	Good	Good	Fair
Color	Very good	Good	Poor
Die	Good	Good	Badly worn
Punch	Plain, good	Plain, good	Plain, good
Monogram	None	None	None
Carrying Qualities	Good	Fair	Good
Disintegration	Good	Fair	Fair
Disintegration Agent	Potato starch	Potato starch	Corn starch
Uniformity of Weight	Good	Good	Poor
Maximum Weight	6.2	6.4	6.6
Minimum Weight	5.9	5.7	5.3
Excipient	White dextrin	Evidently tragacanth	Evidently gelatin or gelatin and gum acacia
Other Filler	Potato starch	Corn starch	Corn starch
Lubricants	Oil, none. Talcum 1/8 grain	Oil, small quantity. Talcum, 1/4 grain	Entirely too much oil. Talcum, very heavy
Contamination	None	None	With metal, apparent
Packing	Good, in glass only	In glass, good	Good

Sample No. 7, examined June 1918: Purchased in a Washington, D. C. drugstore. Name of manufacturer could not be obtained. Had evidently been heated too long in drying, with apparent contamination. The edges were poor, and the tablets quite mottled as if too dark a shade of talcum had been used. This sample was so far outclassed by those of other manufacturers that it is of no interest whatever except that it tends to show that very poor workmanship in pharmaceutical products still is practised.

tion. The first desirable thing is to present in tablet form the chemical as nearly in its original condition as is possible. The second important thing is disintegration, though in the case of aspirin this is not vital as it takes, according to various authorities, about forty minutes for aspirin to become decomposed in the gastric fluids.[2] The next feature is to have present as little foreign ingredient as is possible. As we know, there are many tablets such as formin, potassium iodide, sodium chloride, sodium bicarbonate, potassium permanganate, sugar, etc., which if obtained in granular form of the proper size may be compressed without the use of any excipient, or binder, without the presence of any filler, and without the addition of any disintegrating agent whatever. The physical properties of aspirin are such that it is placed in a class of tablets known to some manufacturers as moist tablets. This class includes such tablets as quinine, acetanilid, etc., or tablets which can never be produced with a glass-like surface. The term moist in this case originated with the appearance of the tablet which no amount of blowing, or dusting will make entirely smooth. Such tablets, if great pressure is applied are inclined to cap, or on account of their sticky surface allow small particles to adhere to the punches, thus leaving dents in the surface of the tablet. This to the manufacturer is known as "picking," meaning that the punches pick off a small particle, leaving a cavity in the tablet. It will be readily seen from the physical properties of aspirin that it is necessary to have present a binder, or ex-

[1] Tablets on account of excessive pressure used in manufacture would not disintegrate speedily enough, yet their fracture was soft.

[2] (U. S. Dispensatory, 20th Edition.)

cipient. Sugar has not proven satisfactory for this purpose, as sugar itself attracts moisture, and complicates the operating of a compressing machine. It must also be remembered that moisture decomposes aspirin, and its presence in large quantities is highly objectionable, therefore the excipient must be one that can be dried very readily and that, at a low temperature. Glucose, gelatin and tragacanth all fail to answer on account of their sticky and slow drying qualities. Honey would not answer, as its tendency is to darken white tablets, and the need of much filler makes it unsuitable. Water alone will not bind properly. Solution of acacia answers fairly well, but both starch paste and acacia are lacking in making a fine aspirin tablet. It will, therefore, be found that a weak solution of white dextrine in combination with a filler of starch answers better than any other excipient for producing a mass of aspirin for proper granulation. It might here be explained for the information of the uninitiated that except in extremely rare cases it is never possible to compress powders of fine degree, but that granules must be built up from the powder.

Another feature involved in the preparing of an aspirin mass or mixture is that it must not be exposed to contamination from metals. From the samples examined it is evident that some of these have been manufactured in the ordinary iron mixers, or if granite-ware containers have been used, the surface has not been perfect, and iron has been exposed. If this is not the case the moist mass, before drying, has evidently been forced through a brass or an iron screen, which has produced contamination and resultant discoloration. In this particular product the writer has found nothing more satisfactory than the mixing of the aspirin ingredients in a special wooden tub made of maple. The operator may mix the dry ingredients through a properly protected powder mixer, but the addition of the dextrine solution must be made in these wooden tubs, the operator wearing long rubber gloves. Care should be exercised in all cases that the minimum amount of moisture for the best results to be obtained shall be strictly adhered to. The finished mass taken from these wooden tubs should be forced very quickly through perfectly clean and well tinned screens, placed immediately in aluminum trays, and dried *in vacuo* at a temperature not exceeding 120° F.

It will be found if all these rules are observed to that aspirin may be dried in three or four hours. If during this time the aspirin has not been exposed to the air it will be found that the granulation, dry and ready for compression, is in proper condition to be placed on the presses. No oil should be added in the running of aspirin tablets unless absolutely necessary on account of weather conditions. It will be found that though on account of the absence of oil the sides of the tablets will not be bright and polished (due to the moist physical properties of the ingredients as was spoken of earlier) the edges will be sufficiently smooth for all purposes; and the absence of the oil (which would in time penetrate the tablet) will permit of a harder tablet.

A minimum amount of pure white talcum, not exceeding $^1/_8$ grain to the tablet must be used as otherwise picking on surface of the tablet will occur. If the engraving of monogram punches is very fine it will be necessary to increase this amount of talcum in order to prevent the material from sticking in the engraving. It should be borne in mind that talcum is objectionable in all cases and as little as possible should be used.

As speedy disintegration of all tablets is considered essential, a disintegrating agent must be used. Doubtless, known to many, potato starch is the disintegrating agent par excellence as it swells very rapidly and ruptures a tablet very quickly when it is introduced into aqueous solution.

The following criticisms in general might be based on the aspirin tablets at present supplied by all except one or two manufacturers: that many of them are off color, some having unquestionably been subjected to contamination. Corn starch has been used by many in preference to potato starch; the excipient used by some is also too heavy and too slow drying.

The nature of engraving used on such monogram punches as have been operated in making aspirin tablets is not of a proper make to use on tablets of such dusty physical appearance. Others through not using a proper disintegrating agent have compressed the tablets too hard which makes them too brittle for carrying. In other cases, to permit of speedy disintegration, insufficient pressure has been applied.

In behalf of the tablets examined, however, the writer would like to state that the disintegration in general has been exceptionally good, the discoloration only moderately bad, and that while the appearance of most of the tablets is poor, it is undoubtedly preferable to sacrifice physical appearance for efficacy in all cases and when all is said and done it is quite probable, too, that though these matters are of considerable importance to manufacturers, the retail druggist may be in a position to inform us that the public are not sufficiently educated in such details, and may prove to us that the poorest looking tablet is the best seller of all.

WHAT IS THE MEANING OF A DEGREE IN PHARMACY?*

BY L. E. SAYRE.

It will not be the aim of this paper to extol pharmaceutical degrees, or make a plea for their standardization or unification, but rather to suggest for consideration the importance of some questions indirectly associated with degrees.

The desirability of unification and standardization of degrees in pharmacy has been ably presented at former meetings of this Association by prominent members and instructors in pharmacy. Professor McGill, of Nashville in 1904[1] very ably set forth what was then considered as needed to bring about greater uniformity. It may be in place to review briefly his paper. His statistics were gleaned from 48 schools and colleges of pharmacy. He found among these institutions the following degrees conferred: Graduate in Pharmacy, Bachelor of Pharmacy, Master of Pharmacy, Doctor of (or in) Pharmacy, Bachelor of Science in Pharmacy and Master of Science in Pharmacy. To show the lack of uniformity he cited statistics to show that the degree of Ph.G. was conferred for work ranging from 40 to 72 weeks. Greater uniformity was found to exist in the requirements leading to the degree of Ph.C., but in the Bachelor of Pharmacy, Master of Pharmacy and Doctor of Pharmacy much incongruity existed. For

*Read before Section on Education and Legislation, A. Ph. A., Chicago Meeting, 1918.

[1] Proceedings A. Ph. A., 1904, p. 115.