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POISONED CONFECTIONARY.

DETECTION OF GAMBOGE, LEAD, COPPER, MERCURY, AND CHROMATE OF LEAD,

In various articles of Sugar Confectionary.

By W. B. O'SHAUGHNESSY, M.D.

In the following observations, it is my principal aim to lay before the public and the medical profession, a calm, dispassionate statement of the existence of the various poisons enumerated above, in several articles of confectionary, the preparation of which, from their peculiar attractions to the younger branches of the community, has grown into a separate and most extensive branch of manufacture. I am fully aware of the hazardous task that individual undertakes, who ventures in this country to signalise such abuses. The wrath of the particular trade is, of course, especially excited. The sneers and ridicule of the ignorant are also abundantly provoked, principally through the recollection of the indiscreet and mischievous efforts, which over-zealous or designing alarmists have occasionally made to terrify the public mind by topics of this description. I hope, however, by a plain narrative of facts, and by reference to justly-accredited authorities, to avoid at the same time these unpleasant imputations, and to show the real extent of the danger in question.

I had, as far back as a year since, been requested, by the Editor of this Journal, to undertake a series of analytic investigations into the truth or inaccuracy of various alleged adulterations, with the view that the authenticated information thus obtained might either dissipate needless apprehension, by pointing out the falsity of many alarming statements, or might lead to the efficient protection of the public health, by showing, as far as analysis could teach, what were the admixtures really prejudicial and essential to be prohibited. Different circumstances, unnecessary to particularise here, combined to delay the commencement of these inquiries until a fortnight since,

when I received from Mr. Wakley the numbers of the *Journal de Chimie Medicale* for the preceding three months, to an article in which (*Janvier*, No. 2) he requested me to direct my attention.

The article alluded to is from the pen of the distinguished *Chevallier*, whose labours in this department of medical police have acquired for him the highest reputation as a philanthropist and physician; it is entitled, "Note sur la vente des sucreries, colorées, bonbons, &c.," and as it places the importance of the subject in the most striking light, and shows, at the same time, the enlightened measures adopted by the French government on the occasion, I subjoin a sufficient abstract of its contents.

M. Chevallier commences by observing, that at several times he had related in the *Journal de Chimie*, various serious accidents produced by the consumption of sugar confectionary coloured by mineral poisons. Of these he particularises the *schœnfurst green*, a compound of arsenious acid (arsenic) and copper; the *chromate of lead*, and the *sulphuret of mercury*. Lastly, he enumerates *gamboge*, a drastic purgative, and consequently an active irritant poison. Despite of the notification of this dangerous practice, made in nearly all the journals, literary, political, and medical, this mode of colouring was persevered in, till at length the Council of Health was consulted on the subject. This body lost no time in investigating it as it deserved, and the result was, an ordonnance of police for the suppression of the nuisance. The following document, which led to the ordonnance, is well worth attention:—

Report, addressed by M. Andral to the Prefect of Police, on the dangers which may result from the use of coloured sugar confectionary.

"M. le Prefet.—You have instructed the Council of Health to report to you, on the danger which may result from the consumption of coloured confectionary, and on the measures necessary to be adopted to correct the manufacture and sale of any such prod-

Journal de Chimie, tome 4, p. 204.

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nicious articles. The delegates of the Council have the honour to submit to you the following propositions:—

" 1. It will be important to specify in the ordonnance, what are the colouring substances which should be prohibited. These are, in the first place, all those derived from the mineral kingdom, except the oxides of iron, ferruginous lakes, or Prussian blue, all of which may be safely employed. Of vegetable substances, *gamboge* should be severely proscribed, as being a drastic cathartic, which even in minute doses necessarily occasions violent intestinal irritation. *Litmus* should be equally prohibited, as well on account of its being occasionally incorporated with putrified urine, as that some manufacturers mix it with common arsenic and the peroxide of mercury.

" The most diversified colours may be obtained by the confectioners from totally harmless compounds. Thus from the lakes of cochineal and carmine, they can prepare all the reds; the lakes of logwood will afford them the violet; the lakes of dyer's broom (*genista tinctoria*), &c. will give the yellow; the lake of Persian grain (*polygonum Persicaria*), with Prussian blue, form a more beautiful green than any mineral can produce; finally, by the mixture of these harmless colours all the intermediate tints and shades will be obtained.

" 2. The papers used for wrapping up sugar confectionary should also be strictly attended to, since they are coloured with the same poisonous materials, and children invariably will suck or eat these papers, from which it is evident the most fatal accidents may occur. A member of the Council of Health, a short time since, snatched a coloured paper of this description from an infant's mouth, and by analysis obtained from it both ARSENIC AND COPPER.

" 3. The delegates of the Council are of opinion, that to ensure the observance of the ordonnance, you should determine, M. le Prefet, that a committee be appointed to visit the workshops of the manufacturers of this species of confectionary: all the poisoned articles should be seized and their vendors fined. Lastly; the delegates of the Council recommend, as a measure of great utility, that on the day following the seizure, the names of the confectioners should be published in all the journals and placarded over the walls of the city.

" In conclusion, the delegates of the Council believe, that an ordonnance, founded on the principles thus pointed out, will prove of essential service, by suppressing a practice so pernicious to the public health."

The immediate result of this pointed and satisfactory report, was the issuing of an ordonnance from the prefecture of police, dated the 10th of December, 1830, and

signed by the Comte Treilhard, in which the practice is denounced in the most energetic terms, the poisonous ingredients specified, the harmless enumerated, and in addition to the proposals of M. Andral, orders are given that no confectionary shall be sold unless wrapped up in paper, stamped with the name and address of the confectioner. Further, by this edict, the vendors are held personally responsible for all accidents occasioned by the confectionary or liqueurs sold in their establishments.

Pursuant to these resolutions, the visits were made, and several poisoned specimens destroyed. Generally speaking, the confectioners gladly banished from their laboratories the pernicious materials, and availed themselves of the harmless substitutes recommended in the report. Lastly, M. Chevallier describes the mode in which the sulphuret of mercury (vermillion), the chromate of lead, and the arsenite of copper (Schweinfurt green), may be detected by chemical analysis.

The preceding abstract, sanctioned by the name of M. Chevallier, and of that illustrious pathologist M. Andral, is amply sufficient to entitle me to the attention of the public, while I describe the extent to which the practice of using poisonous colours is carried on in London, and thence disseminated over the united kingdom, and its foreign colonies and possessions.

On the subsequent day to that on which I perused the article just alluded to, I purchased, in company with my friend Dr. Green, at several shops, different specimens of coloured confectionary, and of coloured articles, wrapped in stained paper. Of the coloured articles, the greater number (class 1) were sold expressly for eating, some (class 2) cast into small figures of cards, &c., were apparently rather intended for ornament, but were sold without restriction; and, lastly, some (class 3) were expressly designed for ornament alone. Of the first class I examined about thirty different kinds, and found the reds tinted as follows:

Ten Specimens of Red Comfits, &c.

- 1 Minium, or red oxide of lead.
- 2 Red sulphuret of mercury (vermillion).
- 1 Mixture of both the former.
- 1 Of a yellowish or orange tint, chromate of lead, and a vegetable lake of lime.
- 2 Cochineal alone.
- 1 Cochineal, with a trace of vermillion.
- 2 Vegetable lakes of alumina and lime.

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It is seen here, that of the ten specimens of comfits sold for eating expressly, six contained mineral poison; all these specimens, with one exception, were only coloured externally.

Of the *yellows*, class 1, seven specimens of different forms and tints. 4. *Gamboge*, coloured externally; 1. Coloured throughout a vegetable lake of lime; 1. Coloured throughout, oxide of lead, and traces of antimony, or Naples yellow. Six of the seven consequently contained deleterious substances.

Of the *greens*, class 1, several specimens, all were coloured by Prussian blue, and a vegetable yellow lake of alumina mixed with the sulphate of lime, except one specimen, of which I had only two comfits, and which gave me a mixture of copper and lime.

The *blues*, class 1, were chiefly Prussian blue, and contained no hurtful compound.

In the second class, or those apparently intended for ornament, but sold without restriction, and formed in all sorts of fantastic shapes, of eight forms of yellow, three contained chromate of lead; one Naples yellow; one massicot or yellow lead, and three vegetable lakes of alumina and lime. All these were coloured throughout, and contained moreover sugar, and the sulphate of lime or plaster of Paris.

The *reds* in this class were, of six specimens, three vegetable lakes of alumina or lime, one chromate of lead, with a red vegetable lake, two red lead.

The *greens* and *blues* were composed as I described in class 1.

In the *third* class the composition was precisely the same, and the proportion little different from class 2.

The papers were next examined, especially those used for enveloping the sugar drops called "kisses." Without exception the *reds* were coloured by the RED SULPHUR of MERCURY, the *yellows* by the CHROMATE OF LEAD, and many of the *greens* by VERDEGRIS, or the carbonate of copper.*

With respect to the quantities of the poisonous substances, I had not leisure to submit the various products to the tedious process of delicate weighing. Moreover, it appears to me to be altogether unnecessary to take the trouble, as the mere presence of the minutest possible quantity of any such substance should not be allowed. In this opinion I entirely coincide with MM. Chevallier and Andral. It is perfectly unnecessary for me to occupy the pages of this Journal with any observations on the nature of the danger which thus threatens the junior branches of the community, and which indisputably exercises the most pernicious effects on their constitutions; I will merely

remark that one concern in the city, from which I have obtained the greatest number of poisonous specimens, employs eleven men daily in the preparation of these articles, furnishes immense quantities of them to country confectioners, supplies many of the minor shops in the metropolis, and, if I am rightly informed, exports to our foreign possessions to a considerable amount. Extent of manufacture always implies extent of sale, and in this case the ratio of the consumption of course equals both. I cannot, therefore, be accused of exaggeration, when I assert that millions of children are thus daily dosed with metallic and vegetable poisons, in minute quantities it is true, but in quantities dependent on their amount on the caprice of a workman or a machine, and sufficient in the minutest degree to exercise their peculiar insidious effects, if taken as a practice from day to day. Neither are these effects chronic alone, for not long since an acute case of poisoning arising from the use of confectionary of this description occurred in the children of a highly respectable family in Southwark, and on analysis the comfits were found to contain minium, or the red oxide of lead.

The next topic remaining for me to notice is the

MODE OF ANALYSIS OF SUSPECTED SPECIMENS.*

This varies, in its first step, according to the extent to which the colouring matter pervades the specimen. If entirely external, it should be agitated in water in a wine glass till the colour is washed off, which takes place usually in a few seconds. The solid part, or body of the article, should then be removed by decantation into another vessel, and the liquid if transparent and coloured filtered through paper and preserved. If the colour be throughout as seen on the fracture, the specimen should be reduced to powder, and boiled in a small flask in distilled water, which dissolves the sugar, and leaves the mineral substance, vegetable lake, &c., which should next be transferred to a watch-glass, and dried in the water-bath.

If the supernatant liquid in either case remain transparent and colourless, it is an indication that the colouring matter is either a mineral substance, or a vegetable lake; in this case the fluid may be rejected, and attention confined to the deposit alone. If again we obtain a coloured fluid and a considerable residuum, it indicates a vege-

* Sealed phials, containing specimens of the poisoned comfits, are left at THE LANCET Office for public inspection in order to supersede the necessity of a description of their forms, which could at best communicate a very faint idea of the pernicious

* M. CHEVALLIER merely describes the mode of detecting vermilion, the arsenical green, and chromate of lead. I have ventured to recommend different processes in this paper, under the restriction that those employed by M. Chevallier were not detailed with sufficient minuteness to be of practical utility.

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able colouring extract, and a lake or mineral colour, and both are to become the subject of experiment. Lastly, if there be no residuum, and the specimens wash clean, and the fluid filter of a deep, transparent colour, the fluid is alone to be reserved.

ANALYSIS OF THE YELLOW.

[The yellows ordinarily met with, are coloured either by gamboge, massicot, Naples yellow, the chromate of lead, or vegetable lakes.]

The *yellows*, coloured by *gamboge* externally, when washed thus with distilled water, form an opaque yellow emulsion, which lets fall no deposit. By evaporating this emulsion to dryness, a little strong alcohol, added to the residuum, dissolves instantly the gamboge in a state of perfect purity. The alcoholic solution is then to be transferred to a test tube, and an equal quantity of distilled water added. The gamboge is now precipitated as a lively yellow; a drop or two of strong ammonia added, redissolves the gamboge, producing a blood-red solution, which again is precipitated pale yellow by the addition of nitric acid. This simple concatenation of experiments affords abundant proof of the presence of this substance. If the yellow colour proceeded from saffron, turmeric, or any other similar substance, it would form a *solution*, not an *emulsion*, with water. It would not be precipitated from its alcoholic solution by water, neither would it be precipitated from its ammoniacal solution by nitric acid. Two or three small comfits are amply sufficient for the process, as it will detect the 100th part of a grain of gamboge. If great expedition be required, alcohol may be used at first to dissolve the colouring matter, and thus the tedious evaporation will be avoided.

If the *yellows*, when washed with water, and the comfits removed, let fall a yellow deposit, and leave the supernatant liquid colourless and transparent, the deposit is either the chromate of lead, Naples yellow (*oxide of lead and antimony*), massicot (or the yellow oxide of lead), or, finally, a vegetable lake of alumina or lime. In most cases also, the precipitate contains sulphate of lime.

We can now readily gain a clue to which of these divisions it belongs, by the following simple system of trial tests, viz., by placing a minute portion of it, moistened with a small drop of distilled water on a thin slip of mica,* and holding it over the flame of a spirit lamp till it be heated to redness. If it be a vegetable lake of lime or alumina, it first chars, blackens, exhales

smoke, and then leaves a brilliant, white, earthy mass, entirely soluble in acetate, when transferred to a watch crystal. A portion of this mass, if lime, stains moistened turmeric paper red; if alumina, has such effect.

If, instead of charring and becoming white the spot becomes red, and is surrounded with a little yellow circle, the colouring matter is massicot or yellow lead.

If, during this operation, dense white fumes are evolved, and leave a copious circle of the same colour on the mica, the substance, besides lead, *probably* contains antimony, and is, therefore, the Naples yellow.

If the colouring matter be chromate of lead, beautiful phenomena mark the action of heat, accomplished in the manner to be described; the substance on trial first darkens to a colour, then shows a red surface, and by-and-by bright-green spots are seen mingled with the red. This contrast of colours becomes especially striking on the addition of a drop of water.

So far the experiments are trial tests, and may be performed in as short a time as it takes to read their description; our next object is to obtain unimpeachable evidence of this, in the case of the massicot, is acquired readily, by treating a grain or two of the yellow mass on a watch glass with ten drops of nitric and six of muriatic acid, aiding the action by the momentary application of heat, white flakes of the chloride of lead now form and float on the acids; they are to be removed with a capillary tube, and transferred to a bit of firm charcoal; by directing the blowpipe flame on the chloride, it instantly fuses, and disengages globules of metallic lead, surrounded by concentric circles of red and yellow.

If the evolution of dense white fumes indicate the presence of antimony, the yellow matter should be treated, as just now described, with nitric and muriatic acid. The chloride of lead should be removed, and a few drops of distilled water poured on the residual fluid previously evaporated to dryness. If antimony be present in the smallest quantity, a white precipitate remains, which, if exposed to a current of sulphuretted hydrogen, expelled from a small bladder, furnished with a tube and stop-cock, is converted into the orange-red sulphuret of antimony. The chloride of lead is then to be reduced by the blowpipe as before, and we have thus certain evidence of the presence of antimony and lead. Half a grain of the Naples yellow is sufficient for this chain of experiments.

If on the mica, green spots are mixed with the red, indicating chromate of lead, two or three grains of the remaining yellow matter should be fused for a quarter of an hour on a slip of mica, with an equal quan-

* Mica can be procured at the mineralogists' shops at a very cheap rate, it is of immense service in minute analyses of this kind. (See LANCET, No. 366.)

nitrate of potash, chromate of potash is thus formed, the green spots disappear, and red flocks of minium, or the red oxide of lead, are seen in the fused nitre. The fusion should now be discontinued, and the cooled mass dissolved in distilled water in a watch glass; the solution should then be separated from the red oxide by a capillary tube, and transferred to another crystal. Nitrate or acetate of lead will now occasion to it a precipitate of the yellow chromate of lead. The red flocks are to be heated with nitro-muriatic acid, and the resulting chloride of lead reduced on charcoal to the metallic state.

The protracted fusion of the nitrate of potash may be easily accomplished, by placing a slip of mica four inches long and two broad, over the mouth of a wine glass, so that it can be balanced by a shilling placed on it over the glass; about two inches thus project, beneath which is placed a spirit lamp, and the fusion may be kept up an unlimited length of time. To those unprovided with costly apparatus, this simple substitute may prove, as it has to me, of considerable value.

ANALYSIS OF THE RED.

The red, on being washed or boiled with water, either form a coloured transparent solution, which affords no deposit, and filters through paper, or is coloured and affords a deposit, or affords a dense deposit, and leaves the fluid transparent and colourless.

In the first case, the solution is entirely decolorized by chlorine, or by dropping in a particle of the chloride of lime. If a second portion of it be changed to orange yellow by sulphuric acid, and a third assume a violet with ammonia, and if no black colour is produced by adding the sulphate of iron, it may be concluded to be a solution of *cochineal*.

If a deposit takes place, which, when dried and heated on mica, chars, blackens, and finally becomes white, and the residuum soluble in acetic acid, it is a vegetable lake of alumina or lime, probably *carmine*.

If the deposit be a bright-red colour, and subside rapidly, it is probably either the red oxide of lead, or the sulphuret of mercury; in either case heat on mica; if the former, the colour remains unchanged, and the substance is permanent at a red heat. If the latter, it is darkened on the slightest application of heat; if then removed, it remains on cooling a brilliant vermilion colour. This alternate blackening and reddening may be repeated *ad libitum*, till it is finally volatilised, leaving no trace behind.

So far, as in the analysis of the yellows, the experiments are but trial tests. The reduction of the respective metals is next to be accomplished. This is easily effected, by boiling a few particles of the colouring

matter in nitro-muriatic acid. If the trial test has pointed out the sulphuret of mercury, on evaporating nearly to dryness, brilliant crystals form on the watch glass, these should be redissolved in a few drops of distilled water, acidulated with nitric acid, and a gold ring with a bit of thin iron wire introduced. If the colouring matter contains the one-thousandth part of a grain of mercury, it will be thus deposited on the gold as a white amalgam.

If the red colour was permanent on the mica, the colouring matter is to be heated with nitro-muriatic acid as before described, and reduced on charcoal to the state of metallic lead.

ANALYSIS OF THE BLUE.

All the blues which I examined were prepared with Prussian blue. The analysis was very simple. On agitation with water, the specimens gave out a blue substance, which rapidly subsided after decantation. On boiling this with a little red precipitate of mercury the blue colour disappeared, and brown-red flocks (the peroxide of iron) floated on the liquid, which, when filtered and redissolved in nitric acid, struck a blue colour with the ferro-cyanate of potassa.

ANALYSIS OF THE GREEN.

In all the greens, with one exception, I found merely Prussian blue and a vegetable yellow lake. The single specimen which contained the carbonate of copper was dissolved in nitric acid, and the solution divided into three portions. Ammonia added in excess to one, produced a beautiful blue colour. The ferro-cyanate of potash gave a chesnut-brown precipitate with the second. The third portion, after the separation of its copper by a current of sulphuretted hydrogen gas, gave a white precipitate with the oxalate of ammonia, which was converted by a red heat into carbonate of lime.

ANALYSIS OF THE COLOURED PAPER.

This is to be conducted precisely in the manner just described, except that the bit of paper examined need not exceed half an inch square, and should be cut into small slips, which are to be removed from the solution when the colour disappears. The papers tinged with vermilion exhibit, in a striking and beautiful manner, the appearance of alternate blackening and reddening before a common fire, or over the spirit-lamp flame.

Before I leave the analytic part of my subject, I may observe, that the absence of the Schweinfurt green in the specimens I have examined, proceeds probably from the fact, that that description of pigment, as well as Scheele's green, are seldom or never sold pure in the paint shops, but are usually

imitated by the carbonate of copper and lime. Thus fortunately for the public health, the dishonesty of one trade affords it some protection against the reckless negligence of the other.

In conclusion I may state, that urged by a feeling of public duty I have laid the present subject before his Majesty's Government, through the Secretary for the Home Department, who favoured me with an interview, in which I submitted to his Lordship, the paper published by M. Chevallier in the *Journal de Chimie*, and specimens of the poisoned confectionary. How far this representation may induce the authorities of the land to direct their attention to matters of this description, I should not be justified in offering even a conjecture. The statute law of England affords the public little protection against any system of this kind, no matter how deadly in its nature. It will scarcely be believed that the only enactments in the English code relating to the public health which Mr. Coleridge thought worthy of insertion in his latest edition of Blackstone's Commentaries, are those which enforce the observance of quarantine, which prohibit the sophistication of wine, and the sale of unwholesome meat, or meat bought of a Jew.* Bakers are, it is true, prohibited from using carbonate of ammonia and some other ingredients, and the fiscal or revenue laws interdict the mixture of some pernicious substances with malt liquors. It is to be feared, however, that the collection of the hop-duty was the main object of our legislators in devising the latter provision.

In these particulars it is that our continental brethren, whether medical or judicial, have most outstripped us in their race with the progress of knowledge. The time, I trust, is not far distant when our legislature will perceive the necessity of imitating the rival nation in the establishment of councils of health on principles to which monopoly will be a stranger, and which shall have for their only object the preservation of the public life. No system of medical police can be less obnoxious to individual feeling, or more aptly calculated for the utter destruction of practices such as those I have endeavoured to describe.

* "A second, but much inferior species of offence against the public health, is the selling of unwholesome provisions; to prevent which, the statute 51 Hen. III., stat. 6, and the ordinance for bakers, stat. 7, prohibit the sale of corrupted wine, contagious or unwholesome flesh, or flesh that is bought of a Jew; under pain of amercement for the first offence, pillory for the second, fine and imprisonment for the third, and abjuration of the town for the fourth. And by the statute 12 Car. II., c. 25, sec. 11, any brewing or adulteration of wine is punished with the forfeiture of 100*l.* if done by the wholesale merchant, and 40*l.* if done by the vintner or retail trader. These are all the offences which may properly be said to respect the public health."—Blackst. Com. 1*st* ed., 1763, edit. by J. T. Coleridge; vol. 4, chap. 13, p. 163.