

COLORING SUBSTANCES AND ADULTERANTS OF CONFECTIONERY.

by

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At the present day when the amount of confectionery consumed by the people of America, both young and old, is somewhat appalling, a great many detrimental effects upon the human system might be avoided if more thought were given to the composition of these delectable but in many cases impure sweets.

The highly colored candies which catch the eye of the most frequent candy buyer - the small child - are sometimes the medium for introducing into the child's system the most deadly poison.

There are few of us who have reached mature years, but can remember our school days when every tooth in our heads seemed to be the proverbial "sweet-tooth," crying aloud for fuel to feed our rapidly growing bodies. It was then with penny in hand, we stood on tiptoe at some confectioner's counter, and surveyed the tempting array displayed therein, and after much parleying as to how much of this and how much of that we would receive for our cherished penny, we at length decided in favor of the beautiful scarlet "red hots," chiefly because of their brilliant color. Children in general, have the impression that the more highly colored a confection is, the better it will taste.

While harmless coloring substances are used for the most part in the manufacture of confectionery, occasionally a dye is used which might prove harmful if the child consumed a large amount of the candy containing it.

The mineral dyes constitute the majority of injurious coloring substances, but fortunately these are being replaced largely by the harmless organic dyes.

Those of coal tar origin seem to be used very frequently for coloring candies at the present time. These may be either

injurious or non-injurious, but the largest proportion of them are not harmful in the least. They are used largely now on account of their cheapness and brilliancy. An estimate of the latter may be obtained from the following figures taken from "Food Analysis" by Dragendorff. "One part of eosin or fluorescein will give the average tint to 28,000 parts of cream candy or 21,000 parts of clear and hard candy. One part of auramin will color 30,000 parts of melted sucrose to the deepest yellow required. These figures are for solid coloring, that is, the whole mass is dyed. When merely surface coloring is done the quantity required is about 1 part to 50,000.

A great variety of adulterants are used, among them calcium sulphate or gypsum, calcium carbonate or limestone, clay and various forms of starch. The last seems to be the adulterant most commonly used.

It is not necessary to make any statement in regard to the harmful character of these substances as it is well known that limestone, gypsum, and clay are indigestible, and in time would prove harmful to the person consuming large quantities of the candy containing them. Starch is the least harmful of those mentioned, but even this is somewhat indigestible if eaten in the raw state.

The method used in the detection of dyes in the following experiments was the one based upon the fact that coal tar dyes will give clean, white wool a permanent color. The mineral and vegetable dyes do not do this, but impart a grayish stain to the cloth. The wool was first freed from grease by boiling it in a very dilute sodium hydroxide solution. It was then washed thoroughly and boiled in water until all alkali was removed. After this it was boiled in a dilute solution of the candy

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acidified with hydrochloric acid. Potassium bisulphate should be added before acidifying if the candy solution has a neutral reaction.

After boiling in this solution, the dyed samples were thoroughly cleansed, dried and subjected to the reactions given for the detection of dyes upon wool.

No vegetable dyes were found, but when mineral dyes were present, the regular system of analysis was followed as given in Noyes' Qualitative Analysis.

Robin's test for cochineal was used with good results. The method is as follows:- The substance to be examined is dissolved in water and acidulated with hydrochloric acid. The solution is placed in a separatory funnel and amyl alcohol added. The two solutions are then thoroughly shaken together and a yellow coloration appears if cochineal is present. The water is then separated from the alcohol, the latter divided into two portions, uranium acetate being added to one portion and ammonia to the other. If cochineal has been used, the uranium acetate will produce a characteristic emerald green coloration, while the ammonia will cause a violet color to appear.

Tests were made for insoluble material and were conducted in the following manner:- A portion of the candy to be tested was weighed, dissolved in cold water and filtered in a Gooch crucible which had been dried thoroughly and weighed. After filtering the solution the crucible was dried in a hot-air oven at a low heat. It was then weighed and the difference between this weight and the weight of the empty crucible gave the figures for insoluble residue. The residue was then burnt off and if any considerable increase in weight over the weight of the empty crucible was observed, it was attributed to the presence of

inorganic material. Any clay, gypsum or limestone could be detected in this ash. Starch was tested for by the iodine test.

When a large amount of glucose was present, it was found necessary to take a very small amount of the sample, else it would not filter easily. This was also the case when flour or other forms of starch were present in large quantities. Gelatin or albumin could be detected by Kjeldahl's method, but it was not found necessary to do this, as the presence of either substance was not suspected at any time.

The flavoring agents were easily detected by the odor or taste.

No determination of sucrose, invert sugar, dextrose or gum was made, as it is a long difficult process and of no practical importance.

No tests were made for preservatives, as the addition of these substances to confectionery is usually unnecessary.

Results obtained from analysis.

The figures represent the mean between two duplicates.

Sample No.I. Fig. 1.

A soft, yellow cream candy containing a small amount of cocoanut and flavored with vanilla.

Weight of sample 7.4584 gms.

Insoluble residue .0899 gm.

Dye - methyl orange.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No.II. Fig. II.

Ordinary small fondant wafers dyed a light violet.

Peppermint flavoring.

Weight of sample 1.7725 gms.

No insoluble residue.

Dye - methyl Violet.

Pure candy.

Sample No. III. Fig. III.

Chocolate creams. 20¢ per pound.

Weight of sample .7070 gm.

Insoluble residue..0095 gms.

Dye - Bismarck Brown.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. IV. Fig. IV.

Candy violets imported from France. Contained a real violet on the inside.

Weight of sample .2514 gm.

Insoluble residue .0020 gm.

Dye - Methyl Violet.

All insoluble material burned off on ignition.

Insoluble material consisted of withered violets.

Sample No.V. Fig. V.

Fondant wafers colored green. Peppermint flavoring.

Weight of sample .8420 gm.

No insoluble residue.

Dye - Methyl Green.

Pure candy.

Sample No. VI. Fig. VI.

Common red cinnamon drops.

Weight of sample - 6.6462 gms.

Insoluble residue .2000 gms.

Dye - Carmoisin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. VII. Fig. VII.

Large soft gum drop. Lemon flavoring.

Weight of sample 2.8788 gms.

Insoluble residue .1018 gm.

Dye - Primulin Orange.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. VIII. Fig. VIII.

Cocoanut squares. Vanilla flavoring.

Weight of sample 1.2428 gms.

Insoluble residue .1613 gm.

Dye - Fuchsin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. IX. Fig. IX.

Stick candy - red-and-white stripe. Peppermint  
flavoring.

Weight of sample .5938 gm.

No insoluble residue.

Dye - Fuchsin.

Pure candy.

Sample No. X. Fig. X.

Stick candy resembling sample No. IX.

Weight of sample .5666 gm.

No insoluble residue.

Dye - Azo Eosin.

Pure candy.

Sample No. XI. Fig. XI.

A large pink ball of taffy, carefully wrapped in

tissue paper, and it contained two clay marbles. This bargain sold for a cent.

Vanilla flavoring.

Weight of sample 7.0651 gms.

Insoluble residue .1573 gm.

Dye - Phloxin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XII. Fig. XII.

A hard, clear candy. Very cheap. Wintergreen flavoring.

Weight of sample 13.9165 gms.

Insoluble residue .9278 gm.

Dye - Azo Eosin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XIII. Fig. XIII.

Another hard, clear candy. Peppermint flavoring.

Weight of sample 3.6788 gms.

Insoluble residue .0213 gms.

Dye - Azo Eosin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XIV. Fig. XIV.

A very hard, small, dark green gum-drop, containing much starch. It was almost totally insoluble in water.

Weight of sample 8.5856 gms.

Insoluble residue .2056 gm.

Dye - Alkali Green.

All insoluble material burned off on ignition.



Insoluble material consisted of starch.

Sample No. XV. Fig. XV.

Black candy in the shape of beans.

Licorice flavoring.

Weight of sample .7587 gm.

Insoluble residue .0188 gm.

Dye - Resorcin Black.

All insoluble material burned off at ignition.

Insoluble material consisted of starch.

Sample No. XVI. Fig. XVI.

A large red, round gum-drop suspended by a rubber string. Another penny bargain.

Weight of sample 3.4629 gms.

Insoluble residue .0932 gm.

Dye - Azo Eosin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XVII.

Small white cakes, about the size of a quarter, coated with cochineal. The interior was a floury mass.

Weight of sample .6325 gm.

Insoluble residue .0030 gm.

Dye - cochineal.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XVIII.

Like sample No. XVII, only in shape of spheres.

Weight of sample 1.4882 gms.

Insoluble residue .0042 gm.

Dye - cochineal.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XIX.

Candy in shape of beans, coated with cochineal. Lemon flavoring.

Weight of sample .8039 gms.

Insoluble residue .0265 gm.

Dye - cochineal.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XX.

Cheap chocolate caramels.

Weight of sample 1.9670 gms.

Insoluble residue .2115 gms.

Coloring substance - Ferric Hydroxide.

All insoluble material burned off on ignition except  
.0092 gm.

Insoluble material consisted of ferric oxide and  
starch.

Sample No. XXI.

Very expensive chocolates with a soft licorice filling

Weight of sample 2.7006 gms.

Insoluble residue .5027 gm.

Coloring substance - Ferric Hydroxide.

All insoluble material burned off on ignition except  
.0402 gm.

Insoluble material consisted of ferric oxide, lime-  
stone and starch.

Sample No. XXII.

Easter egg with a soft filling coated with ferric

oxide. Lemon flavoring.

Weight of sample 3.7526 gms.

Insoluble residue .0562 gm.

Coloring substance - Ferric Oxide.

All insoluble material burned off on ignition except  
.0008 gm.

Insoluble material consisted of starch and ferric  
oxide.

Sample No. XXVII.

Large, peppermint drops with the word "Salina" stamped  
upon them.

Weight of sample 2.5840 gms.

Insoluble residue .0413 gm.

Dye - Azo Eosin.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

Sample No. XXIV.

Easter egg, painted with chrome green. Lemon flavor-  
ing.

Weight of sample 7.9278 gms.

Insoluble residue .0924 gm.

Coloring substance - Chrome Green.

All insoluble material burned off on ignition except  
.0015 gm.

Insoluble material consisted of starch and chromic  
oxide.

Sample No. XXV.

Oblong pieces of red candy. Flavored with licorice.

Weight of sample .9575 gm.

insoluble residue .0076 gm.

Dye - Cochineal.

All insoluble material burned off on ignition.

Insoluble material consisted of starch.

The conclusions to be drawn from these experiments are:-

- (1) The chief adulterant of candy at the present time is starch.
- (2) The greatest proportion of dyes used are of coal tar origin.
- (3) Candies of low prices are almost invariably adulterated
- (4) Even high priced candy is apt to be adulterated.
- (5) The candies containing chocolate are especially impure.

Fig. I.



Methyl Orange.

Fig. II.



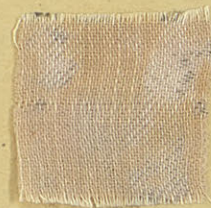
Methyl Violet.

Fig. III.



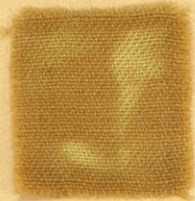
Bismarck Brown.

Fig. IV.



Methyl Violet.

Fig. V.



Methyl Green.

Fig. VI.



Carmoisin.

Fig. VII.



Primulin Orange.

Fig. VIII.



Fuchsin.

Fig. IX.



Fuchsin.

Fig. X.



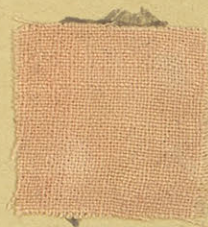
Azo Eosin.

Fig. XI.



Phloxin.

Fig. XII.



Azo Eosin.

Fig. XIII.



Azo Eosin.

Fig. XIV.



Alkali Green.

Fig. XV.



Resorcin Black.

Fig. XVI.



Azo Eosin.