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Extraction of Raisin Concentrate from Raisin

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Abstract

Raisin concentrate extraction is studied in this paper since raisin concentration posses many properties as well as getting varieties of by-products which are used in different industries. In order to extract it, the experiments were conducted in three different extraction temperature (40, 60, and 80 ºC) and three different solvent values (1:1, 2:1, and 3:1) as well as three different evaporation temperature (65, 75, and 85 ºC). Finally the physiochemical properties of obtained concentrate (color, sugar, and recovery percentage and production efficiency) were studied; additionally microbial experimentation (mould, fermentation and total count) was performed. Statistical analysis is conducted after 81 experimental iterations. The outcomes show that iterations under the conditions of extraction temperature of 80 ºC, evaporation temperature of 75 ºC and solvent proportion of 2:1and 3:1 led to better resultants.

Key words: Raisin, Extraction, Raisin concentrate

Introduction

Nowadays raisin concentration is introduced as a valuable product for producing different kinds of syrups, sweat drinks, confectionary industries as well as a natural alternative for sugar. In this paper its laboratory's procedures is studied; whereas its results in the form of technical information and production technology can be a great help for industrial plants producing concentrate which in turn leads to reduction of sustain toward the farmers who produce raisin. Considering high raisin production in Iran raisin concentration is in fact one of the most important products among grapes various productions. This is supported by having partial exporting 20% to 15% interior usage of, where the remaining grapes are left useless.

Exports especially agricultural productions can play a significant role in employing economical strategies. Long since in Iran ,dried fruits especially raisins was considered of export materials; and till two decades ago Iran was among the most important countries in exporting raisin to Asian, European, and Persian golf countries. Unfortunately these markets were missed for two major reasons: a) weakness in production and packaging b) the superiority of market searching of other countries such as America, Australia, Turkey and Greece over Iran. These markets were captured by such countries which were at a time importing raisin products. While in Iran, not only producing raisin has not been

decreased but also shows an increase of 72-82 % during a decade of farming pried; and since just 15% to 20% of produced raisin is used inside the country where as the remaining raisin should be exported, varieties in production seem to be essential.

Materials and Methods :Reagents and Materials

Raw material, Tampson raisin (types 2 and 3) , Diatoms Soil, Copper Sulfide, Sodium Potassium, Matilan blue, Chloride Acid and Notrint Agar (N.A) were obtained from Merck.

Apparatus: Rotary evaporator, Foor, Auto clove. Grinder and Mixture (Mulinex type), Vacuum Pump and Refracto-meter.Rotational iscometer, Microscope. Refrigerator (an 8 feet Azmayesh set) and Lovibond .

Methodology: After selecting and transforming the samples to the lab they are allowed to be stiffened, washed, and dried. A slight scratch by Mulinex mixture is done on samples for penetrating water within their crust. Here definite proportion of 1:1, 2:1and 3:1 of water and solvent is used. Then those Bashers containing raisin and solvent are kept in Ben Mary in three different extracted temperatures 40 ºC, 60 ºC, and 80 ºC. Brix is measured one time per hour, the performing point is determined by Brix stability which is lasted for 24 hours. Then produced extraction is filtered and passed through Bookhner funnel again, using Diatoms soil as filtering aid. The extraction then evaporated in the evaporator under vacuum in three different temperatures 65 ºC, 75 ºC, and 85 ºC.Since the time needed for each evaporation are2 to 3 hours, before evaporating, the samples are heated for 5 minutes. To avoid fermentation during evaporation, every half an hour Brix is measured to control the operation; the process is continued to get the Brix of 70. At the end the microbial experiments including mould, fermentation and total count as well as experiments for determining quality characteristics such as efficiency, Glucose, and color are performed.

Extraction Efficiency:Considering the sample weight and using 300 grams raisin for each experiment, the optimal percentage of concentration is estimated.

Percent of Sugar Recover: Using Line and Ainon method, the samples were studied and after titration operation by referring to Line and Ainon chart the percentage of sugar recovery were recorded for all samples.

Color: In order to perform color experimentation lovibond machine is used. In this system the extract sample color is compared with standard color palates which are composed of a few series of moveable and colored glamour palates in red, yellow, and blue(each of which is consisted of a series of palate from light to dark color). So the desirable sample color can be determined by comparing with one of the palates combining with few palates. For measuring the color, containers of 0.25, 1, and 5.25 inches can be used.

Mould and Fermentation

The total samples were cultivated within three different concentrations of 0.1, 0.01 and 0.001 M .then the operation was studied after putting in Ben Mary.

Total count: ***All samples were studied and cultivated within three different concentrations of 0.1, 0.01 and 0.001 M then total count was handled after predetermined time .***

Statistical Relationship for Analyzing the Results

For analyzing the obtained data from aforementioned experiments such as efficiency, color and percentage of sugar recovery, by considering the 81 times iterations, a design of

factorial examinations in the format of completely random was used. The M-Stat software was employed to determine the significant of differences between experiments and their interactions, experiments which brought about the significant were identified using the least different significant test.

Results and Discussions:Statistical analysis of results

The obtained means for all observations via Danken multi-domain test were compared with each other and the amount of the least statistical significant difference at the level P≤ 0.05 were determined.The results are summarized in Table 1. As Table 1 indicates,There is no significant differences at all levels of iterations. Howere considering it, a significant difference is observable at the level of P≤ 0.01. But There is no significant difference on color of red and blue at any levels.. At the levels of evaporating temperature; effects and interact ional effect of solvent proportion and evaporated temperature on the amount of recovery sugar a statistical significant difference is observable. Also there is a highly significant difference at the level of interact ional effect of three parameters (extracting temperature, solvent ratio, and evaporated temperature). Of course here there is no significant difference of the effect of extraction temperature and solvent proportion.

Comparing the means: All of the obtained means from statistical analyses based on Danken multi-domain test, compared with each other and their least amount of the statistical significant difference (LSD) was determined.

The effect of extracting temperature on efficiency

Concentrate producing efficiency has also been increased with increasing the extracting temperature. This effect is indicated in Figure 1.

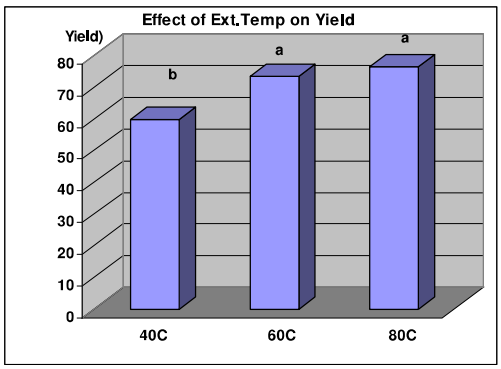

Fig. 1. The effect of extracting temperature on concentrate production efficiency

The effect of extracting temperature on sugar recovery percentage

The extracting temperature did not have any significant effect on existing sugar recovery on final concentration. Non-sugar substances or non-recovery sugar may cause efficiency increasing. Extracting temperature has also had no effect on increasing or decreasing of the amount of recovery sugar.

The effect of extracting t emperature on color

By increasing the extracting temperature especially in 80 ºC the color of produced concentration has been increased. As increasing the color specially red and blue brings about darkness and reduces appearance properties on the production; extracting operation under 80 ºC seems suitable for obtaining desirable color.

The effect of solvent production on concentrate production efficiency: By increasing the amount of solvent to the proportion of raw material, the concentrate production efficiency also increases. The results are shown in Figure 2considering the ratio of 2:1 and 3:1, the efficiency increases comparing with the proportion 1:1; however, the Brix is 70 for all samples.

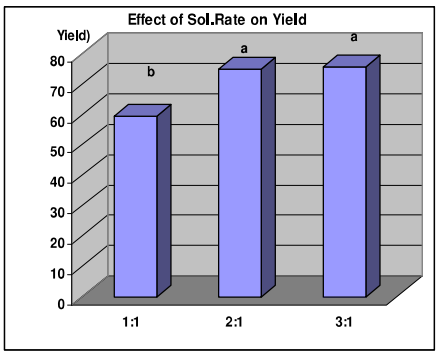

Fig. 2. The effect of solvent ratio on efficiency

The effect of solvent proportion on sugar recovery percentage: Varying the solvent proportion has no significant effect on the amount of sugar recovery.

The effect of solvent proportion on color

The amount of color is more in higher solvent proportion because of the solvable and unsolvable solid substances, i.e. the most and the least amount of color is in the proportion of 3:1, and 1:1 respectively.

Interactional-effect of solvent proportion and extracting temperature on observed properties

Like weight concentrate producing efficiency increases by increasing extracting temperature and solvent proportion (Figure 3). It seems that the effect of solvent proportion and extracting temperature on efficiency is equal.

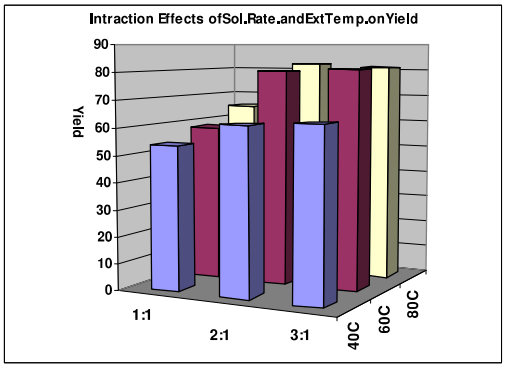

Figure 3. The interact ional-effect of solvent proportion and extracting temperature on concentrating production efficiency

The interactional-effect of solvent proportion and extracting temperature on sugar recovery percentage

There is no significant difference in the amount of sugar recovery within the interact ional-effect of extracting temperature and solvent proportion. The observed difference in different levels shows no statistical differences (Figure 4). However it seems that the highest percentage of sugar recovery is obtained in 80 ºC and solvent proportion of 3:1, which makes different with similar solvent proportion in different temperatures.

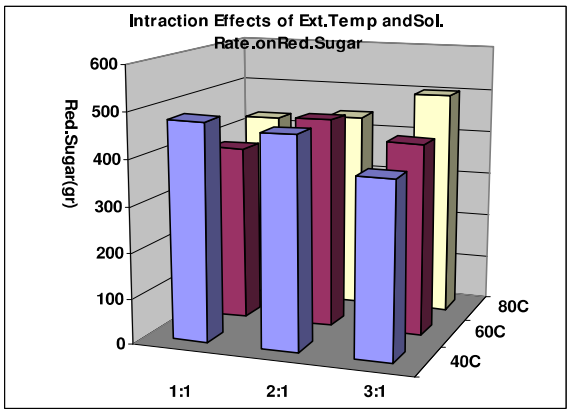

Fig. 4. The bilateral effect of solvent proportion and extracting temperature on sugar recovery percentage

The interact ional-effect of solvent proportion and extract temperature on color

Concentrate color factors by increasing extracting temperature and solvent proportion and in lower temperature together with lesser solvent proportions, the color density was lessened.

The effect of evaporating temperature on raisin concentrates efficiency: Concentrate producing efficiency in 65 and 85 ºC shows increasing with respect to the 75 ºC. As it is shown in Figure 5 the highest amount of producing efficiency is obtained in 65 ºC.

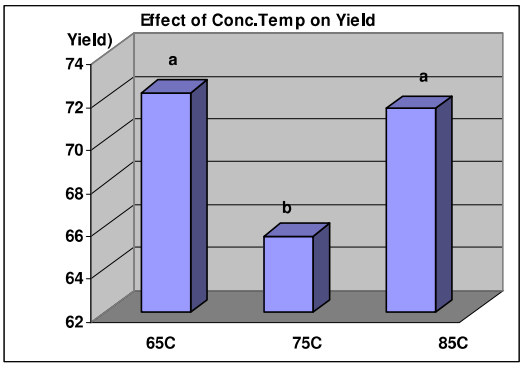

Fig. 5. The effect of evaporating temperature on raisin concentrates efficiency

The effect of evaporating temperature on sugar recovery percentage

The effect of evaporating temperature on sugar recovery percentage and the obtained means has no statistical significant differences with each other.

The effect of evaporating temperature on color factor

The highest amount of factors relating to color was obtained in 65 ºC evaporated Temperature. However, there are some differences in these amounts which have been obtained in 65 ºC but not in 75 ºC and 85 ºC. The reason of increasing color in 65 ºC is, lengthening the evaporated time and appearing the caramelization phenomena.

Interactional-effect of extracting and evaporating temperature on efficiency

Based on obtained results (Figure 6), the concentrate efficiency is increased by increasing the extracting and evaporating temperature. It seems that the effectiveness of extracting temperature on concentrates' weight is higher than evaporating temperature. Also the obtained production in 60 ºC and 80 ºC has the highest volume obtained comparing with 60 ºC extraction and 65 ºC evaporation , and has no significant differences comparing with those obtained in 80 ºC and 75 ºC.

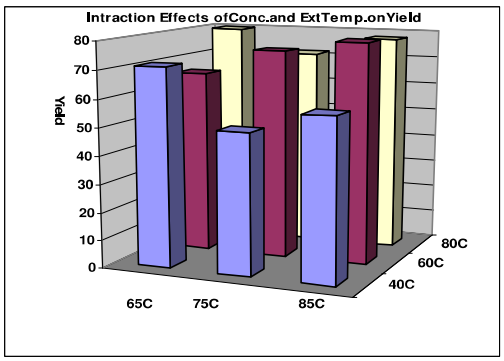

Fig. ۶. Interactional-effect of extracting and evaporating temperature on efficiency

Interactional-effect of extracting and evaporating temperature on the sugar recovery percentage

There is no significant difference among the obtained value of most sample iterations. As it is shown by scattered numbers the extracting and evaporating temperature has had no effect on the value of sugar recovery.

The interact ional-effect of extracting and evaporating temperature on color factor

The maximum color value which is caused by double heating on color is in the extracting temperature of 75 ºC and 80 ºC. Since decreasing of red and blue color and increasing of yellow shows the better quality of production, lower temperature of extracting i.e. 40 ºC and evaporating in 65 ºC is more desirable comparing with other sample iteration.

The interact ional-effect of solvent proportion and evaporated temperature on efficiency

The concentrate product efficiency in solvent proportions of 2:1 and 3:1 are higher and highest respectively, which have been increased by increasing the evaporated temperature. This happens because the percentage of extracting substances was higher; and evaporating in higher temperature not only decreases

the production time, but also increases the production efficiency (Figure 7).

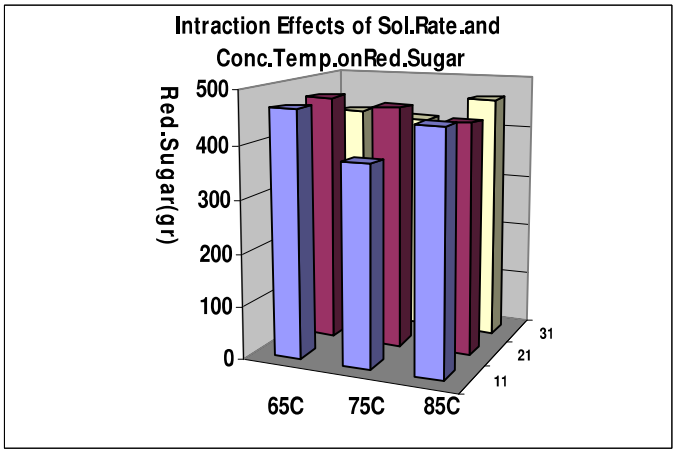

Fig. 7. The interactional-effect of solvent proportion and evaporated temperature on efficiency

The interactiona-effect of solvent proportion and evaporated temperature on sugar recovery percentage

Although the existence of statistical differences in lower degrees of evaporation is because of lesser karamelization, these differences are not significant in general. Solvent proportion and evaporating temperature has no effect on sugar recovery percentage (Figure 8).

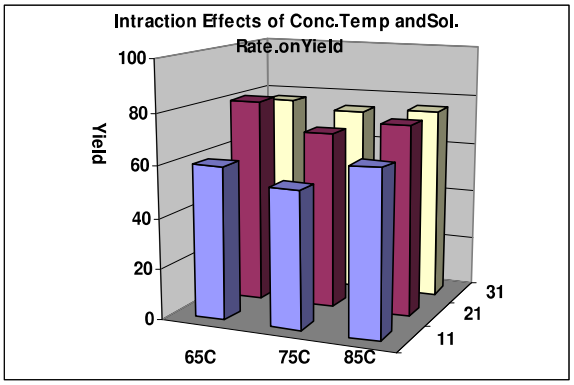

Fig. 8. The interactional-effect of solvent proportion and evaporated temperature on sugar recovery percentage

The interactional-effect of solvent proportion and evaporated temperature on color factor

The least amount of color factors that shows the desirable color quality are obtained in solvent proportion 1:1 and evaporated temperature of 75 ºC. Increasing in yellow color volume happened in evaporating temperature of 75 ºC and solvent proportion of 2:1.

The interactional-effect of three factors, extracting temperature, solvent proportion and evaporation temperature on efficiency

Extracting temperature higher than 80 ºC increases the efficiency. Comparing the means, it is shown that by increasing solvent proportion especially of 3:1 and 2:1 values, causes significant differences on efficiency with respect to other samples iterations.

The intreractional-effect of three factors, extracting temperature, solvent proportion and evaporation temperature on sugar recovery

The scattering of optimal means indicates that three aforementioned factors have no significant effect on sugar recovery percentage.

The interactional-effect of three factors, extracting temperature, solvent proportion and evaporation temperature on color factor

The obtained means from yellow color with respect to red and blue color has higher value and lesser temperature in extracting and evaporating, whereas in higher solvent proportion the obtained color had better quality with respect to the remaining sample repetitions.

Conclusion

In this study the effect of extraction temperature, solvent proportion, and evaporating temperature were studied on the efficiency variables, color and percentage of sugar recovery. Experiment factorial 3*3*3*3 used randomly. Here extracting temperature at three levels 60 ºC, 40 ºC, and 80 ºC, and solvent proportion at three levels 2:1, 1:1, and 3:1 and evaporating temperature at three levels 75, 65, and 85 ºC were tested within three times iterations. The obtained data from experiments was fed to Excel software 97 and analyzed by M-stat soft ware.

The results are as follows; meanwhile in microbial testing everything was alright, only in one case in total count in 0.1 condensed colony was observed which was considered as experimental error. The best sample iterations were obtained in extracting temperature of 80 ºC and proportion of 2:1, 3:1 and evaporating temperature of 65 ºC and 75 ºC.

Table 1.Statistical analysis of data obtained through conducting experiments

Color			Suger Recovery	Efficiency	Degree of freedom	observations levels of experiments
Blue	yellow	Red				
$0.003^{n.s}$	$0.120^{n.s}$	$1.059^{n.s}$	$194.84^{n.s}$	$4.664^{n.s}$	2	levels of iterations
7.159^{**}	$1.239^{n.s}$	277.402^{**}	$6711.68^{n.s}$	2121.84^{**}	2	Levels of extraction temperature
0.365^{**}	$8.810^{n.s}$	30.429^{**}	$4368.407^{n.s}$	2304.66^{**}	2	Levels of solvent ratio
0.564^{**}	$2.173^{n.s}$	12.993**	22581.49^{**}	143.48^{**}	4	Levels of inter-actional effect of extraction temperature and solvent ratio on concentration
0.281^{**}	$4.943^{n.s}$	16.485^{**}	11092.97^{*}	361.878^{**}	2	Levels of concentration
0.119^{**}	$1.514^{n.s}$	11.167^{**}	10902.97^{**}	624.715^{**}	4	The interact ional effect of extraction and concentrated temperature on concentration
0.110^{**}	$1.370^{n.s}$	20.309^{**}	8417.915^{*}	94.632^{**}	4	The interact ional effect of concentrated temperature and solvent ratio on concentration
0.175^{**}	$3.047^{n.s}$	10.811^{**}	27944.223^{**}	229.752^{**}	8	The interact ional effect of concentrated and extraction temperature plus solvent ratio on concentration

**Highly statistical significant differences at the level of P≤ 0.01.

*Statistical significant differences at the level of P≤ 0.05.

n.s: No statistical significant differences.

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