

temperature variation. By plotting a curve of the sub-tangent of the viscosity-temperature curve against the temperature, a subsidiary curve was formed which should, in all the types of formula proposed, be a straight line, but which turned out to be a parabola. On determining the constants of the parabolic equation and integrating this to obtain the equation of the viscosity-temperature curve, a formula was deduced which represented the experimental results to within the limits of experimental accuracy. This formula was an exponential one, the exponent being the inverse tangent of a linear function of the temperature. Reasons were given for believing that this would represent the temperature variation of the viscosity of any liquid.

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THE EFFECT OF GRAPE-SUGAR UPON THE COMPOSITION OF CERTAIN FAT-PRODUCING BACTERIA. BY ROBERT E. LYONS.

It has been observed by Dr. E. Cramer\* and others† in studies upon the composition of bacteria, that the same micro-organism grown upon Peptom and Grape-sugar Agar-Agar produces in each case different quantities of nitrogenous substances and matter which is soluble in alcohol and ether.

In this same direction Ducleaux‡ demonstrated that yeast cells grown upon a material containing grape-sugar produced fat, while the same yeast grown upon pure nitrogenous material did not produce fat.

To study how grape-sugar affects the quantities formed of nitrogen, ash, fat and matter to be extracted by means of alcohol and ether, three varieties of capsule bacilli were selected:

Pfeiffers' Capsule Bacillus.

Fadenziehender Capsule Bacillus.

No. 28 Capsule Bacillus.

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\*Dr. E. Cramer—"Zusammensetzung der Bacterien in ihrer Abhängigkeit von dem Nährmaterial." *Arch. für Hygiene*—16, 151-191.

†Tayosaka-Nishimura—"Zusammensetzung eines Wasserbacillus." *Arch. für Hygiene* 18, 318-333.

‡Ducleaux—"Sur la nutrition intercellulaire." *Ann. de l'Institute Pasteur*—1889 No. 8, p. 413.

§Fadenziehender and No. 28 are forms from the water of the River Lahn, near Mosbourg.

The culture medium employed was a neutral 1 per cent. meat extract, agar agar, with the addition of varying quantities of grape-sugar, 1, 5 and 10 per cent., respectively.

The agar was prepared in an autoclave after the method of v. Meyer & Buchner and every care taken in each preparation to obtain as uniform a material as possible.

To control the uniformity of the various preparations, estimations were made from time to time of the solids (105° C.) in the nutrient media, for example:

10 cc. 1 % grape-sugar agar	=	0.369	gm.	Residue.
10 cc. " " "	=	0.383	" "	" "
10 cc. " " "	=	0.374	" "	" "

To grow the organisms agar agar plates were inoculated with a fresh bouillon culture, by means of a roll of thin platinum foil and within a moist chamber placed in the thermostat at 37.°5 C.

At the expiration of 48 hours the purity of the culture was controlled and the bacteria-mass carefully removed with a scalpel and dried in a vacuum over sulphuric acid.

Dr. F. Smith (1) maintains that the presence of grape-sugar in the culture medium causes an increased production of gas and acids.

However, when the drying operation was conducted in the apparatus of Arzberger & Zulkowsky, connected with a condenser, the presence of acid in the distillate could not be demonstrated.

The gas production varied, as the amount of sugar, and the odor of ethylic alcohol was always present, but the odor of the fatty acids was never encountered.

That volatile acids are formed during the growth of the cultures, under the conditions given, could not be demonstrated.

The material dried finally at 105° C. was subjected to analysis.

Estimation of ash:

" "	Nitrogen (Kjeldahl $N \times 6.25 =$ nitrogenous substances.)
" "	Ether extract (Soxhelet's app., 48 hours.)
" "	Alcohol extract (Soxhelet's app., 90 hours.)

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(1) Dr. F. Smith—"Bedeutung des Zuckers. in Kultur Medien." Centralblatt für Bact. u. Parasit 18, 1-s. 1.

	1 per cent. Grape-sugar Agar Agar.	5 per cent. Grape-sugar Agar Agar.	10 per cent. Grape-sugar Agar Agar.	
Pfeiffer .....	N. Subst.....	62.75	58.88	45.88
	Ether Extr. ....	1.68	3.50	2.67
	Alcohol Extr....	12.17	17.30	29.60
	Ash.....	7.16	2.97	3.09
	Total.....	83.76	82.65	81.24
No. 28.....	N. Subst.....	71.81	59.12	46.25
	Ether Extr. ....	3.32	3.84	2.84
	Alcohol Extr....	11.39	15.91	22.78
	Ash.....	6.51	3.66	4.18
	Total.....	93.03	82.53	76.05
Fadenziehender.	N. Subst.....	61.05	44.31	33.25
	Ether Extr. ....	1.75	2.24	1.87
	Alcohol Extr....	18.40	21.80	27.50
	Ash.....	8.09	4.50	3.02
	Total.....	89.29	72.85	65.64

On examination of the table it is seen that a constant decrease in nitrogenous substances of the bacteria-mass accompanies the increasing per cent. of sugar in the culture medium.

Whether or not the total nitrogen consists in part of albumen-nitrogen, or in part of extract-nitrogen; and, further, if the extracted nitrogenous substances contain a lower per cent. of nitrogen than the albumen of the bacteria, can not as yet be determined owing to the very small amount of material.

The increase in the quantity of extract matter goes hand in hand with the increasing per cent. of sugar in the agar agar.

For the matter soluble in ether this is true only to five per cent. grape-sugar; at ten per cent. sugar the maximum production of fat seems to have been attained.

In this connection it is interesting to observe the relationship between the ether extract and the ash.

A decrease in the ash and an increase of fat corresponds to five per cent. sugar and to ten per cent., vice versa.

It might seem that the apparent increase in fat was due wholly or in part to the relative decrease in the ash.

It is readily seen that this is not the case by calculating the per cent., excluding the ash; on the contrary, the three forms studied produce more matter soluble in ether and alcohol when they are grown upon media with a high per cent. sugar than when they are grown upon such containing a lower per cent. sugar.

Briefly stated the results of the investigation are :

1. The quantity of nitrogenous material is inversely proportioned to the quantity of sugar present.

2. To a certain limit the increase of sugar is accompanied by a decided increase in the quantity of fat.

At ten per cent. sugar the most favorable conditions for fat production appear to be overstepped.

3. Matter soluble in alcohol increases constantly with the increasing per cent. of sugar.

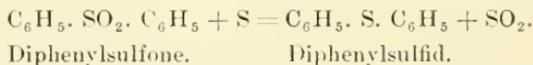
A NEW METHOD FOR THE PREPARATION OF PHENYL-COMPOUNDS WITH SULPHUR, SELENIUM AND TELLURIUM. BY ROBERT E. LYONS.

The very great similarity between the compounds of sulphur, selenium and tellurium was observed by Frederick Woehler and other chemists of his time.

To trace this similarity further I was led to attempt preparing certain bodies to fill up the gaps between the known compounds of the organic radicals, methyl, ethyl and phenyl, with sulphur, selenium and tellurium.

C. Chabrie\* gives the results of several years' study of aromatic compounds of selenium prepared after the Friedel-Crafts' reaction, but this method in my hands did not lead to satisfactory results.

On the other hand, the method proposed by Drs. F. Krafft and W. Vorster,† *i. e.*, the replacement of the SO<sub>2</sub> group in the sulfone by sulphur or selenium :



was easily carried out and afforded 60-70 per cent. of the theoretical amount.

As excellent as this method is for the preparation of sulphur and selenium compounds, it was nevertheless found, that the sulfohenzid, even after prolonged heating with powdered tellurium, remained unchanged.

Tellurium dichloride, Te Cl<sub>2</sub>, was next prepared in the hope that through its action upon mercury diphenyl, Hg (C<sub>6</sub>H<sub>5</sub>)<sub>2</sub>, the diphenyltelluride would be obtained according to the following reaction :



\*Ann. de Chemie et de Physique, **VI** serie t. **XX**, p. 202-286 (1890); also, Compt. rend. **109**, 182 et 568 (1889).

† Berichte der Deutschen Chem. Gesell. 26, 2813.