1.3 sec., while a slightly greater influence is shown by contamination with 2 per cent of mineral matter. The combined effect of mineral matter and soda solution is found slightly higher than that of the mineral matter alone, but not quite the sum of both. There seems to be some selective separation of bitumen as shown under Consistency Tests 4 and 5, which, however, will be reduced some under the application of the method as it is aimed to extract all of the bitumen, not half; when the extraction is completed any bitumen adhering to the mineral aggregate would be but a small percentage. By taking an average of Tests 4 and 5 (consistency), 42.8, and comparing it with Test 3 a comparison is obtained of the accuracy of the test, which in this instance was 5.5 sec., which seems reasonably close when it is seen that the float test itself under these conditions gives a variation of 4 sec.

The "Insoluble in Benzene" tests clearly demonstrate that the free carbon content of the bitumen is not altered to any appreciable extent by the application of the method.

The centrifuge method for the removal of the soda solution was adopted because of its ease of application. With the regular method of dehydration¹ there was a very great tendency to foam, and a possible loss of lighter constituents.

CONCLUSIONS

While the above tests were not as elaborate as desired, they indicate that the method would prove sufficiently accurate for the purpose for which it was designed. It is more rapid than many other methods, and the tar bitumen is separated from its mineral aggregate in substantially its true state as existing in the mixture.

The increase in consistency of the extracted bitumen is due largely to contamination and not to loss of constituents which with proper care can be reduced to a minimum; although there does seem to be some slight solvent action of the soda solution as evidenced by its change to a reddish brown solution.

Such satisfactory results were obtained by the application of this method to the extraction of tar bitumens, that there is no doubt in the authors' minds but that it would prove equally well adapted to the extraction of asphaltic binders from their mineral aggregate, perhaps not exactly as used here, but with some slight modification of the solution, dependent upon the character of the asphaltic material. This, of course, would require some further work which was not undertaken at this time.

THE ACTION OF ULTRAVIOLET LIGHT ON THE YEAST-LIKE FUNGI—I

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The effect of light on both a variety of microbial organisms and chemical reactions has received con-

siderable study. Berthelot and Gandecheon,¹ Kailau,² Thiele,³ and Lesure⁴ have demonstrated the effect of ultraviolet rays in causing polymerization or decomposition of chemical compounds. Ostromisslenski⁵ showed that vinyl bromide can be polymerized by ultraviolet light in a few hours to cauprene bromide. Similarly, Pribram and Franke⁶ found that freshly distilled formaldehyde being exposed to ultraviolet rays for some time contains a substance identified as glycol-aldehyde. Studies by Buchta⁷ show that light prevents the germination of cells. He also finds that yeast cells exposed to ultraviolet light for 10 sec. do not germinate and exposure for 3 min. kills the cell. Stiner and Abelin⁸ found hemolytic amboceptors, diluted 1 : 100, to be destroyed in 10 min.

FIG. 1—TIME OF SURVIVAL OF EACH ORGANISM AFTER EXPOSURE TO ULTRAVIOLET LIGHT

Likewise Hartoch, Schürmann and Stiner⁹ found diphtheria toxin to be weakened by exposure to the rays. Agulhon¹⁰ and Chaulpecky¹¹ studied the action of ultraviolet rays on enzymes which were shown to be rendered inactive. Amylase and invertin are exceedingly sensitive to them, and albumin is coagulated by their action. Further, Chamberlain and Vedder¹² find amebae existing in water supplies, whether motile or encysted, very easily killed on comparatively short exposure to the rays. Von Recklinghausen¹³ gives considerable data on the bactericidal activity of ultraviolet light together with its adaptability in the purification of water.

¹ *Compt. rend.*, **153** (1911), 383.

² *Monatsh.*, **34**, 1209.

³ *Z. angew. Chem.*, **22** (1909), 2472.

⁴ *J. pharm. chimie*, [7] **1** (1910), 569.

⁵ *Chem.-Zig.*, **36** (1912), 415.

⁶ *Monatsh.*, **33**, 415.

⁷ *Centr. Bakt. Parasitenk.*, II Abt., **41** (1914), 340.

⁸ *Z. Immunitt.*, **20** (1914), 598.

⁹ *Ibid.*, **21** (1914), 643.

¹⁰ *Ann. inst. Pasteur*, **26** (1912), 38.

¹¹ *Zentr. Biochem. Biophys.*, **14** (1912), 927.

¹² *Philippine J. Sci.*, **6B** (1911), 383.

¹³ *J. Frank. Inst.*, **1914**, 681; *J. Am. Water Works Assoc.*, **1** (1914), 565.

¹ Test B3.

As shown by the foregoing, ultraviolet rays have received extensive application in a variety of ways and considerable data is now available from these investigations. To add to the present state of knowledge of the subject this work was undertaken in order to get a preliminary idea of the length of time necessary for the survival of a variety of yeast-like fungi upon exposure to the ultraviolet rays. Kny and Lohman¹ are the only investigators who have studied the effect of light on yeast cells, but their interest was mainly in the matter of germination. Further, they did not investigate the germicidal effect of the ultraviolet light on the types of organisms taken up here.

A variety of thirty (old) cultures of yeasts listed in the appended table, Fig. 1, were used for this investigation. The technique employed was primarily as follows:

A water suspension of the organism was made by taking a standard loop full of the growth from a dextrose agar slant and distributing it in a tube containing 9 cc. of sterile water. In turn these 9 cc. suspensions were placed in small-sized Petri dishes, placed in the position indicated in the accompanying sketch, Fig. 2, and exposed to the action of the rays.

FIG. 2—APPARATUS USED IN DETERMINING TIME OF SURVIVAL

The source of ultraviolet light used was from a R. U. V. quartz mercury vapor lamp operating on 110 volts. The suspension in an uncovered Petri dish was placed directly under the lamp, at a distance of 25 cm. By means of a thermometer placed beside the dish during the experiment the temperature was noted to vary between 30° and 40° C. At intervals of one minute until 10 min. were reached and then at intervals of 5 min. one loop full of the suspension was removed and used to inoculate a dextrose agar slant which in turn was incubated at 37° C. for a period of 3 days. The presence or absence of growth after this period of incubation determined whether or not the cells were killed. Precautions were taken to have the suspension as homogeneous as possible, to secure representative

samples, and to keep all conditions uniform throughout all the experiments. Blanks were used in all cases to check in each experiment.

The results obtained are presented diagrammatically in Fig. 1. The vertical lines indicate intervals of one minute. The horizontal line drawn for each organism shows the length of time the organism survived. Twenty-three out of 30 organisms were killed before one minute elapsed, two survived one minute, one survived three minutes, one four minutes, two seven minutes, and one ten minutes. This shows that the majority of the yeast-like fungi are not any more resistant to ultraviolet light than the ordinary water bacteria.

CONCLUSIONS

From the data obtained it is evident that yeast cells are not very resistant to ultraviolet light.

Possibilities are seen for the use of ultraviolet light in controlling the development of yeast cells in the industries.

Further work is planned to obtain quantitative data and study the effects of the light on the cells suspended in a variety of media.

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SOME ANOMALIES IN THE SOLIDIFICATION POINT OF TRISTEARIN¹

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In common with certain other triglycerides, tristearin shows the phenomenon of a double melting point, thus apparently existing in two forms. The melting point of the stable form, obtained by crystallization from any solvent, or by keeping the unstable form, is variously given as 71.6° to 72.2°. After barely melting, it is said by Bömer to resolidify at 70°. Heated a few degrees above its melting point, tristearin solidifies on cooling to the unstable form, which is stated to melt in a capillary at about 55°, and on further heating to resolidify and show the melting point of the stable modification. The same change to the stable form occurs on standing for some hours at room temperature.

Curiously enough, in spite of the rapidity with which conversion into the stable form takes place at higher temperatures, the solidification point usually reported for tristearin is about 56°,² apparently that of the unstable form.

The usual method of determining solidification points

¹ Presented in part at the 52nd Meeting of the American Chemical Society, Urbana, Ill., April 18 to 21, 1916.

² R. Kremann and R. Schoulz, *Monatsh.*, **33** (1912), 1063. The quantities with which they worked are not stated, but even with "larger quantities" the results were reported to be the same.

¹ *Ber. botan. Ges.*, No. 3, **2** (1884).