

beautiful color was prepared from the uric acid contained in guano, and used largely by calico printers and silk dyers under the name of Roman purple, or murexide.\*

Before leaving the study of this important animal secretion, let me say a few words on the urine of herbivorous animals. It is generally alkaline, and contains, besides an aromatic principle, an acid discovered by Liebig, and called hippuric acid, together with urea and uric acid, also found in human urine. Hippuric acid is easily obtained in the well defined crystals, by rapidly evaporating the fluid containing it. This acid does not exist in the food of the animal; but benzoic acid, or its homologues, are found there, and, during the phenomena of digestion, the nitrogenated principles produced by the wear and tear of life fix themselves on benzoic acid, and convert it into hippuric, as seen by this formula :



A further proof of the correctness of this view is that when hippuric acid is treated with strong acids or alkali, it transforms itself into benzoic acid, which can be easily extracted.

(To be continued.)

*On the Action of Silicate and Carbonate of Soda in Cotton Fibre.*

By F. GRACE CALVERT, F.R.S., F.C.S.

From the London Journal of the Chemical Society, March, 1865.

I have lately been engaged in investigating a case of injury to goods, which I hope will prove interesting to chemists and manufacturers, from the novelty of the ascertained chemical facts to which the injury is traceable.

A large quantity of blue-tipped indigo cotton goods, with white reserves, were shipped two or three years ago to South Africa, and when opened some time after their arrival, were found so unsound as to be quite unsaleable, the cotton fibres being so much injured as to give way upon the slightest strain. The goods were, therefore, returned to this country, and placed in my hands to investigate the cause which had produced this damage.

As a large number of bales were returned without having been opened abroad, an excellent opportunity offered itself for selecting a well defined series of pieces for experiments, and also for judging of the effects of packing on goods generally, when exposed for a long period to the hot and moist atmosphere of tropical climates.

First, on opening the bales, I observed that the boiled oil cloth which had been employed to protect the goods from external damp, yielded, when subjected to a very slight strain, proving that the texture of the cotton fibre had been injured by the oxidation it had undergone, in consequence of its having been saturated with boiled oil.

Secondly, on examining the goods forming the bales, it was found, in every instance, that the outer folds, including the second, and some-

\* See, for further details, my lecture at this Society, February 5, 1862.

times the third, were stained and dirty, but this did not extend deeper, the inner folds being perfectly free from stain or mildew. These facts show the importance of returning to this country (where claims are intended to be made upon the manufacturers or packers) entire and unopened bales of goods, instead of a few sample pieces, which cannot show the state of the bales, and enable the examiner to speak with certainty as to the cause of injury.

I also ascertained that the rottenness of the fabric could not have been caused by their having been packed in a damp condition, for the hygrometric moisture of a piece in the centre did not exceed 8·5 per cent. Further, the goods were carefully examined to ascertain if any mildew could be discovered, which would have occurred if the goods had been packed in a damp state, and which would have certainly developed itself more fully in the interior of the bales than nearer the outside, if damp packing had been the cause. What completely removed from my mind all doubt as to the cause, was that, on carefully examining the pieces composing the bales, I found among the injured pieces, some which were quite sound, and on submitting these pieces to analysis, comparatively with those which were injured, the following results were obtained:

The sound pieces left only from 0·55 to 0·65 of ash, whilst the injured pieces left 8·29 and 8·59 of ash, the composition of which was as follows:

	No. 1.	No. 2.
Insoluble Silica, . . . .	2·94	3·81
Silica combined with soda, . . . .	2·35	2·53
Soda, . . . .	1·77	1·69
Other salts, . . . .		
Sulphate of soda, . . . .	1·23	0·65
Chloride of sodium, . . . .		
Sulphate of lead, &c., . . . .		
	8·29	8·59

These analyses show that the pieces had been finished with silicate of soda, which had undergone a partial decomposition; while the pieces which left only a few thousandths of ash were found, on further examination, to have been finished in the ordinary way, viz: with amylaceous substances. This induced me to examine more minutely the goods, to ascertain whether it was to the silicate of soda, or to the carbonate of soda, arising out of its decomposition, that the injury sustained was due; and I was further prompted to carry on this investigation from the fact that at the present time, the tendency amongst manufacturers is to weight their goods. It is well known that the risk of mildew is considerably increased in proportion to the weight of size; consequently there is a great inducement to use mineral, in preference to vegetable substances for that purpose. I therefore trust that the results now published will warn manufacturers of the risk they run in using mineral size, without great care and experience, whilst on this point I may be permitted to give here an insight into the nature of the size often used in Lancashire for sizing the warps of grey calicos, and, therefore, I give a few of the results obtained at my laboratory.

## Analysis of Various Cloths.

## No. 1.

Mineral matter, principally clay and sulphate of magnesia,	5.2
Water in excess,	2.8
Fermented flour,	10.0
Hygrometric moisture,	8.0
Fibre,	74.0
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	100.0

## No. 2.

Mineral matter, principally sulphates of baryta and magnesia,	4.5
Water in excess,	2.1
Fermented flour,	11.3
Hygrometric moisture,	8.0
Fibre,	74.1
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	100.0

## No. 3.

Mineral matter, principally sulphate of soda and clay,	4.8
Flour,	10.0
Water in excess,	4.5
Hygrometric moisture,	8.0
Fibre,	72.7
	<hr/>
	100.0

## No. 4.

Mineral matter,	1.24
Water in excess,	1.74
Fermented flour,	13.02
Hygrometric moisture,	8.00
Fibre,	76.00
	<hr/>
	100.00

The above data show that warps are sized with sour flour (*viz* : flour which has been allowed to ferment for several days or weeks) and various mineral matters, to the amount, irrespective of moisture, of about 15 per cent. There can be no doubt that goods thus sized are extremely liable to mildew, owing, on the one hand, to the use of fermented flour, or organic matter in a state of decay, and on the other, to the use of clay, which tenaciously retains moisture, which facilitates cryptogamic vegetation when the goods are packed. I may state, *en passant*, that sulphate of magnesia, sulphate of lime, sulphate of baryta, sulphate of soda, and the chlorides of sodium and magnesium are often used, with or without clay, as weighting materials.

On examining the comparative strength of various pieces composing a bale, I observed that the outside folds of the pieces which formed the external parts of the bale (above alluded to as dirty and stained) were comparatively strong when tested against the folds of the same piece which were towards the interior of the bale. I therefore took the same weight of cloth from both classes of folds and submitted them to analysis, with the following results :

	Interior of bale.	Exterior of bale.
Insoluble silica, . . . . .	4.81	7.08
Silica combined with soda, . . . . .	2.53	0.20
Soda, . . . . .	1.60	0.47
Other salts, . . . . .	0.65	0.55
	<hr/> 8.59	<hr/> 8.30

On examining and comparing these figures, it is at once seen that the stained fold shows a large increase in the amount of insoluble silica, and a corresponding decrease in the amount of silica combined with soda; but, notwithstanding this, the total amount of silica is nearly the same in both classes of cloth. Further, that there is a total disappearance in the stained fold of 1.13 per cent., or more than two-thirds of the total amount of soda. From the results it would appear that the silicate of soda, when first applied to the goods, contained the whole of its silica in combination with the soda, and that, under the influence of the carbonic acid of the atmosphere, the silicate of soda has been decomposed into insoluble silica and carbonate of soda, thereby giving rise to great increase in bulk; whilst in the goods which were protected from an excess of moisture—as towards the interior of the bales,—and also from the action of carbonic acid, there is only a partial decomposition of the silicate of soda. Mr. Walter Crum has kindly suggested, and I believe the view to be correct, that the cotton fibre has, by its organic nature, a cohesive attraction for silica, which enhances the decomposition of the silicate of soda employed to finish and weight the goods.

From these facts we may assume that there were two destructive influences brought to bear upon the cotton fibre: 1st, that of the increase of bulk resulting from the decomposition of the silicate of soda, giving rise to the formation of free silica and carbonate of soda, which exercised a distending and disintegrating action upon the cellular tissue of the cotton fibre, causing it to burst, and necessarily weakening its tensile strength; 2d, the direct and destructive action of the free carbonate of soda upon the fibre. The latter appears to be the principal cause of injury, for in the external folds we have a more complete decomposition of the silicate, as shown in the above figures, by the increase in the amount of insoluble silica, and at the same time a decrease of the soda, amounting, as previously stated, to more than two-thirds of the total weight.

We shall now trace more in detail this interesting decomposition of silicate of soda, and endeavor to show what had become of the soda which had disappeared. To attain this object, a complete series of specimens were obtained from an entire bale, viz: 1, a piece which formed the outside and was stained; 2, some of the paper employed in wrapping the goods, which was in immediate contact with the stained cloth; and 3, some of the flax wrapping placed next to the paper and between the latter and the oil-cloth covering above alluded to. The following are the results yielded by analysis:

	Pieces of Goods.		Paper Wrapping.		Flax Wrapping.	
	No. 1. inside fold.	No. 2. outside fold.	No. 3. in contact.	No. 4. not in contact.	No. 5. in contact.	No. 6. not in contact.
Insoluble silica, . . .	4.05	5.65	0.02	0.03	0.04	0.01
Silica combined with soda, . . .	2.21	0.38	0.09	0.02	0.08	8.03
Soda, . . .	1.76	0.25	0.85	0.01	0.29	0.02
Other substances, . .	1.96	1.91	15.15	15.28	1.19	1.25
Total ash, . . . .	9.98	8.19	16.11	15.34	1.58	1.31

In examining these results we have again a most striking and marked difference in the amount of insoluble silica and soluble silicate of soda in the two different parts of the same cloth; and, further, where the carbonate of soda has been removed, the folds of the cloth remain comparatively sound. As to the paper wrapping, it is evident that the paper in contact with the goods has absorbed a great part of the soda which was previously combined with the silica, and that the soda is partly in the state of carbonate, and partly in combination with some of the organic matter of the brown paper; for, when some of the paper was treated with water, it yielded a yellowish brown substance which colored the liquid, whilst the part of the same paper which had not been in contact with the goods did not discolor the water in any marked degree. Further, the aqueous solution was neutral and not alkaline, as in the previous case. As to the flax wrapping, the same difference as noted in the paper was observed, viz: that the part of the wrapping in contact with the stained paper and the stained fabric contained carbonate of soda, whilst that which was in contact with the clean paper contained only a trace. In looking over the bales, a piece of cloth was found which had been finished with silicate of soda, and was partly overlapped by another piece, showing one-half of its exterior fold stained and comparatively sound, whilst that half of the fold which was prevented from forming the exterior of the bale by being overlapped by the previous one, was quite tender and rotten, though it showed no signs of any stains or mildew. I also examined a sound piece which had laid in contact with an injured one, and found that in those folds which had been in contact there was in the injured piece less soluble silicate, and in the folds of the sound piece a considerable quantity of carbonate of soda, the presence of which could not be found in the folds forming the centre of it.

Having observed that the reserved white patterns of the blue-dipped indigo cloth were a great deal more tender than the blue portions of the same piece, I carefully cut out a portion of the white parts and submitted them, with the blue parts, to analysis, with the following results:

	White.	Blue.
Insoluble silica, . . .	5.48	3.17
Silica combined with soda, . . .	0.18	2.10
Soda, . . .	0.78	1.43
Other salts, . . .	1.08	0.67
Total, . . . .	7.52	7.37

These figures illustrate the fact that the decomposition of the silicate of soda has been carried on to a much greater extent in the white parts than in the blue; and I am led to believe that the cause of the increased rottenness in the white is due to the printer having used a resist-paste too acid, and having found that the whites were slightly tendered, he endeavored to check the further action of the acid on the cotton fibre (which, as chemists well know, continues until the cotton fibre is completely destroyed) by the employment of a strong solution of silicate of soda, which, being an alkaline salt, was well adapted to neutralize any acid in the cloth and arrest its action. And, as previously, only weak solutions of silicate of soda had been employed for this purpose, the printer of these goods could not have foreseen that the use of a more concentrated solution would result in such serious consequences. The above figures also prove another interesting fact, viz: that the white parts of the cloth contain a much larger proportion of silicate of soda than the blues, thus proving that the dyed indigo fibres, being partially filled with this resinous dyeing material, were not in a condition to absorb so largely the silicate of soda.

Messrs. H. Caro & Dancer, who were also employed to investigate this matter, entertain a different opinion as to the cause of the white parts being more injured than the blues. These gentlemen are led to believe, from their results, that the reason why the whites are more injured than the blues is, that a slow chemical action has ensued between the sulphate of lead remaining from the reserve paste and the silicate of soda, and that a silicate of lead has been formed, and, as this salt occupies a larger bulk than the sulphate of lead previously existing in the fibre, the production of it inside the cellular tissue of the fibre has been the cause of the increased tenderness of the whites. But as these gentlemen are engaged in investigating the question more fully, I shall leave to them the pleasure of publishing their results.

Lastly, I deemed it my duty to make some direct experiments on the action of silicate of soda on cotton fibre. I therefore took some white cotton and dyed a portion of it with indigo. This blue dyed cloth, with a part of the white one, were dipped in a moderately strong solution of silicate of soda, then dried, and a portion of them introduced into a bottle, at the bottom of which a little of water had been placed, and to help the action of the carbonic acid of the *atmosphere*, a slow current of carbonic acid was then passed through the bottles containing the cloths. After three months' time the warps of these samples were tested, and their comparative breaking weights were found to be as follows:

	On an average of 10 essays.
The warps of the unsilicated cloth dyed blue, . . .	334
The same silicated, . . . . .	{ 299 284 289

The results leave no doubt that the warps, even during the short period of three months, had been considerably injured by contact with

silicate of soda. In conclusion, I beg to add that I am aware that silicate of soda has been used for finishing colored goods, but when employed it has been in a very dilute state, and therefore its destructive action has not been sufficiently marked to draw the attention of calico printers.

*Pharaoh's Serpents' Eggs.—The Preparation of Sulphocyanide of Ammonium.*

From the London British Journal of Photography, No. 284.

By referring to the letter of our foreign correspondent, some notice of these curious chemical toys will be found. Mr. C. H. Wood gives the following process for preparing the white powder, and, as his remarks embrace the preparation of sulphocyanide of ammonium, which is used by several persons as a fixing agent for positive prints, we feel that they will be all the more welcome. Describing the toy, Mr. Wood says:

“It consists of a little cone of tin foil, containing a white powder, about an inch in height, and resembling a pastile. This cone is to be lighted at its apex, when there immediately begins issuing from it a thick, serpent-like coil, which continues twisting and increasing in length to an almost incredible extent. The quantity of matter thus produced is truly marvellous, especially as the coil which so exudes is solid and may be handled, although, of course, it is extremely light and somewhat fragile.

“Having a little of the white powder, with which the cones are filled, placed at my disposal by a friend, I submitted it to analysis, and found it to consist of sulphocyanide of mercury. This salt, when heated to a temperature below redness, undergoes decomposition, swelling or growing in size in a most remarkable manner, and producing a mixture of *mellon* (a compound of carbon and nitrogen) with a little sulphide of mercury. The resulting mass often assumes a most fantastic shape, and is sufficiently coherent to retain its form. It presents a yellow color on the exterior, but is black within. The “serpent” shape, of course, results from the salt being burnt in a cone of tin foil.

“Both the mercurous and mercuric sulphocyanides decompose in the same manner, but the mercuric salt, containing more sulphocyanogen, seems capable of furnishing a larger quantity of mellon, and is the one used in the French serpents. A solution of pernitrate of mercury is readily precipitated by sulphocyanide of ammonium, and the mercuric sulphocyanide may be easily so prepared. It is best to use the mercurial solution as strong as possible, and to *keep it in excess* throughout the precipitation. Solution of perchloride of mercury is not so easily precipitated as the pernitrate, probably owing to the solubility of the mercuric sulphocyanide in the chlorides.

“Perhaps I may be excused for adding that sulphocyanide of ammonium, suitable for the above purpose, may be very easily and economically prepared as follows: One volume of bisulphide of carbon,