STUDIES ON THE EFFECT OF THE FOOD PRESERVATIVE SODIUM BENZOATE ON THE PHYSIOLOGY OF THE OSMOPHILIC YEAST

Saccharomyces rouxii

A Thesis

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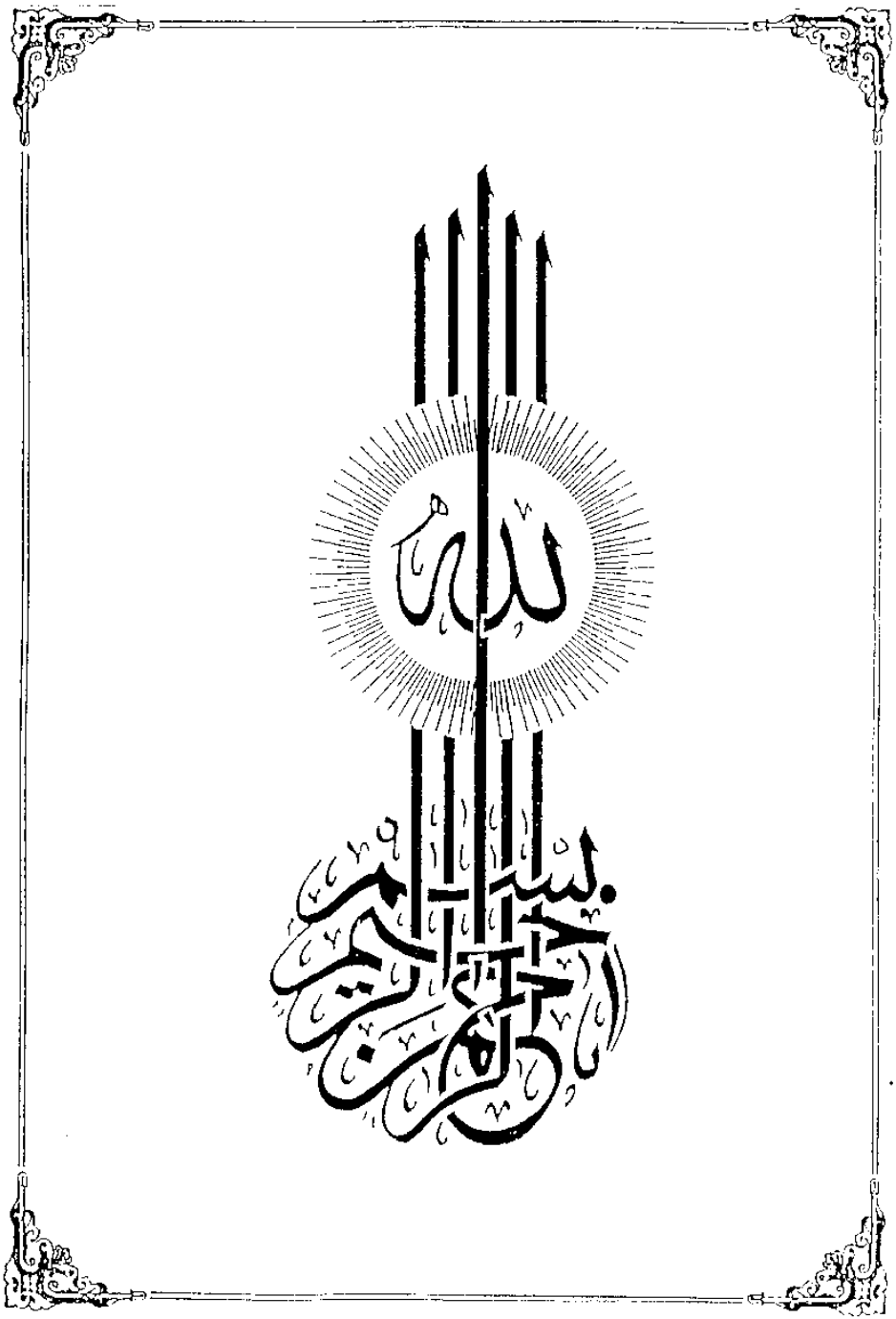

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INTRODUCTION

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Sugar-tolerant yeasts are normally found in the nectar of flowers and finally transmitted to the honey combs, and on the surface of the fruit.

Food preservatives are always used to preserve jams, fruit juices and other food products were yeasts are one of the main organisms responsible for their spoilage. If these yeasts get exposed to the lethal doses of preservative, they will get killed. However, an exposure to sublethal doses of the preservative they will survive but one should expect some alterations in their physiology.

The aim of the present study is to show the effect of sublethal doses of the preservative, sodium benzoate at different levels of water activity on the levels of some cellular components of the osmophilic yeast *Saccharomyces rouxii*, such as carbohydrates, proteins and lipids as well as on the level of the enzyme lipase. Also, rates of both glucose and phosphate - uptake were taken as a parameter for alterations in their physiology of the osmophilic yeasts.

REVIEW
OF
LITERATURE

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Osmophilic yeasts is a group of microorganisms which can grow well on special environments of sugar and salt so high that ordinary yeasts can not grow at all.

The term "Osmophilic" was given by Von Blenter (1912), to the group of yeasts that can grow well in an environment of high osmotic concentration. The sugar tolerance of yeast culture was certained by incubating the organisms in a series of sugar media at 30°C for up to two months Scarr and Rose, 1966). According to the nature of solute, osmophilic organisms are divided into two groups:

A Halophiles, where the solute is salt sodium chloride.

B Saccharophiles, where the solute is sugar.

Microbial spoilage:

Microbial spoilage of food is commonly the result of the combined activities of yeasts; moulds and bacteria, however, depending upon the environment:

one of these group of microbes may prevail over the others.

Yeasts usually do not compete well in mixed populations and, therefore, cause spoilage under conditions which are favourable for their growth but unfavourable for growth of most bacteria. Ingram (1958), in his review on yeasts as spoilage agent, emphasized the conditions in food or in the environment that cause spoilage by yeasts.

Factors of paramount importance in determining the ability of yeasts to compete with other organisms are the numbers and types of yeasts infecting the food initially; nutrients available in the food, pH value, redox potential, temperature during storage, and relative humidity or water actiity (a_w) of the surrounding food product. Ujüe and Yokoyama (1956), showed that the spoilage of mispaste of yeasts depends mainly on the water content; no deterioration could occur during long storage in mispaste containing less that 45% water Mogi and Naka Jinaa, (1942). Several investigators have been published which cover various aspects of spoilage yeasts (Teramato and Hashida,(1954),Okazaur et al., (1961).

In mixed populations, bacteria will usually out grow yeasts in substrates having a neutral or slightly acid pH value. As the pH value decreases below 5.5 yeasts are generally favoured and out grow bacteria at this level of acidity. Reoa and Mrak, (1952), have reported the growth of various yeasts at pH value as low as 1.5-2.0.

Certain oxidative yeasts utilize organic acids and alcohols, leading to deteriorations of food product in which their metabolic by-products are not desirable. In addition, depletion of these organic acids raises the pH value and favour growth of bacteria that can cause spoilage problem. Most yeasts grow best under aerobic conditions but many can also grow slowly under conditions of low oxygen tension. Thus, yeasts sometimes may be responsible for fermentative spoilage of certain products from which air has been excluded. Ingram (1958) has pointed out that the redox potential is highest at the surface of food for which reason the more aerobic yeasts develop on the surface of the food products; examples of this phenomenon are film yeasts on brines and myocarderma as on wines. Acid tolerance and ability to grow under low redox potential account, in part, for the ability of yeasts

to prevail in the fermentation of fruit juices and pickling solutions.

Several extensive reviews have been published which cover various aspects of osmophilic yeasts (von Schelhorn, 1951; Flannery, 1956; Scott, 1957; Ingram, 1957, 1958; Onishi; 1963; Spencer, 1968; Brown and Simpson, 1972; Brown 1974 and 1975).

In the literature previous to 1952, most of the yeasts capable of growing in high sugar concentrations have been referred to as species of Zygosaccharomyces. Kroemer and Krumbholz (1934), in their studies on osmophilic yeasts divided Zygosaccharomyces into two groups. The first group was related to Zygosaccharomyces pasteurianus, of the disaccharides, only maltose was fermented. The second group, related to Zygosaccharomyces hanseii, was less sugar tolerant and could not ferment maltose, but could ferment sucrose and raffinose with the production of much volatile acid. Ingram (1959), suggested dividing yeasts resistant to sugars into two groups; namely semiosmophiles fermenting sucrose, represented by Saccharomyces rosei, and osmophiles represented by Saccharomyces rouxii and Saccharomyces mellis.