

XI.—*On some Derivatives from the Olefines.*

By FREDERICK GUTHRIE.

IV.

A CONSIDERABLE number of the substances whose formation and properties I have had the honour of describing to this Society in Memoirs I, II, and III, are non-volatile and uncrystallizable liquids. Hence, with regard to them, the two so-frequently adopted criteria of homogeneity are inapplicable; viz., constancy of boiling point and crystalline form. Although this want is shared by a vast number of bodies, both organic and inorganic—solid, liquid, and gaseous,—whose homogeneity is never called into question, yet additional evidence in this direction is not superfluous.

A method peculiarly applicable in such cases, is that of fractional

solution. It has been already successfully employed in determining the homogeneity of gases; and may be thus proposed. "When a solvent has partly dissolved a body, and the entire body has the same composition as either of the parts (dissolved or undissolved), or if the latter have the same composition as one another, then the original substance is simple or homogeneous."

No mixture can show this property unless its constituents are isomers or polymers of one another. The law itself enjoys, of course, nearly the same amount of truth as the proposition that no two substances are soluble to exactly the same extent, in the same medium, under the same conditions, unless the solubility of both be infinite.

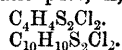
The inverse of the law is untrue to the extent that solution may effect decomposition.

The substances which I have submitted to this test are the two of the substances previously described, which seemed most prolific of derivatives; viz.,

*Bisulphochloride of ethylene $C_4H_4S_2Cl_2$.

*Bisulphochloride of amylene $C_{10}H_{10}S_2Cl_2$.

* M. Wurz (Répertoire de Chimie pure, ii, 337), in noticing these bodies and the two



remarks:—

" SCl_2 , corresponding to SO_2 , being diatomic, it follows that SCl_2-Cl ; that is, SCl , ought to be monatomic. Nevertheless, it is to be observed, that the constitution of these bodies may be regarded in another manner, by supposing them to contain the diatomic groups,—

Sulphide of ethylene ($C_4H_4S_2$)" and

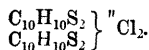
Sulphide of amylene ($C_{10}H_{10}S_2$)",

corresponding to the oxides. These groups, on combining with 2 atoms of chlorine, form the two following chlorides:—

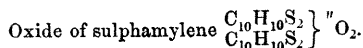
Dichloride of sulphethylene ($C_4H_4S_2$)" Cl_2 .

Dichloride of sulphamylene ($C_{10}H_{10}S_2$)" Cl_2 .

"As for the chloride $C_{10}H_{10}S_2Cl_2$, we double its equivalent, representing its constitution by the formula,—



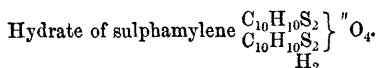
"It is known that 2 atoms of oxide of ethylene may unite, in order to combine with 1 atom of water. Hence, it is not extraordinary that 2 atoms of sulphide of amylene should join together in order to combine with 2 atoms of chlorine. If this way of looking at the matter is exact, we should represent the constitution of the oxide of disulphamylene and that of the hydrate of the oxide of disulphamylene by the formulæ—



The method was applied as follows :—A few grammes of the bisulphochloride of ethylene were warmed, with alcohol of about 85°, until nearly half dissolved. The alcoholic solution was then poured off, and the alcohol removed by evaporation on a water-bath, and washing with water. The product, after drying in *vacuo* over sulphuric acid, gave the results—

- I. 0.4436 gave 25.27%C, and 4.36H.
 II. 0.4280 gave 33.88%S.
 III. 0.2838 gave 36.00%Cl.

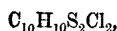
Comparing this with the analysis given before of the entire substance, we find,—



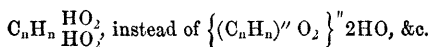
In reply, I would observe :—

1. That SCl_2 has not yet been formed; and that therefore speculations as to what its "atomicity" might be, are premature. Still more so must considerations be as to the effect which the withdrawal of chlorine would have on the hypothetical atomicity of this hypothetical body.

2. That, in such bodies as



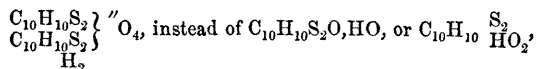
it seems preferable to suppose that the halogens are arranged in two "monatomic" groups, than to imagine, with M. Wurz, that there are two stages of saturation, each stage being a biatomic one. This, applied to glycols would give,—



3. Concerning the bodies,



I admit, in regard to some of their reactions, we have reason (neither more nor less) to double their formulæ than to double the formulæ of the ethers. But, to write the hydrated oxide of bisulphamylenes,



is, I think, a useless complication. It does not represent the formation or properties of the body more clearly than the older formulæ; and moreover involves the idea of a "mixed type," which I have never been able to understand. But I must again insist here upon the uselessness of seeking to establish *the* formula of a body;—if formulæ of bodies at chemical rest are to express their potential recompositions. (See I.)

FROM THE OLEFINES.

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	$C_4H_4S_2Cl$ requires	Entire Substance	Dissolved Portion.
C	= 25·13	25·93	25·27
H	= 4·19	4·32	4·36
S	= 33·51	33·47	33·88
Cl	= 37·17	36·29	36·00
	<hr/>	<hr/>	<hr/>
	100·00	100·01	99·51

About the same quantity of the bisulphochloride of amylene was treated in exactly the same manner. The dissolved portion, on analysis, gave the following results:—

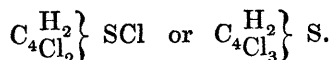
- I. 0·3934 grm. gave 23·81% S.
 II. 0·2677 „ gave 25·66% Cl.

Whence, comparing, as before, with the composition of the whole substance, we have,—

	$C_{10}H_{10}S_2Cl$ requires	Entire Substance.	Dissolved Portion.
C	= 43·64	43·80	„
H	= 7·27	7·47	„
S	= 23·27	23·93	23·81
Cl	= 25·82	24·73	25·66
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	100·00	99·93	

Hence, it appears that, in both cases, the entire substance has virtually the same percentage composition as the dissolved portion; and accordingly, under the limitations above specified, the homogeneity of both bodies is established.

We have already seen the curious relation existing between the bisulphochloride of chlorethylene and the bisulphide of ethyl, in regard to the action on both of chlorine. The product in either case is the chlorosulphide of bichlorethylene or the sulphide of terchlorethyl.



This identity of product extends also to the bisulphochloride of ethylene. If a few grammes of the bisulphochloride of ethylene be exposed to a current of dry chlorine, the action being carried on for a few hours and assisted at last by the heat of a water-

bath, a product is obtained, which after expulsion of the excess of chlorine by a current of carbonic acid, showed the following composition :—

- I. 0.3824 grm. gave 70.69 % Cl.
 II. 0.4380 grm. gave 10.63 % S.

The sulphide of terchloroethylene requires

71.73 % Chlorine,
 10.63 % Sulphur.

So that the action of chlorine is to convert the bisulphochloride of ethylene, into the sulphide of terchloroethyl. *Towards chlorine*, therefore, bodies of the form



behave like sulphides of chloriferous radicles



inasmuch as the bisulphides of the radicles $C_n H_{n+1}$, give rise to the same products.

On treating $C_{10}H_{10}S_2Cl$ with oxide of lead, or with hydrate of potash, we have already seen the chlorine replaced by O and by HO_2 . Doubtless $C_4H_4S_2Cl$, would give rise to $C_4H_4S_2O$, on treatment with PbO . As yet I have only examined the action of hydrate of potash upon $C_4H_4S_2Cl$. If $C_4H_4S_2Cl$, and $KOHO$, be both in alcoholic solution, the reaction between them on slightly warming is both immediate and complete. The $KOHO$ being employed in slight excess, and the filtrate from the precipitated KCl having been freed from alcohol by evaporation and washing with water, the hydrated bisulphoxide of amylene is obtained pure.

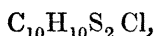
On analysis :

- I. 0.4333 gave 31.33 % C, and 6.67 % H.
 II. 0.2984 gave 42.26 % S.

$C_4H_4S_2OHO$			
requires		I.	II.
C = 31.17		31.33	"
H = 6.49		6.67	"
S = 41.56		"	42.26
O = 20.78		"	"
<hr style="width: 50%; margin: 0 auto;"/>			
100.00			

The hydrate of bisulphoxide of amylene is a yellowish liquid of curious smell; like the body from which it is derived, it acts violently upon the mucous membrane. It dissolves in alcohol and ether, but is insoluble in water.

Further transformations intimately connected with the above, and with others previously described, are afforded by the replacement of the chlorine in



by cyanogen and sulphocyanogen. The method used in both cases, is similar to that employed for the oxygen and peroxide of hydrogen replacements, viz: digestion of the $\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cl}$ with cyanide or sulphocyanide of potassium respectively, in alcoholic solution. The reaction is very neat. The precipitated chloride of potassium having been separated by filtration, the filtrate is evaporated on a water-bath, washed with water, and dried over sulphuric acid *in vacuo*.

Both products are liquids which can scarcely be distinguished by smell or other physical property. They have however evidently different densities. The first gave on analysis:

- I. 0.2432 gave 55.65 % C, and 7.60 % H.
 II. 0.3881 gave 24.66 % S.

$\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cy}$ requires	I.	II.
C = 56.25	55.65	"
H = 7.81	7.60	"
S = 25.00	"	24.66
N = 10.94	"	"
100.00		

The specific gravity of this body is 1.07 at 13° C. Since there can be little doubt but that the sulphur and cyanogen in this substance are not in the same relation as in the sulphocyanides (for if so, S_4Cy_2 would be required to saturate $\text{C}_{10}\text{H}_{10}$), it is advisable to call the above body the *bithiocyanide* of amylene, rather than the "sulphocyanide" or "bisulphocyanide."

The product obtained by the action of the sulphocyanide of

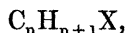
potassium upon the bisulphochloride of amylene, gave the following results on analysis :

- I. 0.2336 gave 44.46 C, and 6.54 H.
 II. 0.3768 gave 39.32 S.

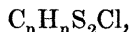
$C_{10}H_{10}S_2S_2Cy$			
requires		I.	II.
C = 45.00		44.46	,,
H = 6.25		6.54	,,
S = 40.00		,,	39.32
N = 8.75		,,	,,
<hr style="width: 100px; margin: 0 auto;"/>			
100.00			

The specific gravity of this body at 13°C is 1.16. The least ambiguous name which can be given to it is, perhaps, the *bithio-bithiocyanide* of amylene.

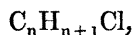
If we now compare the above and previously described behaviours of the bodies $C_4H_4S_2Cl$ and $C_{10}H_{10}S_2Cl$, with that of the halide of a radicle of the form



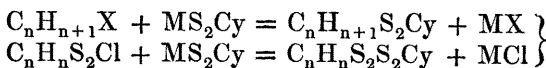
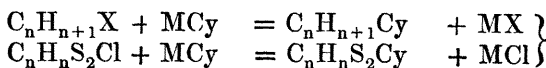
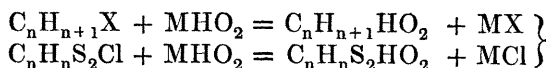
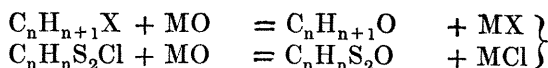
we must at once admit the parallelism of the recompositions in the two cases, and therewith admit that bodies of the form



behave like the chlorides of the form



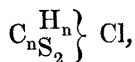
towards oxides, hydrated oxides, cyanides, and sulphocyanides.



Hence the rational formula of

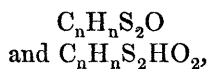


towards oxides, hydrated oxides, etc., may be written

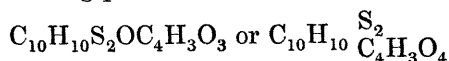


wherein we have the *chloride of a sulphuriferous radicle*: for in presence of these bodies, the sulphur and hydrocarbon remain together. We here then see a prominent example of the variations in the re-agent producing a corresponding variation in the rational formula.

According to this view, the bodies

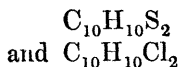


represent an ether and an alcohol. An additional argument for considering $\text{C}_{10}\text{H}_{10}\text{S}_1\text{HO}_2$ as an alcohol, will be found in the fact, that on dropping it into a large excess of strong sulphuric acid, which is kept cold, a conjugate acid is produced, having a soluble baryta-salt. This acid will be described subsequently. Again it would appear from a few experiments performed in this direction, that the peroxide of acetyl may replace the chlorine in $\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cl}$, by the action of acetate of potash, the acetate of bisulphamylene being produced:



a body which is an analogue of acetic ether. Such derivatives must for the present be reserved.

The body $\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cl}$, being thus prolific, it becomes important to examine the formation and properties of the bodies formed by the union of amylene with the separate halogens S and Cl, viz:



The first of these bodies, or the bisulphide of amylene, is easily obtained by the direct reduction of $\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cl}$, by means of metallic zinc. Nascent hydrogen, which was at first tried, effects too profound a reduction, by withdrawing a portion of the sulphur. To prepare $\text{C}_{10}\text{H}_{10}\text{S}_2$, an ounce or two of $\text{C}_{10}\text{H}_{10}\text{S}_2\text{Cl}$ is dissolved in alcohol, and boiled for some hours with granulated zinc, the alcohol being condensed and allowed to flow back. The greater quantity of the alcohol is then distilled off, and the residue washed with water. A colourless liquid product collects on the surface of

the water, which after washing and drying over chloride of calcium, may be rectified. It boils constantly at about 200°C.

I. 0.8012 gave 30.60 % S.

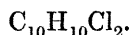
II. 0.2833 gave 58.32 % C, and 10.26 H.

III. 0.3270 gave 58.26 % C, and 10.24 H.

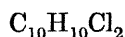
$C_{10}H_{10}S_2$ requires	I.	II.	III.	
C = 58.82	,,	58.32	58.26	58.29
H = 9.80	,,	10.26	10.24	10.25
S = 31.38	30.60	,,	,,	30.60
100.00				99.14

The specific gravity of the bisulphide of amylene is 0.907 at 13°C.

Considerable difficulty attends the formation of bichloride of amylene.

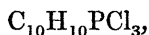


Amylene absorbs chlorine with the greatest eagerness; but when the two are brought together alone, as also when cold chlorine-water acts upon amylene, floating on its surface, large quantities of hydrochloric acid are formed, which points to the occurrence of some chlorhydrogen replacement. The formation of Dutch liquid by the action of pentachloride of antimony upon ethylene, suggested the possible formation of



by an analogous process.

Pentachloride of phosphorus was finely pounded and treated with perfectly dry amylene. No hydrochloric acid escaped, a few degrees of heat were evolved, and the whole became nearly dry. After having stood for twelve hours, the mass was placed in a basin and floated on water. At the end of another twelve hours, two layers were found, the lower consisting of phosphoric, and as experiment showed, phosphorous acid and hydrochloric acid,—the upper of bichloride of amylene. From the fact that the amylene and pentachloride of phosphorus produced in the first instance a solid, it would appear that the complementary PCl_3 re-united with the amylene to form the unstable body



which subsequently underwent decomposition. After washing

with water and drying, the upper layer was rectified. A product was thus obtained, which boiled at 141° – 147° C. On analysis :

- I. 0.2866 gave 42.22 % C, and 7.40 % H.
 II. 0.4279 gave 50.88 % Cl.

$C_{10}H_{10}Cl_2$ requires	I.	II.
C = 42.55	42.22	,,
H = 7.09	7.10	,,
Cl = 50.36	,,	50.88
100.00		100.50

At 9° C. bichloride of amylene has the specific gravity 1.058.

It is not improbable that bichloride of amylene may give rise to bicyanide of amylene, on treatment with cyanide of potassium. Bicyanide of amylene may however be prepared in another and very singular manner.

It will be remembered that the gas NO_4 unites directly with amylene to form the body $C_{10}H_{10}.2NO_4$ (see III). This fact was used to support the view of NO_4 being a true halogen. The same conclusion is also suggested by the behaviour of $C_{10}H_{10}.2NO_4$ towards cyanide of potassium. If $C_{10}H_{10}.2NO_4$ be dissolved in alcohol at a gentle heat,* and added to an alcoholic solution of cyanide of potassium, an immediate precipitate is produced, which, after washing with alcohol and drying, gives a precipitate with nitrate of silver, soluble in nitric acid, and which, on treatment with sulphuric acid, gives an amount of sulphate of potash corresponding to the nitrite of potash (nitroxide of potassium). The alcoholic solution from the nitrite of potash is evaporated on a water bath, at about 60° C, until the greater portion of the alcohol is expelled. The residue is then repeatedly washed with small quantities of water, and dried over sulphuric acid in *vacuo*. The composition of the liquid product was found by analysis to be as follows :—

- 0.2760 gave 9.16 % of H.
 0.3500 gave 9.16 % of H, and 51.26 of C.
 0.3079 gave 16.00 % of N.

* An alcoholic solution of $C_{10}H_{10}.2NO_4$ is decomposed on boiling. Chloroform dissolves $C_{10}H_{10}.2NO_4$ abundantly, as also does glacial acetic acid. Strong sulphuric acid instantly decomposes it.

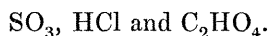
$C_{10}H_{10}Cy_2 + 5HO$			
requires	I.	II.	III.
C = 50.30	„	51.26	„
H = 8.98	9.16	9.16	„
N = 16.77	„	„	16.00
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76.05			76.42

The body according to this analysis, is the pentahydrate of bityanide of amylene. The water attached to the cyanide is to be compared to water of crystallization. It is given off on heating the hydrate, but remains combined when the hydrate is exposed for any time over sulphuric acid. It may be sufficient here to notice—(1) That five equivalents of water would be essential to the conversion of the cyanide of amylene into pimelate of potash by the action of caustic potash. (2) That my few experiments to prepare pimelate of potash from the cyanide have not been successful.

The binitroxide of amylene appears also to exchange its NO_4 for O, HO_2S , and S_2Cy . Most of these bodies will probably be soon described by those chemists who are engaged in researches on the diatomic alcohols.*

A body intimately connected, on the one hand, with $C_{10}H_{10}2NO_4$, and, on the other, with the chlorine-derivatives of $C_{10}H_{10}S_2Cl$, is the product of the action of $HO.NO_5$ upon $C_{10}H_{10}S_2Cl$.

On warming $HO.NO_5$ with $C_{10}H_{10}S_2Cl$, a tempestuous, and, in some respects, complicated, reaction is established. One phase of the reaction results in the formation of the products,



showing that a part of the $C_{10}H_{10}S_2Cl$ has suffered complete disorganisation. Moreover, a copulated sulphuric acid is formed, which has a soluble baryta-salt, but has not been further examined. The other, and more easily applicable reaction, is the formation of



or, the nitrosulphide of nitroxamylene.

* Dr. Simpson's preparation of cyanide of ethylene, and thence of succinate of potash, will, I expect, on publication of his analyses, throw light on this subject.

It is this body which appears in the distillate when $C_{10}H_{10}S_2Cl$ is warmed in a retort with $HO.NO_5$, as a heavy liquid of green colour, insoluble in water. After washing with water and drying, it is pure.

grms.	
0·2579	gave 34·82% C and 4·82% H.
0·2620	gave 34·26% C and 5·25% H.
0·1838	gave 9·39% S

$C_{10}H_9S_2NO_4$				
requires.	i.			
C = 33·89	34·82	34·26		„
H = 5·08	4·82	5·25		„
S = 9·04	„	„		9·39

The nitroxisulphide of nitroxamylene is soluble in ether and alcohol, and suffers, apparently, very easy reduction by sulphide of ammonium.

Before leaving this part of the subject, it may be in place to offer a view connecting the two nitroxiolefines described with some known bodies. Such connection at once appears on looking at the following list, which might be much extended.

Example.

C_nH_n , or $C_nH_n\{C_nH_n$	Olefiant gas.
$C_nH_n\left\{\begin{matrix} C_nH_{n+1} \\ H \end{matrix}\right.$	Ethyl.
$C_nH_n\left\{\begin{matrix} Z_n \\ H \end{matrix}\right.$	Zinc-ethyl.
$C_nH_n\left\{\begin{matrix} C_mH_{m+1} \\ H \end{matrix}\right.$	Ethyl-amyl.
$C_nH_n\left\{\begin{matrix} H \\ H \end{matrix}\right.$	Hydride of ethyl.
$C_nH_n\left\{\begin{matrix} H \\ Cl \end{matrix}\right.$	Chloride of ethyl.
$C_nH_n\left\{\begin{matrix} Cl \\ Cl \end{matrix}\right.$	Dutch liquid.
$C_nH_n\left\{\begin{matrix} H \\ O \end{matrix}\right.$	Ether.

$C_n H_n \left\{ \begin{array}{l} H \\ HO_2 \end{array} \right.$	Alcohol.
$C_n H_n \left\{ \begin{array}{l} O \\ O \end{array} \right.$	Ethylenic ether.
$C_n H_n \left\{ \begin{array}{l} HO_2 \\ HO_2 \end{array} \right.$	Glycol.
$C_n H_n \left\{ \begin{array}{l} NO_4 \\ NO_4 \end{array} \right.$	Binitroxide of amylene.
$C_n H_{n-1} \left\{ \begin{array}{l} S \\ NO_4 \end{array} \right.$	Nitroxisulphide of nitroxamylene.
$C_n H_n \left\{ \begin{array}{l} SO_3 \\ SO_3 \end{array} \right.$	“Sulphate of carbonyl.”
$C_n H_n \left\{ \begin{array}{l} H \\ NO_4 \end{array} \right.$	Glycocine.

To which might be added the much-formulized acid series:—

$C_n H_{n-2} \left\{ \begin{array}{l} HO_2 \\ HO_2 \end{array} \right.$	Hydrated acetic acid.
$C_n H_{n-2} \left\{ \begin{array}{l} HO_2 \\ O \end{array} \right.$	Acetic anhydride.

A series such as the above may assert a claim rather as a device for classification than as a method of accomplishing what most formulæ profess to perform, viz., an index to molecular arrangement.

To many of what are called homologous series, methylene plays the same part chemically as the common difference plays in an arithmetic series. Hence the question forces itself upon us: Is it possible, by means of the successive chemical additions of methylene, to advance from an inferior to any superior term of such a homologous series?

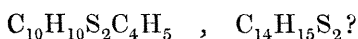
The doubt as to the existence of methylene, and even, in the eyes of some, as to the possibility of its existence, puts a practical end to this question at present.

A moment's consideration shows that the successive formation of all higher terms could be effected by means of ethylene, provided *two* consecutive homologous terms were taken, that is, terms differing by methylene.

Further, by means of propylene, we could effect the same

purpose, provided that *three* consecutive homologous terms were at our disposal to begin with. And so *mutatis mutandis* for the other olefines.

The suggestion as to the possibility of this method of building up was already given in Memoir I, wherein the action of zinc-ethyl upon $C_{10}H_{10}S_2Cl$ was suggested. The subsequent experiments which have been described as to the easy replacement of the Cl in $C_{10}H_{10}S_2Cl$ by other halogens only confirmed this idea. In zinc-ethyl, as far as it consists of zinc and ethyl, the ethyl is the halogen. Can, then, the ethyl from zinc-ethyl be made to replace the chlorine $C_nH_nS_2Cl$? and what relation will the body thus produced bear to the bisulphide of œnanthyl?



If an excess of ethereal solution of zinc-ethyl (as it comes from the digester) be allowed to fall upon the bisulphochloride of amylenes, considerable heat is developed. It is best to allow the heat to moderate itself by the evaporation of the ether, and not to cool artificially. Two layers are formed. These are treated separately with water, the oil which floats on the surface is taken off, and the solid body (oxide of zinc) is exhausted with alcohol. The alcoholic solution and the oil are mixed, freed from alcohol by gentle evaporation, washed with water, dried and rectified. The product boils almost constantly at about 240° – $250^{\circ}C$. It gave, on analysis,

0.2730 gave 65.31% C and 11.22 H.

0.4152 gave 65.4% C and 11.26 H.

0.4186 gave 23.72% S

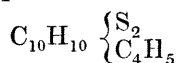
$C_{14}H_{15}S_2$ requires	I.	II.	III.
C 64.12	65.31	65.42	„
H 11.46	11.22	11.26	„
S 24.42	„	„	23.72
100.00			100.32

so that the product has, in fact, the percentage-composition of bisulphide of œnanthyl.

Although I believe by this means to have found the key to the problem of the successive synthesis of ascending terms of a homo-

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logous series; it will be more generally acceptable if the above body be termed, for the present, the bisulphethide of amylene.



An examination of the products of recomposition of this and similar bodies I reserve for a future communication.

The bodies which I have had the honour of bringing before the notice of the Society in this and previous Memoirs, are the following:—

From Ethylene.

$C_4H_4S_2Cl$	Bisulphochloride of ethylene.
$C_4H_4S_2Cl_2$	Bichlorosulphide of ethylene.
(α) $C_4H_2S_2Cl_3$	Chlorosulphide of bichlorethylene.
(β) $C_4H_2S_2Cl_3$	Sulphide of terchlorethyl.
$C_4H_4S_2HO_3$	Hydrate of bisulphoxide of ethylene.

From Amylene.

$C_{10}H_{10}S_2Cl$	Bisulphochloride of amylene.
$C_{10}H_{10}S_2Cl_2$	Bichlorosulphide of amylene.
$C_{10}H_7S_2Cl_4$	Chlorosulphide of terchloramylene.
$C_{10}H_{10}S_2O$	Bisulphoxide of amylene.
$C_{10}H_{10}S_2HO_2$	Hydrated bisulphoxide of amylene.
$C_{10}H_9S_2$	Bisulphide of fusyl.
$C_{10}H_{10}S_2$	Bisulphide of amylene.
$C_{10}H_{10}Cl_2$	Bichloride of amylene.
$C_{10}H_{10}Cy_2 + 5HO$	Penthydrated bicyanide of amylene.
$C_{10}H_{10}S_2Cy$	Bithiocyanide of amylene.
$C_{10}H_{10}S_4Cy$	Bithiosulphocyanide of amylene.
$C_{10}H_{10}.2(NO_4)$	Binitroxide of amylene.
$C_{10}H_9S.2(NO_4)$	Nitroxisulphide of nitroxamylene.
$C_{10}H_{10}S_2C_4H_5$	Bisulphide of œnanthyl.

The above are, of course, merely the equivalent formulæ. The formulæ of all these compounds are on the type

