

minated lime used were about 1/300 of those used in the room tests, the amount of formaldehyde gas evolved was so great that it was impossible to remain in the laboratory until it had been thoroughly ventilated. Qualitative tests for formaldehyde in the aqueous absorbing liquid from laboratory tests gave positive reactions for formaldehyde with Leach's, Hehner's, the resorcinol, and the phenylhydrazine hydrochloride tests. The bacterial results also indicate that Hamilton's statement is not correct. Horn states¹ that "Hamilton's experiments were faulty in that the expelled formaldehyde gas was redissolved in the water condensed on the upper, cool walls of the Frankforter and West apparatus, and, thus dissolved, was returned to the now hot oxidizing agent. Naturally, under these conditions, an aldehyde would be destroyed."

Another objection investigated was the possible bleaching or fading of colored fabrics and the tarnishing of metals exposed in rooms disinfected by this method. Horn¹ states that no bleaching action on moist litmus paper and no tarnishing of metals or bleaching of colored fabrics have been reported by health officers who have used this method without complaint. In our experiments wool, cotton, silk, velvet, and cheap printed calico were exposed in the rooms disinfected over 24-hr. periods. The colors included blues, yellow, pinks, greens, orange, gold, black, etc. No general bleaching or fading effect was noted except in one test in which all the fabrics were moistened with water. In the tests conducted under practical conditions only the cheap cotton fabrics showed signs of fading. It was found, however, that such fading occurred when other oxidizing agents were used to liberate the formaldehyde gas.

Gold, silver, copper, brass, and nickel-plated ware were found to be slightly tarnished on exposure to bleach-formalin disinfection over 24-hr. periods. The tarnishing is entirely superficial and we do not consider this a valid objection to the use of this method as the thin film may easily be removed by polishing the metallic surface with a soft cloth. The extent of the tarnishing is apparently no greater than that which occurs in homes under ordinary conditions.

SUMMARY

I—The relative practical efficiencies of several substitutes for the permanganate-formalin method of disinfection have been studied in comparison with the permanganate method.

II—The barium peroxide, sodium chlorate, and chlorinated lime methods are all as efficient as the permanganate method.

III—The barium peroxide and the chlorinated lime methods involve the simplest manipulation.

IV—The relative economy of the different methods is given.

V—Possible objections to the chlorinated lime method are considered.

VI—The chlorinated lime method is recommended for routine disinfection as combining germicidal efficiency, economy, and simplicity of manipulation.

¹ Personal communication to the senior author.

CONCLUSION

As a result of this brief study we are inclined to recommend the chlorinated lime-formalin method (either formula) as the most practical method, of those studied, for routine disinfection of rooms.

CHEMICAL AND BACTERIOLOGICAL LABORATORIES
DISTRICT OF COLUMBIA HEALTH DEPARTMENT
WASHINGTON, D. C.

THE PHOSPHORUS, POTASSIUM, AND NITROGEN CONTENT OF THE WATERS OF THE INTER- MOUNTAIN REGION

By J. E. GREAVES AND C. T. HIRST

Received August 28, 1918

In a preceding paper¹ we have shown that the irrigation waters of the intermountain regions vary greatly, both qualitatively and quantitatively, in their content of injurious soluble salts, many of them carrying sufficient toxic salts to the soil to render it in a few years sterile. Little, however, has been done to determine the influence of irrigation waters on the fertility of the soil. It is certain that irrigation waters may either increase or decrease the plant food of the soil, depending upon the composition of the water and the quantity used. The fact that many western irrigated soils are extremely fertile even after long periods of continuous cropping raises the question: is it not at least occasionally the case that the quantity of plant nutrients carried to a soil by water greatly exceeds that removed by the drainage waters? This work was planned with the hope that it would throw some light on this subject.

During the years 1916-17 the chemical department of the Utah Agricultural College collected several hundred samples of water representing 58 streams, the majority of which are extensively used for irrigation purposes. From the majority of the streams monthly samples were taken during the irrigation season. These were collected according to standard methods in carefully cleaned containers and shipped to the laboratory where composite samples were made and these analyzed by standard methods for total phosphorus, potassium, and nitrogen.

POTASSIUM

The water from 67 streams, 4 drains, and 3 wells was analyzed for total potassium. Although these do not represent all the irrigation systems of the state of Utah, the distribution of the streams is such that we are fairly safe in taking them as representative. Hence the results indicate fairly accurately the potassium content of the water of the intermountain regions. The results as reported in Table I represent the total potassium in parts per million and pounds per acre-foot of water. Each reported result is the average of two or more closely agreeing determinations.

These waters vary in potassium content from 49 p. p. m. in the case of the drain at St. George to 0.79 p. p. m. in Mill Creek. Only 14 out of the 71 samples

¹ THIS JOURNAL, 10 (1918), 1001.

TABLE I—TOTAL POTASSIUM IN WATERS FROM THE FOLLOWING STREAMS

STREAM	Sampled at	Parts per Million	Pounds per Acre-Foot
Drain.....	St. George.....	49.00	133.3
Green River.....	Green River.....	25.30	68.8
White River.....	Stage Road Crossing.....	21.62	58.7
Blue Creek.....	Howell.....	19.82	53.9
Beaver.....	W. Milford.....	17.36	47.2
Beaver.....	Milford.....	17.24	46.9
Drain (Logan Land & Drainage Co.).....		16.18	44.0
Jordan.....	Narrows.....	16.00	43.5
Uinta.....		14.81	40.3
Utah Lake.....	Pumping Plant.....	14.81	40.3
Ray's well.....	West Meadows.....	14.32	38.9
Bear River.....	Corrine.....	13.48	36.7
Spanish Fork.....		11.78	32.0
U. S. Reclamation Service Canal.....		10.29	28.0
Lake Fork.....		9.23	25.1
Cedar Creek.....		8.59	23.4
Drain.....	June Ogden's farm.....	7.66	20.8
Sevier.....	Siguard Bridge.....	7.27	19.8
Little Bear.....	Mendon (Logan Road).....	7.17	19.5
Sevier.....	Delta.....	7.16	19.5
Bingham Creek.....	Grace Ranch.....	7.14	19.4
Beaver.....	Minersville.....	7.01	19.1
Drain.....	Richfield City.....	6.76	18.4
Red Creek.....		6.76	18.4
Indian Creek.....		6.71	18.2
Price River.....	Price.....	6.37	17.3
Seepage water.....	Creek bed 6 mi. s. w. Cedar City.....	6.24	17.0
Duchesne.....	Randlett.....	6.08	16.5
Rock Creek.....		5.86	15.9
Summit.....	N. Summit.....	5.69	15.5
Strawberry.....		5.02	13.7
Weber River.....	Riverdale.....	4.94	13.4
Drain.....	F. B. Stevens.....	4.75	12.9
Ferron.....		4.57	12.4
Herriman Irr. Ditch.....		4.50	12.2
Cottonwood.....	Orangeville.....	4.46	12.1
Spring Creek.....	Mendon (Logan Road).....	3.99	10.9
Ogden.....	Mouth of Canyon.....	3.99	10.9
Clear Creek.....	Sevier Station.....	3.76	10.2
Santa Clara.....		3.60	9.8
Hobbs Creek.....		3.42	9.3
A. Robinson's well.....	S. W. Filmore.....	3.42	9.3
Paragonah.....	East of town.....	3.40	9.2
Beaver.....	City power plant.....	3.25	8.8
Santa Clara Creek.....	Santa Clara.....	3.23	8.8
Ashley Creek.....	Vernal.....	3.20	8.7
Salt Creek.....	Nephi.....	3.06	8.3
Duchesne.....	Tabby.....	2.96	8.1
Parawan Creek.....		2.93	8.0
Emigration Creek.....		2.90	8.0
B. Tompkin's well.....	W. Filmore.....	2.84	7.7
Spanish Fork.....	Thistle.....	2.74	7.5
North Creek.....	N. of Wm. Twitchell's.....	2.65	7.2
Provo.....	Olinstead.....	2.64	7.2
Irrigation ditch.....	Buhl.....	2.52	6.9
Duchesne.....	Duchesne.....	2.51	6.9
Little Cottonwood.....		2.49	6.8
Huntington Creek.....	Huntington.....	2.22	6.0
Haw's Bush well.....	N. W. Filmore.....	2.12	5.8
Big Cottonwood.....		1.99	5.4
Cub River.....	Franklin.....	1.93	5.3
Parley's Creek.....		1.93	5.3
Boxelder.....	Brigham.....	1.64	4.5
Maple Creek.....		1.61	4.4
Dry Creek Co.....	Crescent Ditch.....	1.37	3.8
American Fork.....	American Fork.....	1.29	3.5
Emery Canal.....		1.25	3.4
Summit Creek.....	Santaquin.....	1.13	3.1
Rasmussen well.....	W. Filmore.....	1.08	3.0
North Creek.....	Stamp mill.....	0.92	2.5
Logan River.....	State dam.....	0.80	2.2
Mill Creek.....		0.79	2.2

TABLE II—TOTAL PHOSPHORUS IN WATERS FROM THE FOLLOWING STREAMS

STREAM	Sampled at	Parts per Million	Pounds per Acre-Foot
Green River.....	Green River.....	5.47	14.9
White River.....	Stage Road.....	4.24	11.5
U. S. Reclamation Service.....		3.97	10.8
Spanish Fork.....		3.20	8.7
Rasmussen well.....	W. Filmore.....	2.04	5.5
Beaver River.....	Milford.....	1.22	3.3
Uinta River.....		1.07	2.9
Cedar Creek.....		0.90	2.5
Duchesne.....	Randlett.....	0.83	2.3
Drain (Logan Land & Drainage Co.).....		0.76	2.1
Summit Creek.....	N. Summit.....	0.72	2.0
Lake Fork.....		0.72	2.0
Price River.....	Price.....	0.60	1.6
Strawberry.....		0.60	1.6
Sevier.....	Delta.....	0.59	1.6
Ferron.....	Ferron.....	0.58	1.6
Cottonwood.....	Orangeville.....	0.54	1.5
Beaver.....	W. Milford.....	0.48	1.3
Duchesne.....	Tabby.....	0.46	1.3
Beaver.....	City power plant.....	0.40	1.1
Santa Clara.....	W. Town.....	0.38	1.0
Kaysville Reservoir.....		0.32	0.9
Big Cottonwood.....		0.28	0.8
Clear Creek.....	Sevier Station.....	0.26	0.7
Santa Clara.....	Santa Clara.....	0.26	0.7
Drain.....	St. George.....	0.25	0.7
Drain (June Ogden's farm s. w. Cedar City).....		0.25	0.7
Hobbs Creek.....		0.24	0.7
Bear River.....	Corinne.....	0.24	0.7
Spring Creek.....		0.24	0.7
Drain.....	F. B. Steven's farm.....	0.24	0.7
Indian Creek.....		0.23	0.60
North Creek.....	Stamp mill.....	0.22	0.60
Blue Creek.....	Howell.....	0.22	0.60
Summit.....	Santaquin.....	0.20	0.54
Ashley Creek.....	Vernal.....	0.20	0.54
Paragonah Creek.....	East of town.....	0.20	0.54
A. Robinson's wells.....	W. Filmore.....	0.20	0.54
American Fork.....	American Fork.....	0.18	0.49
Salt Creek.....	Nephi.....	0.17	0.46
Spanish Fork.....	Thistle.....	0.16	0.44
Strawberry Reservoir.....		0.16	0.44
Red Creek.....		0.16	0.44
Weber River.....	Riverdale.....	0.16	0.44
Cub River.....	Franklin.....	0.16	0.44
Bingham Creek.....	Grace Ranch.....	0.16	0.44
Parawan Creek.....		0.15	0.41
Beaver.....	Minersville.....	0.14	0.38
Well (Haw's Bush).....	N. W. Milford.....	0.14	0.38
Drain.....	Richfield City.....	0.13	0.35
Seepage Water.....	Creek bed 6 mi. s. w. Cedar City.....	0.12	0.33
Dry fork.....	Crescent Ditch.....	0.12	0.33
B. Tompkinson's well.....	Filmore.....	0.12	0.33
North Creek.....	N. of Wm. Twitchell's.....	0.12	0.33
Emery Canal.....	Near Emery.....	0.11	0.30
Little Bear.....	Mendon (Logan Road).....	0.11	0.30
Emigration Creek.....	Canyon.....	0.10	0.27
Rock Creek.....		0.10	0.27
Utah Lake.....	Pumping plant.....	0.10	0.27
Ray's well.....	West Meadow.....	0.10	0.27
Boxelder.....	Brigham.....	0.08	0.22
Maple Creek.....		0.08	0.22
Huntington Creek.....	Huntington.....	0.08	0.22
Provo.....	Olinstead.....	0.07	0.19
Parley's Creek.....	East of town.....	0.06	0.16
Jordan.....	Narrows.....	0.04	0.11
Logan River.....	State dam.....	0.02	0.05
Duchesne.....	Duchesne.....	0.00	0.00
Mill Creek.....		0.00	0.00
Ogden.....	Mouth of canyon.....	0.00	0.00
Sevier.....	Siguard Bridge.....	0.00	0.00

analyzed contained over 10 p. p. m.; 31 contained over 5 p. p. m. Hence we find slightly over half of the waters analyzed containing less than 5 p. p. m. of total potassium. The importance of these results becomes more obvious when we examine the pounds of potassium carried to an acre of soil by one acre-foot of water. This varies from 133.3 lbs. to 2.2 lbs. It may be taken from these results that considerably more potassium is being carried from the soil by the drainage water than is being stored by the irrigation water, but this conclusion is not warranted by the facts in the case, for unfortunately we have no analysis of the waters which are being applied to the soils in these drainage areas and all the soils where the drainage is in operation which were analyzed are high in alkali salts. Hence the results cannot be taken to indicate a great loss of potassium from a normal agricultural soil. It is quite likely that where the application of

water does not exceed 2 acre-feet per year the whole of the potassium is left in the soil within reach of the plant roots, for we have found that with the use of this quantity of water there is but little loss of the readily soluble nitrates for the soil.¹

Although the extreme variation in the potassium content makes an average of little value, yet it is interesting to note that the average pounds per acre-foot of water for the streams is 16.7 lbs., for the drains 51.8, and for the wells 15.4 lbs.

Some of these values are not without economic significance, for the potassium in one acre-foot of the water from Green River is sufficient for the production of 362 bu. of corn, 265 bu. of wheat, or 9 tons of sugar beets. That of Logan River, however, is sufficient for the production of only 12 bu. of corn, 9 bu. of wheat, or 15 lbs. of sugar beets. The average potas-

¹ J. Agr. Res., 9 (1917), 293.

sium content of the streams is sufficient for the production of 98 bushels of corn, 64 bu. of wheat, or 1.2 tons of sugar beets. The actual significance of these results is apparent when we remember that about 2 acre-feet of water must be applied for the production of maximum crops.

PHOSPHORUS

Many of the soils of the intermountain region are rich in potassium, hence this element is not as important as is the phosphorus, which although used by the crop in smaller quantities, is nevertheless at times the limiting factor in crop production.

TABLE III—TOTAL NITROGEN IN WATERS FROM THE FOLLOWING STREAMS

STREAM	Sampled at	Parts per Million	Pounds per Acre-Foot
U. S. Reclamation Service Canal		24.3	66.1
Spanish Fork		15.9	43.2
Paragonah	East of town	14.50	39.4
Green River		12.46	33.9
Beaver River	Millford	5.67	15.4
Duchesne	Tabby	5.60	15.2
Summit	N. Summit	5.54	15.1
Summit	Santaquin	4.62	12.6
Cedar Creek		4.06	11.0
Red Creek		4.00	10.9
Ferron		3.92	10.7
Strawberry	Duchesne	3.22	8.76
Santa Clara	Santa Clara	3.08	8.38
Lake Fork		3.08	8.38
Beaver	Minersville	2.94	8.00
American Fork		2.80	7.62
Price	Price	2.80	7.62
Cottonwood	Orangeville	2.66	7.23
Beaver	City power plant	2.66	7.23
Little Bear	Mendon (Logan Road)	2.58	7.02
Provo	Olinstead	2.40	6.53
Santa Clara	West of town	2.38	6.47
Cub River	Franklin	2.33	6.34
Uinta		2.24	6.09
Bingham Creek		2.24	6.09
Sevier	Siguard Bridge	2.10	5.71
Big Cottonwood		2.04	5.55
Salt Creek	Nephi	1.96	5.33
Indian Creek		1.96	5.33
Rock Creek		1.78	4.84
Emery Canal		1.54	4.19
Clear Creek	Sevier Station	1.40	3.81
Sevier	Delta	1.12	3.05
Weber	Riverdale	0.98	2.61
Duchesne	Duchesne	0.98	2.66
North Creek	N. of Wm. Twitchell's	0.98	2.66
Parley's Creek	Canyon	0.98	2.66
Huntington Creek	Huntington	0.70	1.90
Parawan		0.56	1.52
Jordan	Narrows	0.56	1.52
Emigration		0.56	1.52
Little Cottonwood			
Mill Creek			
Ogden River			
Spring Creek			

The total phosphorus of these waters varies from zero to 5.47 p. p. m. Of all the samples analyzed there were only 4 in which the quantity of phosphorus present was within experimental error. The great majority of them, however, contain less than one p. p. m. There were only 7 in which the quantity exceeded this amount. It is interesting to note that Green River, which is the highest in potassium, is also the highest in phosphorus. The quantity added to the soil by one acre-foot of water by Green River, White River, U. S. Reclamation Service Canal, and Spanish Fork is significant and would be sufficient to increase the phosphorus content of the soil. The average in

one acre-foot of water from the streams is 1.73 lbs., for the wells 1.68 lbs., and for the drains 0.91 lb.

The phosphorus in 2 acre-feet of the water from Green River is sufficient for the production of 175 bu. of corn, 120 bu. of wheat, or 33 tons of sugar beets. In the case of all the other streams, while not as high, it undoubtedly plays a part in maintaining the phosphorus content of irrigated soils.

NITROGEN

Even more important than the phosphorus is the nitrogen content, for nitrogen is the limiting factor of crop production in most of the soil of the intermountain region.

The average results stated as parts per million and pounds per acre-foot of total nitrogen contained in the various waters are given in Table III.

The quantity of total nitrogen in these waters varies greatly, ranging all the way from traces up to 24.3 p. p. m. Four streams, Little Cottonwood, Mill Creek, Ogden River, and Spring Creek contained only traces. Eight others contained less than one p. p. m., whereas 4 contained over 4 p. p. m. The pounds per acre-foot of water in 11 streams is over 10 with a maximum of 66.1 lbs. in the water of the U. S. Reclamation Service Canal. This would be sufficient nitrogen for the production of 66 bu. of corn, 46 bu. of wheat, or 12 tons of sugar beets. The average quantity of total nitrogen in one acre-foot of water from the streams is 11.4 lbs.

TOTAL SALTS

It is not those streams which are high in valuable nitrates which are high in total alkali salts as may be seen from Table IV.

Only three of the streams, Beaver, Jordan, and Bear Rivers, appear both in the column of total soluble salts and of total phosphorus; only two, Beaver and Lake Fork, appear both in the column of total salts and of total potassium; and only one, Beaver River, appears both in the column of total salts and of total nitrogen; whereas seven out of the ten appear both in the column of total potassium and of phosphorus.

SUMMARY

The results herein reported represent determinations made of the potassium, phosphorus, and nitrogen of the main irrigation waters of the intermountain region. The quantity of potassium carried to the soil by one acre-foot of water varies from 2.2 to 133.8 lbs., the phosphorus from zero to 14.9 lbs., and the nitrogen from traces to 66.1 lbs.

Although only a few of the waters analyzed were carrying sufficient phosphorus, potassium, and nitrogen to the soil to supply plants with the necessary

TABLE IV—TOTAL SALTS, POTASSIUM, PHOSPHORUS, AND NITROGEN IN THE TEN BIGGEST STREAMS ANALYZED

TOTAL SALTS		TOTAL POTASSIUM		TOTAL PHOSPHORUS		TOTAL NITROGEN	
P. p. m.		P. p. m.		P. p. m.		P. p. m.	
Emery Creek	1498.6	Green River	25.3	Green River	5.47	U. S. Reclamation Service Canal	24.3
Sevier	1259.8	White River	21.6	White River	4.24	Spanish Fork	15.9
Price River	1210.3	Blue Creek	19.8	U. S. Reclamation Service Canal	3.97	Paragonah	14.5
Bingham Creek	939.7	Beaver	17.4	Spanish Fork	3.20	Green River	12.46
Beaver River	909.3	Jordan	16.0	Beaver River	1.22	Beaver River	5.67
Jordan River	858.9	Uinta	14.8	Uinta	1.07	Duchesne	5.60
Bear River	842.0	Utah Lake	14.8	Cedar Creek	0.90	Summit	5.54
Utah Lake	834.8	Bear River	13.5	Duchesne	0.83	Summit	4.62
Huntington	794.9	U. S. Reclamation Service Canal	10.3	Summit Creek	0.72	Cedar Creek	4.06
Sevier River	772.5	Lake Fork	9.2	Lake Fork	0.72	Red Creek	4.00

quantities of the respective elements yet it is evident in a number of cases that the quantity of plant food carried to a soil by the irrigation water is sufficient to assist in maintaining the fertility, for it is quite certain that where the waters are rationally used the quantity of potassium, phosphorus, or nitrogen carried to the soil exceeds that removed in the drain waters.

UTAH AGRICULTURAL COLLEGE
LOGAN, UTAH

A NEW YELLOW DYE AND LIGHT FILTERS MADE FROM IT

By C. E. K. MEES AND H. T. CLARKE

Received January 2, 1919

In the early days of orthochromatic photography the dye generally used for the preparation of light filters was picric acid, this having the advantage of simplicity and cheapness and of great efficiency, picric acid absorbing the ultraviolet almost completely, and having a very sharp cut in the spectrum. The disadvantage of picric acid, however, is that it is unstable to light, filters made with it soon turning brown. For this reason the early gelatin filters were made chiefly with tartrazine, which is very stable and gives permanent filters. Tartrazine, however, has the disadvantage that its absorption in the ultraviolet is unsatisfactory and even moderately deep tartrazine filters transmit appreciable amounts of ultraviolet, thus detracting very much from their efficiency. For this reason filter yellow, introduced by Hoechst in 1907, rapidly displaced tartrazine as the best dye for filter making and has held that position ever since.

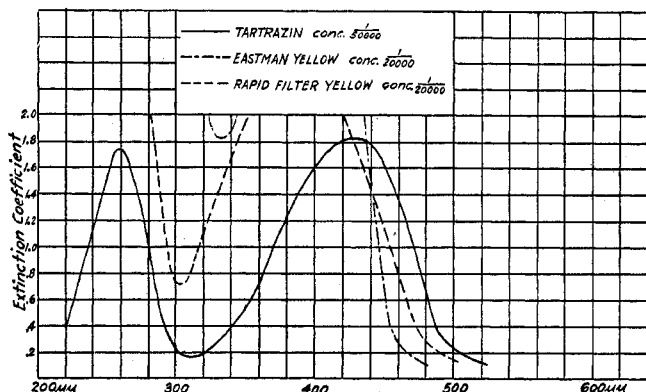


Fig. 1

Filter yellow is extremely stable, absorbs the ultraviolet strongly with the exception of a transmission band at 300μ , which, since it is absorbed by glass, is of little importance, and has a satisfactorily sharp cut for the preparation of orthochromatic filters. A disadvantage of filter yellow, which has always been recognized, however, is the fact that its absorption curve is less sharp than that of picric acid, and for many purposes, especially the preparation of very light filters, a dye possessing the stability and ultraviolet absorption of filter yellow but of greater sharpness of cut would be desirable.

When the need arose for light filters of high efficiency for aerial photography the necessity for such a dye

became pressing, and we undertook a search for such a material. After a great number of trials it was found that suitable absorption and stability were possessed by the phenylglucosazones.

When certain sugars, such as glucose, are warmed with a solution of phenylhydrazine in dilute acetic acid, yellow precipitates are produced possessing definite crystalline structures, by which the sugars may be characterized. These yellow substances are known as osazones, those formed with phenylhydrazine being termed phenylosazones. On measurement of the absorption spectrum of glucose phenylosazone it was found that the absorption curve was very sharp and extended far into the ultraviolet, and since the material is known to be stable, it appeared that a dye prepared from it would possess the properties required for the preparation of light yellow filters.

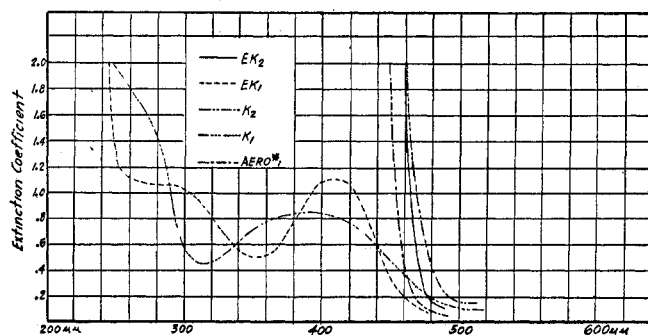


Fig. 2

Glucose phenylosazone is insoluble in water so that to obtain a dye it is necessary to have a salt-forming group present in the molecule, and to produce a dye suitable for use with gelatin, it is desirable that this group should be an acid one. To obtain such a derivative of glucose phenylosazone which will form salts with metals, it is merely necessary to substitute for phenylhydrazine a derivative containing an acid group, and condense glucose with it in the same manner. Several such derivatives were tried and the most satisfactory result was obtained with glucose phenylosazone-*p*-carboxylic acid. This was prepared in the following way:

p-Nitrotoluene was oxidized to give *p*-nitrobenzoic acid. This was then reduced to *p*-aminobenzoic acid, which was diazotized and gave *p*-hydrazinobenzoic acid or phenylhydrazine-*p*-carboxylic acid. The glucosazone of this acid is a yellow crystalline compound insoluble in water and almost insoluble in alcohol. It forms a sodium salt which is extremely soluble in water but which can be precipitated from concentrated solutions by the addition of alcohol, and this sodium salt of glucose phenylosazone-*p*-carboxylic acid has been adopted by us for the preparation of light filters under the name of "Eastman Yellow."

In Fig. 1 are shown the absorption spectra of tartrazine, filter yellow, and Eastman yellow, from which it will be seen that the Eastman yellow has a sharper cut than filter yellow and as strong an absorption in the ultraviolet.

Light filters prepared from it retain these characteristics, and these light filters have been prepared