EFFECT OF TEMPERATURE ON THE PROTEIN AND NUCLEIC ACID CONTENT OF THERMOTOLERANT YEASTS

E.T.A. El Sheikh Idris and D.R. Berry,
Yeast Technology Group, Department of Applied Microbiology
University of Strathclyde, George St., Glasgow G1 1XY, Scotland

SUMMARY

The effect of growth at 30°, 35° and 40° on the biomass yield and on the nucleic acid and protein content of twelve isolates of yeast has been studied. Although yields of 41.6% and a true protein content of 34% were obtained, each of the strains exhibited a lower yield and protein content at 40° than at the lower temperatures. Nucleic acid levels were also reduced at 40°.

INTRODUCTION

The selection of suitable organisms for the production of biomass requires a consideration of many of the properties of the organism. In addition to the obvious requirement for a good growth rate and yield, it is also essential that the organism contains a high level of protein and a low level of nucleic acid (Imrie & Vlitos, 1975). The level of nucleic acid and protein in microorganisms is influenced by the growth temperature. Growth at an elevated temperature has been reported to reduce the nucleic acid and protein content of yeasts (Burrows, 1970; Stokes, 1971), in addition to reducing the overall yield (Cooney et al., 1977).

We have recently isolated a series of yeasts from two sugar refineries which gave satisfactory yields on a basic molasses urea medium (El Sheikh Idris & Berry, 1980). In this paper we report the effects of growth at different temperatures on the yield, protein content and nucleic acid content of these strains.
MATERIALS AND METHODS

The technique used for the isolation and identification of yeast strains from two sugar refineries and for the growth of these strains on a molasses urea medium has been described previously (El Sheikh Idris, 1979; El Sheikh Idris & Berry, 1980). Protein estimations were carried out on homogenates prepared with a Braun Homogeniser, by the Folin assay (Lowry, et al., 1951). RNA was extracted into 0.5% perchloric acid and assayed using the orcinol assay (Herbert et al., 1971). Each value presented represents the mean of four determinations from four different flasks.

RESULTS AND DISCUSSION

Incubation at 30°, 35° and 40° did not have a marked effect on yield (Table 1). Three strains; S. chevalieri (4), C. albidus (4) and C. albidus (5) produced their best yield at 30° but the remaining strains gave their highest yield at 35°. The highest yield obtained; 43%, was not so high as the values of 50% and over, reported for some biomass fermentations (Gray & Berry, 1980). However, as indicated previously, this can be attributed to the limited supplementation of the medium (El Sheikh Idris & Berry, 1980). When Candida utilis was grown under identical conditions to those used in these experiments, the yield obtained was reduced from 43% at 30° to 32% at 40°, (El Sheikh Idris, 1979).

In all the strains studied, the protein content was lowest at 40°. The highest level of protein was obtained at 35° in all the strains except Rhodosporidium toruloides (Table 2). Fungi are often reported as having up to 50% protein. However, these high values are derived from studies using an N x 6.25 value for protein rather than a value obtained by direct analysis of protein (Romantschuk, 1975), and should be reduced by a factor of 0.75 to obtain realistic values for protein in fungi of around 37.5% (Mateles, 1979). The maximum value obtained in these