

THE LIGHT-SENSITIVENESS OF BISMUTH SUBCARBONATE.*

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The usual bismuth subcarbonate on the market is slightly yellow in color or readily becomes so when exposed to light. Since no trace of a yellow cast is present in the freshly precipitated product, it was decided to investigate the cause of this color change.

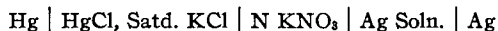
In a cursory study of the literature it was noted that in all cases where light-sensitiveness was reported, silver was found to be present. This led to the determination of the silver content in the subcarbonate marketed by this company, using the electrometric method described in a previous paper from this laboratory.¹ This method consists in measuring the silver-ion concentration by determining the potential of a silver electrode immersed in the silver solution, using a saturated KCl-calomel half cell as the reference electrode, and then calculating the p_{Ag} of the solution. The symbol p_{Ag} represents the negative logarithm of the silver-ion concentration and has the same meaning in connection with silver ions as has p_H in regard to hydrogen ions. These potentiometric measurements showed that in a 1:20 suspension of the subcarbonate silver was present in an amount equivalent to that present in a saturated solution of silver iodide, or in the vicinity of 0.000035 part in 100 parts of solution at 21° C.

Since this result showed only an infinitesimal amount of silver to be present, an experiment was made to find out whether the sulphide contamination of the air was responsible for the discoloration. At the same time the effect of sunlight was also determined. Several commercial products were obtained and treated as follows: one portion was exposed to air but kept in the dark; a second was exposed to modified sunlight but not to air by being placed in a Pyrex desiccator behind a glass window; a third was exposed to sunlight which had passed through a glass window, and air. The sample exposed to both air and sunlight had a pronounced yellowish brown tinge.

The fact that no color change had taken place in the sample exposed to sunlight but kept in the Pyrex desiccator, indicated that light of short wave lengths, which is absorbed by glass, is responsible for the color change occurring in bismuth subcarbonate. To confirm this, portions of each sample were exposed to sunlight directly and also when enclosed in flint, amber, and blue bottles respectively. A brownish coloration developed in each case except in the samples enclosed in amber bottles.

EXPERIMENTAL PART.

The concentration chain used in the work was made up as follows:



The potential measurements were made with a Leeds and Northrup portable potentiometer, at room temperature.

In carrying out the determination, ten grams of bismuth subcarbonate were suspended in 200 cc. of water and 1 cc. of 4% nitric acid was added. After five

* Read before Scientific Section A. PH. A., Des Moines meeting, 1926.

¹ Smith and Giesy, *JOUR. A. PH. A.*, 14, 10 (1925).

minutes a constant reading was obtained. Two cc. more acid was added with no change in the reading taking place. The acidity of the solution was insufficient to dissolve the subcarbonate. This mixture gave an initial voltage reading of 0.0752, the silver electrode being positive.

Using the value 0.497 volt, obtained by Smith and Giesy,¹ for the potential difference between a silver electrode in a solution which is normal with respect to silver-ions and a saturated KCl-calomel half cell, the p_{Ag} of the bismuth subcarbonate mixture was 8.2. This is equivalent to the amount of silver present in a saturated solution of silver iodide, or in the vicinity of 0.000035 part in 100 parts of solution at 21° C.

In another experiment 50 Gm. of bismuth subcarbonate was extracted with aqueous ammonia. After boiling off the ammonia, the solution was tested as above. No evidence of the presence of silver was obtained.

In determining the action of air and sunlight on the subcarbonate the following work was carried out:

Sample no.	Time.	Treatment.	Results.
1	12 hrs.	Enclosed in pyrex desiccator and exposed to sunlight	No change
2	48 hrs.	Exposed to air but not to sunlight	No change
3	12 hrs. Sun 48 hrs. Air	Exposed to both air and sunlight	Brownish coloration
4	15 hrs.	Enclosed in flint bottle and exposed to sunlight	Brownish coloration
5	15 hrs.	Enclosed in blue bottle and exposed to sunlight	Brownish coloration
6	15 hrs.	Enclosed in amber bottle and exposed to sunlight	No change

We desire to express our thanks to Mr. Benjamin Stadholz for assistance in the experimental work.

SUMMARY.

Bismuth subcarbonate develops a brownish coloration when exposed to sunlight. This is apparently a characteristic of the compound itself and not due to impurities either in the atmosphere or contaminating the product. The most effective means of overcoming this difficulty is to market the material in amber bottles or suitable paper cartons.

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GRUBSTAKING LICORICE DIGGERS IN CHINA.

The chief licorice-producing area in China is the Ordos territory, a steppe lying to the north of Shen-Si Province, formerly belonging to Inner Mongolia. The licorice export business of this region is almost monopolized by the merchants of Paote.

Licorice root is gathered by a class of diggers who offer their services for hire to the Paote merchants. Every spring Paote merchants establish their headquarters at Ho-kau and other points near the Ordos territory. From their headquarters collecting agencies are

maintained in different parts of the desert. To these agencies licorice diggers report themselves for work.

When a digger is enrolled by a licorice-collecting agency he is given provisions to last several months and also the loan of digging implements, but no wages. He then sets out for the wilderness to search for the plant. On his return he sells his finds to the collecting agency. The digger is bound by contract to sell the plant to no person but the collector from whom he has obtained provisions and the loan of digging implements.—*Chinese Economic Bulletin.*