THE GROWTH OF YEASTS AT 37°C

by

Wm. Bridge Cooke

Microbiology Section, Basic and Applied Sciences Branch, Division of Water Supply and Pollution Control, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

(22.X.1964)

One factor characterizing several filamentous fungi that cause systemic disease in man is the ability to grow in a yeast-like phase on certain media and under certain cultural conditions in pure culture. In man, and sometimes in other warm-blooded animals, these fungi grow only in a yeast-like phase. At room temperature, in pure culture, these fungi grow only as filamentous molds. Some molds, including species of Mucor, can grow in a yeast-like phase under special conditions of temperature, medium composition, oxygen tension, or carbon dioxide content of the culture atmosphere. Those fungi referred to as yeasts, however, grow in a yeast-like phase at all temperatures at which they are capable of growing, the only morphological change in strains of some species being the loss of production of pseudomycelium.

Many yeasts are capable of growing at 37°C or at higher temperatures. In some types of work these may be considered to be able to grow in man, or at least in warm-blooded animals. While these may not be pathogenic for man, they, or some of them, may be considered to be part of the saprobic biota of the respiratory tract, the alimentary canal, and other surfaces or organs. When the delicate balances of the interactions among various members of this population are upset by pathological conditions or by the techniques used in the treatment of such conditions, some of these organisms may also become involved in the pathogenic condition.

In studies with fungi isolated from sewage and sewage-polluted waters, such as are found in sewage treatment systems and streams carrying raw sewage or sewage treatment plant effluents that have not been chlorinated, it might be of interest to know which species are capable of living at elevated temperatures, since among these species may be ones intimately associated with warm-blooded ani-

mals, including man. Such species may then be useful as possible indicators of pollution of fecal origin.

At the present time more than 50 types of tests are used in developing information upon which to base a description of, or an identification of, a strain or an isolate of yeast. These include morphologic tests and observations, as well as information concerning physiological tests such as ability of the strain to use carbon- and nitrogen-containing compounds, vitamins, and other substances. An additional test that may become useful as more is learned of its reactions in more and more strains of a species or in more species of yeasts is the ability of a strain to grow at various temperatures. At present, at least two types of temperature incubation tests are used: Temperatures up to 32°C, represented at times by room temperature, and temperatures up to 42°C, represented by 37°C. When equipment is available a range of temperatures may be tested simultaneously. We are not concerned here with potentially cryogenic species. The current report is based on growth on agar media in a 37°C incubator.

As recently as 1952, temperature studies were not considered of importance for yeast classification work. The only temperatures cited by LODDER & KREGER-VAN Rij (1952) for such studies are 17°C and 25°C. Both may have developed from the accidental discovery of optimum growth appearances at room temperature and in a storage room that happened to have a temperature lower than that of room temperature. One of the earlier reports of growth temperatures of yeasts is that of Rennerfeldt, who in 1942, found that four species of yeasts commonly isolated from wood chips grew best at 22°C at 27°C. In strictly yeast literature, the first report of the use of elevated temperatures in the description of a yeast species is that of Van Uden & Do Carmo-Sousa (1957), who described Candida slooffii from the intestinal tract of a horse. In 1958, Van Uden & Farinha elevated C. norvegensis from varietal rank under C. zeylanoides to specific rank on the basis of vitamin requirements and the ability to grow at higher temperatures than the former parent species. Again in 1959, Van Uden & Do Carmo-Sousa, working with Candida parapsilosis and a related group of strains, recognized two varieties and two additional species, including C. lusitaniae, on the basis, at least in part, of vitamin requirements and growth temperature levels.

For the present study, no attempt has been made to determine the range of growth of the yeast strains used over a series of temperatures. Following inoculation of plates they were incubated at 37°C for 3 days. Thus we were trying only to determine the ability of a strain to grow at 37°C.

The strains used were those routinely isolated from samples of sewage, sewage-polluted waters and soils, and materials obtained for study from various types of sewage treatment processes including trickling filter- and activated sludge-type treatment plants, waste