

must interest the officers in charge of the Biological Station, besides affording scope for experimental studies in control of this pest.

University Zoology Laboratory,
Triplicane, Madras, C. P. GNANAMUTHU.
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EFFECT OF DIFFERENT GASES ON PROTOZOAL ACTIVITY AND PURIFICATION OF SEWAGE

FOLLOWING the development of the Activated Sludge Process by Fowler and his associates, there was considerable amount of controversy regarding the actual mechanism of purification. Fowler and his associates emphasised the importance of intensive aeration, but other workers laid stress on mechanical agitation. Some methods of purification have also been developed on the latter principle though they do not altogether exclude the presence of air. The importance of air was finally recognised, and during recent years, the role of protozoa as the organisms mainly responsible for the purification is finding general acceptance.

While investigating the role of different species of protozoa in sewage purification,¹⁻⁹ some interesting observations on the effect of differ-

with H.S, laboratory gas, N., and Co., the clarification of sewage was adversely affected. These gases being highly injurious to the life and activity of the protozoa, the organisms became inactive and died. The death of the protozoa caused a steady increase in the organic matter content (*i.e.*, the permanganate-reducing capacity) of the supernatants as determined after removal of the gases; this was confirmed by the experiments carried out without the addition of the protozoan inoculum to the sewage.

The observations made six hours after treatment with the gases on the protozoa, and oxidation changes in the sewage samples are given in Table I.

Considerable amount of attention has been devoted to the study of the different methods of applying air to sewage, the aerating value of various gases and the relative importance of oxygen and stirring.¹⁰ The air which is blown into the activated sludge tank has been generally considered to (a) keep the sludge in suspension, (b) maintain aerobic conditions, and (c) stir up the mixture, bringing fresh liquor into contact with the sludge. It has not been possible to say which of these factors determines the critical air requirement. In the

TABLE I
Effect of different gases on protozoal activity and oxidation changes in sewage
(Results of chemical analysis expressed as parts per 100,000)

Sewage suspensions* containing the protozoa (<i>Epistylis</i> sp.) treated with	Microscopical observations on the condition of the protozoa	6 hours after treatment with the gases			
		Appearance	Quality of the supernatants		Nitrite (N)
	Oxygen absorbed from potassium permanganate in 3 mins.		Oxygen absorbed from potassium permanganate in 4 hrs.		
1. Air	Extremely active	Clear	0.64	1.52	0.040
2. Oxygen	"	"	0.56	1.52	0.044
3. Carbon dioxide	Inactive or dead	Turbid	1.76	3.40	Nil
4. Nitrogen	"	Very turbid	2.68	4.32	"
5. The laboratory gas	"	"	3.52	5.56	"
6. Hydrogen sulphide	"	Extremely "	—**	—**	"

* The composition of sewage in each case at the start of the experiment was as follows:—

Oxygen absorbed from potassium permanganate in 3 minutes 1.96 (as parts per 100,000)
4 hours 3.28 (" ")

Nitrite (N) " " " " " " Nil.

** The figures for oxygen absorption in this case were by far the highest.

ent gases on the protozoal activity and attendant changes in the medium were made. The results of one set of experiments with *Epistylis* sp. (one of the most important forms of protozoa in sewage purification) are briefly described below.

Each of a number of conical flasks (250 c.c.) containing 150 c.c. of heat-sterilised sewage was inoculated with 15 c.c. of a fresh culture of the protozoa, washed in ammonia-free distilled water. Nearly equal volumes of air, O., Co., N., the laboratory gas (mixture of kerosene gas and producer gas) and H.S, were bubbled through the suspensions in the flasks by adjusting the size and number (per second) of the gas bubbles. The progress of purification of the samples was studied by examining at intervals the condition of the protozoa and the sludges as also the quality of the supernatants.

Even during the first two hours of treatment

light of our observations it appears that the more important function of aeration is the supply of oxygen for the aerobic organisms which bring about the purification of sewage.

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Dept. of Biochemistry, S. C. PILLAI.
Indian Institute of Science, M. I. GURBAXANI.
Bangalore, V. SUBRAHMANYAN.
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