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Investigation of Using Bleaching Soil on Physiochemical Properties of Grape Syrup

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ABSTRACT

Grape juice Grape is one of the traditional products for many reasons, including food applications, nutritional value and commercial pigment it among many people, especially in the food industry experts suggest is popular. The aim of this study was to investigate the effect of bleaching soil on physicochemical properties of grape juice and comparison of bleaching method and introduced bleached best of resin used in this study, the efficiency was bleaching method. At first grape juice was extracted by the traditional method. And their impact on grape juice quality characteristics such as color and opacity at wavelengths 420 and 560 nm was measured. Statistical analysis of the data using ANOVA and Duncan's multiple range test at the 95% probability level was performed by SPSS V.19 soft ware. In both the wavelength range of resins PAD900 and D5168, had the greatest impact on reducing color. The use of bleaching white soil alone could reduce the grape juice opacity to 96%, while the resins was not able to do it alone .At 420 nm, the material productive will be removed due to added white color soil to grape juice and remain in effect for not using white clay and resin will not be able to absorb them. The combined use of activated charcoal and white bleached soil not much effect on the bleaching of grape juice. At a wavelength of 560 nm, effect of resins in color reduction is more pronounced. Furthermore resins performance in comparison to white bleaching soil for the removal of agents causing opacity is not very significant.

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INTRODUCTION

Grape is one of the fruits which has been used for many years .there are two concepts about grape consuming; 1) some believe that human being has started using it before cereal.2) but the other group think the antiquity of grape back to 6 or 7 thousand years ago (Patrick *et al*, 2003). The importance of grape cultivation is related to both economical value and its high nutritional value. the value of grape can consider in many different ways such as consumed fresh, raisin production. concentrate, juice ,fermentative products ,jam ,syrup and etc ,thus play an important role in producing countries .There are some other products like ethanol and anthocyanin where utilize in industries (Amirghasemi, 2002). Iran ranks in grape production and raisin import 7th and 3rd respectively, therefore is being considered as one of the main countries in producing grape .Today, most areas of Iran including cold regions of the north to the fringes of the desert, and also parts of south, grape is cultivated .The wild grapes are abundant in the forests of Iran as well. Nutritionally, grape contains lots of vitamins like B1, B2, C and minerals including calcium, potassium, sodium and magnesium (Huffington, 1979). Commercial variety of grape is mainly Vinifera that is originated in southern Europe between the Black Sea and the Caspian Sea .250 varieties of grape have been indentified in Iran (Amirghasemi, 2002). Since grape acreage and production rate compared to other garden products were quite spectacular and used in various domestic and international markets, hence economically is one of the few products that can form of one of the main and largest non-oil export items after pistachio and date(Huffington, 1979). Grape juice is one of the traditional products which are well known among many people, especially Takdaran. Nearly 100 kinds of grapes are cultivated in Iran to produce grape syrup, those grape tree used whose contain skinny, beady berries and have been irrigated less than other varieties .Producing grape syrup includes 3 stages; 1) extracting grape syrup 2) mixing with clay 30 and filtration 3) concentrating to reach desired consistency (Patrick *et al*, 2003). Removing

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turbidity and treatment of extracted syrup seems to be required due to the possibility of passing compounds like pectin, protein, gums and etc in filtration stage (Gill and Bevan, 1876). AL-Hakkak and AL-Madafi, 1983 used foam technique in clarification and Niazmand *et al*, 2006 suggested using enzyme in clarification of date syrup. Ehrenberg *et al*, 1977 used liming to treat date liquid syrup in accordance with limin-phosphatation in sugar refining .Ion exchange resins are solid particles where replace unsuitable ions by suitable ion with the same equivalent and charge. Cationic resins contain movable ion with positive charge while anionic resins have negative charges (Klimczak, 2007). Niazmand *et al*, 2006 used bleaching soil and bentonite as a specific factor of proteins removing to bleach date liquid syrup, besides bleaching soil act through adsorption and removing pigments. Efficiency of Acitivated carbon and bleaching soil is due to their high amounts of their contact areas. Wolf *et al*, investigated 47 types of resin on date liquid syrup bleaching and showed that gel acidic and basic resin are suitable in this goal however Niazmand *et al*, 2001 focus their results on using macro press resins.

Methodology:

Fakhri variety located in Asadabad Hamadan province of Iran. It selected for this study due to its low relative ration of fruit to seed, this variety cultivated for extracting juice.

Providing Grape Syrup:

60 kg of grape (Fakhri variety) purchased, placed in cleaned bag, mashed to extract juice, then clay or syrup soil added, more having coarse texture in soil, better extracting performed. The amount of clay used in extracting differs from region to region, besides temperature of the process varies from ambient to boiling T. After adding 6kg of clay to 200ml water the container, container stirred .in order to achieve desired transparency mixture set for 1 day, then filtered by special white cloth to remove soil and resulted grape syrup boiled for1-2 hr to achieve desired consistency.

Providing Grape Juice to Measure Turbidity:

Obtained Grape juice carried to the laboratory and experiments were conducted to evaluate juice quality. Grape juice diluted by 1:15 ratio (1 ml juice and 14 ml distilled water) , then their turbidity measured by turbidity meter.

Bleaching of Grape Syrup by Resin:

A glass column scaled the height of 50 cm and a volume of 250 ml that has a one liter glass tank used to bleach, refined grape juice .Bleaching process conducted by using 6 absorption resins (900 PAD Purosorb) and 5 anionic resins.

Measurement of Absorption and Turbidity of Grape Syrup:

Spectrophotometer model Milton Roy, Lambada 25 UV/Visible, USA used to conduct absorption measurement at 420 nm and 560nm (base on icumsa and national iran standard N.O. 69), turbidity measured by turbidity meter HANNA HI9370,USA (Sharifi, 2008).

Statistical Method:

SPSS V.19 software and ANOVA and Duncan ($\alpha<0.05$) tests were used to analyze data.

Results:

Bleaching Grape Syrup by Carbon Active:

The effect of carbon active on intensity of light absorption at 560 nm (red pigments):

Figure 1 indicates the reduction of red color of soiled grape syrup and unsoiled grape syrup by carbon active in 560 nm. Activated carbon exhibited a slightly affection on both the bleaching of mixture of grape syrup , white soil and the bleaching of "syrup" lonely that were 25 % and 16 % reduction respectively cause to conclude more efficiency of using white soil and Activated carbon together.

The affection of Activated carbon in the intensity of light absorption of grape syrup at 420nm 9 (yellow pigments):

Fig 2 exhibits that the decrease of yellow pigments were 5 % and 48 % in the mixture of white soil and date syrup and date syrup lonely respectively Fig. 2 also indicated that white soil is able to remove most yellow pigments in the mixture of grape syrup and white soil, however Activated carbon can remove 48 % of yellow pigments alone these later results reveals the no strong affection of the mixture of activated carbon and white soil.

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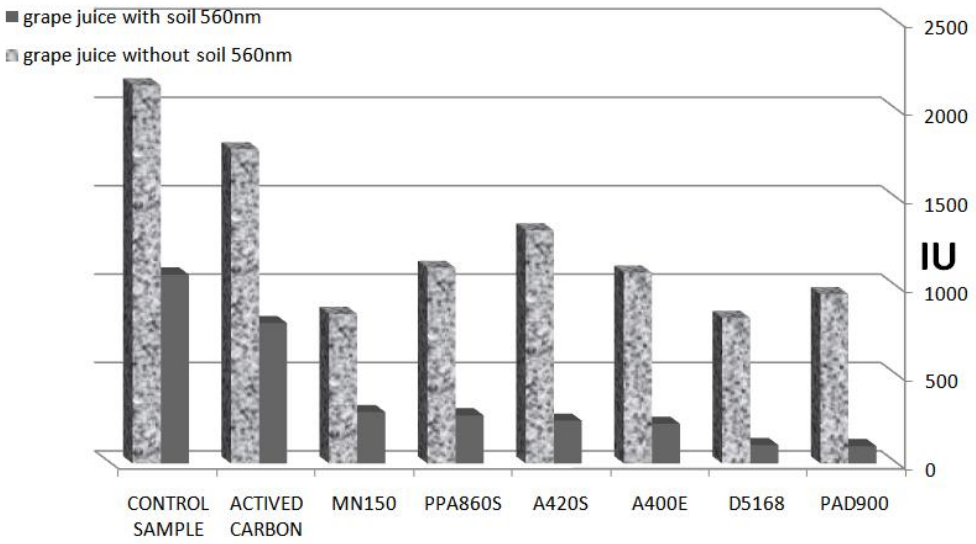

Fig. 1: The comparison of grape juice with soil and without soil at 560 nm.

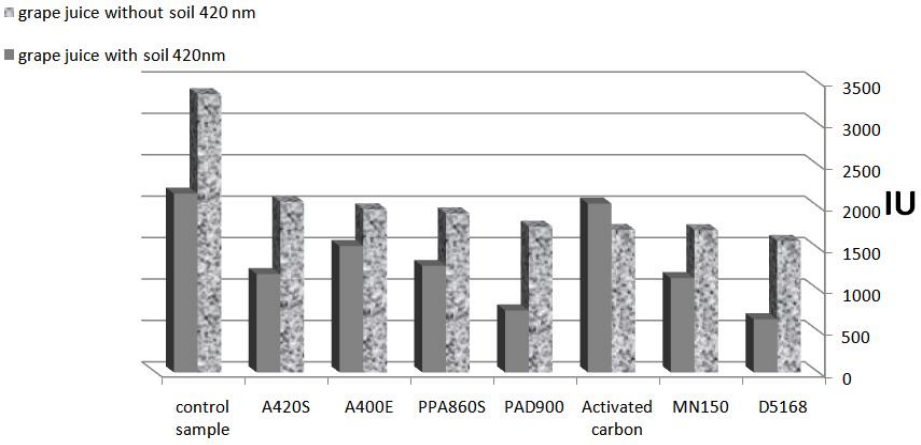

Fig. 2: The comparison of grape juice with soil and without soil at 420 nm.

Bleaching of Grape Syrup by Anionic and Absorbent Resins:
Comparison of efficiency of resins' bleaching at 420nm:

Table 1 show the effect of different resins on changing color of grape syrup at 420nm. Comparison of resins' efficiency revealed that the most effective resin was D5168 which take advantage of macro press basic resins. All the resins are in order based on their efficiency in the following.

D5168 > PAD900 >MN150 > A420S > PPA860S >A400E >Activated carbon> control

Activated carbon follows the same mechanism as resin performs in the soil grape syrup, but exhibits less efficiency than resins. The order of all removing agents is in the following (at 420 nm):

Control D5168 > MN150 > Activated carbon >PAD900 >PPA860S > A400E >A420S >

Grape syrup color is in the range of yellow to red due to this point places in a more stage at 560 nm than 420nm.

Table 1: Comparison the color of bleached grape juice by activated carbon, anionic resins and absorbent resins at Wavelength 420 nm:

Color of simple (plain)grape juice (unit IU)	Color grape juice with soil (unit IU)	Type of resin	Name of resin
1720	2038	Surface adsorbent	activated carbon
1586.33	641.33	Anion macroporous	D5168
1757.66	748.66	Macroporous adsorbent	PAD900
1715.66	1137.66	Macroporous adsorbent	MN150
2057.66	1185.66	Anion gel	A420S
1918.33	1285.66	Anion macroporous	PPA860S
1967.66	1524.66	Anion gel	A400E
3356.33	2157.33		control sample

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Comparison of the Bleaching Efficiency of Resins at 560nm:

Table 2 showed the efficiency of bleaching process of different resins at 560 nm .using of resins caused to a strong reduction of color in red range. D6158 and PAD900 were the best in the removing of red pigments at 560 nm the order of different resins in removing red pigments is in the following (based on table 2)
control PAD900 > D5168 > A400E > A420S > PPA860S > MN150 > Activated carbon>
the comparison of grape syrup without white soil at 560 nm among resins is in the following:
D5168 > MN150 > PAD900 >A400E > PPA860S >A420S > Activateed carbon > control

Table 2: Comparison the color of bleached grape juice by activated carbon, anionic resins and absorbent resins at Wavelength 560 nm:

Color of simple (plain)grape juice (unit IU) or grape juice without soil	Color of grape juice with soil (unit IU)	Type of resin	Name of resin
1777	794	Surface adsorbent	activated carbon
822.66	*104.66*	Anion macroporous	D5168
957.33	97.66	Macroporous adsorbent	PAD900
845.66	290.33	Macroporous adsorbent	MN150
1318.66	241.66	Anion gel	A420S
1106.33	272.33	Anion macroporous	PPA860S
1078.66	224.33	Anion gel	A400E
2138.66	1068.66		control sample

The comparison of efficiency in removing turbidity from grape syrup by anionic, absorbent resins and activated carbon:

Overall the efficiency of resins categorize in two groups; 1) cause to reduction in turbidity respect to control.2) cause to increasing in turbidity in comparison with control.

First group includes D5168, A400E, PAD900, the second group MN150, A420S activated Carbone and PPA860S.The later may cause to increase turbidity in comparison with control due to release of anionic agents where link to resin in bleaching condition. The most efficiency in turbidity reduction of white soil grape syrup related to D5168 with anionic macro press structure. Reduction of turbidity by PAD900 exhibited no significant difference in comparison with control.

Removing colloidal compounds specially in the treatment of drinking water is one the most important use of carbon active .not only carbon active(D=1200 m^2/g), a powder smaller than PAD900, can't exhibits a high ability in removing turbidity of soiled grape syrup but increases turbidity. Carbon active decrease turbidity in high concentration more than control due to its facial absorption. While with respect to necessity of filtration in low concentration it can cause to more turbidity than control as a result of unsuitable filtration (table 3), while the use of activated carbon filtration must perform by tiny meshes.

D5168 removed 52 % of turbidity in grape syrup containing no white soil. The next most effective ones were activated Carbone, MN150 and PAD 900. No significant differences exhibited between A400E AND PPA860S (Table 3).

Table 3: Comparison of bleached grape juice by anionic resin, activated Carbone and absorbent resin.

Grape juice without soil Turbidity(unit FTU)	Grape juice with soil Turbidity(unit FTU)	Type of resin
22.49	88.33	activated carbon
80.33	4.206	D5168
98.66	5.95	PAD900
92.33	7.51	MN150
118.33	13.42	A420S
105.33	26.04	PPA860S
107.66	5.31	A400E
170.66	6.41	control sample

Conclusion:

Red pigments in grape syrup arise from Millard reaction which mainly contain negative charges in grape syrup medium and due to this point link with positive charges on the surface of activated Carbone .this absorption causes to reduce red pigments at 560nm.

Yellow pigments categorize in two groups; 1) natural pigments such as carotenoids. 2) yellow pigments produced in Millard reaction. Activated carbon is able to absorb produced pigments during Millard reactions through electrostatic absorption with pigments having negative charges.

Comparing fig 1and 2 revealed that pigments related to 420 nm are mostly arose from Millard and carotenids. It is concluded because of no absorbing tendency of later pigments to activated carbon (AL-Hakkak *et al*, 1983.

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Adding white soil to grape syrup removed pigments those contain negative charges and not to absorb by anionic resins.

Regarding to the structure of resins, we find that intermediate and end products compose a wide range of compounds that absorb by PAD9009 (general resin), while other anionic resins remove a few of pigments.

Comparing efficiency of different resins at 560nm revealed that overall, activated carbon exhibited less efficiency than other resins .anionic resins absorb pigments (containing negative charges) such as flavenoids and anthocyanines, however other pigments like carotenoids (zeaxanthine and lutein) absorbed by non anionic resins and activated carbon due to their hydrophobic state in white grape juice.

Insoluble complexes like protein and pectin in grape syrup where find in cell wall must filtered. Grape skin contains different pigment agents like anthocyanines whose responsible for red color, tanens which cause to generate the structure of red pigments.

Results revealed that adding white soil decreased 96 % of turbidity, while mixture of white soil and resin reduced 34 % of turbidity of bleached grape syrup. Resisns were capable to decrease turbidity up to 54 %.

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