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FUNDAMENTAL STUDIES ON THE UTILIZATION OF OLIVE FRUITS

IV The pickling of green olives (2) Effect of the addition of supplementary sugar on the fermentation of Spanish-type green olives

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It has been shown in our previous paper[1] that supplementary sugar is necessary for obtaining sufficient acidity in the fermentation of Spanish-type green olives with the *Mission* fruits under Japanese conditions. CRUESS[2] reported that it was necessary to add supplementary sugar in order to obtain satisfactory acid production in California green olives, and the addition of glucose or sucrose became a common practice in the U. S. A. However, the addition of sugar is not practised in Spain[3].

Various factors associated with the sugar supplementation were studied by CRUESS[2] and VAUGHN et al.[4], and the importance of the time interval was pointed out which must elaspe after the olives have been brined before it is safe to add sugar. Spoilage of the olives was reported[2,4,5] to occur very often, if the supplementary sugar was added immediately after brining. The chief problem is the bacterial population in the brine solution of the stage at which the supplementary sugar may be added. It will be safe if the undesirable bacteria have been eliminated at the time of supplementation. It was observed by many workers[2,4,5] that the spoilage bacteria were inactivated or completely eliminated from normal fermentation in about one to three weeks. In the present experiments glucose was added at the eighth day of fermentation as the supplementary sugar, and the effect of sugar was followed on the acid production in green olives. The results obtained will be described in the present paper.

EXPERIMENTAL

The *Mission* olives used in this study contained 1.1–1.3% of total sugar as glucose per fresh flesh at the age of harvesting for green pickling as shown in the first paper of this series[6], but it gave only 0.4% of reducing sugar in the brine solution and produced 0.36% of total acidity as lactic acid after about three months of fermentation[1]. CUBAS ALVAREZ[7] (Peru) reported that green olives contained 1.58–2.64% of total sugar and 0.46-0.98% of reducing sugar on fresh basis, but 1.64% of reducing sugar was described by FERNÁNDEZ DIEZ, et al. (Spain)[8]. From these results it will be seen that the olives in Spain contain more reducing sugar than in Japan or Peru. In U.S.S.R., APT[9] obtained only 0.1% acidity after three months of fermentation when the sugar supplementation was not made. Therefore, the olives in U. S. S. R. seem to contain only a small amount of reducing sugars available in the flesh itself.

The present experiments were conducted to increase the maximum sugar concentration to about 1.2% in the brine solution by adding 0.8% sugar as supplement, and the following fermentations were studied by analyzing the chemical constituents of the brine solutions comparatively with those of nonsupplemented ones. The stage of sugar addition was the eighth day of fermentation and no special manipulation was employed in controlling the fermentation.

Material and Method. The *Mission* olives used in this experiment were treated similarly as in the previous paper[1] except the addition of supplementary sugar to the test lot of experiment.

Glucose of commercial C. P. grade was employed as a supplementary sugar, and it was added at 0.8% to the brine solution on the eighth day of fermentation. The stage of sugar addition was taken as the time when the favorable lactic acid bacteria begin to predominate in the brine solution of normal fermen-

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control, i.e., 3.9 for test and 4.2 for control lots of the experiments, but, as the method of pH determination itself showed a large deviation, the statistical analysis was not performed.

The acidity obtained with the addition of supplementary sugar seems to be sufficient for the preservation[4] and for inhibiting the darkening of the brine solution[14]. The factors which influence the rate of fermentation will be studied in the near future.

SUMMARY

(1) The addition of 0.8% glucose to the brine solution gave a very favorable fermentation and produced 0.5% total acidity (pH 3.9) in about three months of fermentation of the green pickles with the *Mission* olives.

(2) At the end of three months of fermentation, the brine solution with added sugar reserved yet a considerable sugar and the lactic fermentation seemed to be very active at the stage.

(3) It seems to be necessary to study the conditions affecting the favorable rate of the fermentation under Japanese conditions.

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オリブ果実利用に関する基礎的研究

IV オリブの緑果塩蔵

(2) スペイン型グリーンオリブの発酵に対する補糖の効果

楢崎丁市，片倉健二

ミッション種を用いたグリーンオリブでは3カ月の発酵後でも約0.35%の全酸度が得られるのみで保存のために十分な酸度即ち0.5—1.0%を得るには補糖が必要である事を前報[1]において指摘したが，本報ではグルコース添加の効果について報告した。

糖を添加する場合は，その時期及び方法が極めて重要で乳酸発酵が十分盛になっていない場合は腐敗の危険性がある事が報告されている[2,4,10]。本実験では前報と同様に処理した塩蔵の発酵8日目にグルコースを食塩水に対し0.8%添加した。pHの調節，スターターの添加等の処理は全く行わなかったが，非常に優れた発酵経過を示し，3カ月後には全酸度0.5%，pH3.9が得られた。猶発酵は活潑に行われており残糖も0.4%認められたから更に相当の生酸が期待され，恐らく保存に必要な0.5—1%の酸度は達成し得るものと思われる。

発酵速度は Arr[9] 等の結果に比較して非常におそいようであるが，ゆっくり発酵した場合良い製品が得られ易い[13]と言う報告もあり，又発酵が遅いと発酵食塩水の緩衝作用がアルカリ側に傾いて好ましくないと言う[18]相矛盾した結果も得られているので，適当な発酵速度を設定するためには更に研究が必要であると思う。

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