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Value Added Products from Grapes: A Review

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Abstract- **Grapes (vitis vinifera) belongs to the family Vitaceae is one of the major fruit crop. India ranks 11th in grape production with production of 1.8 million tons grapes from an area of 80,000 ha. Approximately 71% of world grape production is used for wine, 27% as fresh fruit and 2% as dried fruit. The value addition in grapes and diversification of grapes products also provide good returns to growers. The major consumption of grapes in India is a fresh fruit followed by resins, wine and juice while at global level 78 – 80 % grapes processed into wine followed by resins and juice. The fruits have appreciable amount of carbohydrates, protein, phytonutrients, polyphenols and contain other important vitamin such as vitamin A, vitamin K, vitamin C, vitamin B6 also rich in thiamine, riboflavin, niacin and minerals like potassium, calcium, magnesium, phosphorous and sodium. Grapes have higher water content (86 to 88%) that helps in keeping the body hydrated and also contain dietary fiber, healthy carbs, antioxidants angoramoderate amount of protein. Grapes also useful for indigestion, breast cancer, blood cholesterol, kidney disorders, antibacterial activity, protection against sunburns, skin softener, fight diabetes, immune system. Value added products of grapes are grape resins, grape wine, grape juice, grape vinegar, grape pekmez, grape verjus, sweet spreads (jam, jelly, butter and marmalade). These value added products are useful for control diabetes, treat anemia, care fever, eye care, prevent acidosis, promote bone health and dental care. Value additional products from grapes need to high moisture, generally acidic food that is relatively easy to process and that offers a variety of flavor, aroma, colour and calories but are an excellent source of directly fibers and essential vitamins.**

Key words: **- Grapes, grape resins, grape wine, acidic food, vitamins.**

I. INTRODUCTION

Grape is believed to have originated in Armenia near the Black and Caspian seas in Russia. An independent and recent origin of grapes is also traced to North America. Grapes are one of the most popular and palatable fruits in the world. In India, grape is grown under two distinct climatic conditions: (i) the sub-tropical climatic conditions of north where the winter temperatures rarely reach as the freezing point but vines undergo dormancy in winter, and (ii) the tropical climatic conditions of the peninsular India where the winter are mild and the vines do not undergo dormancy and remain evergreen throughout.

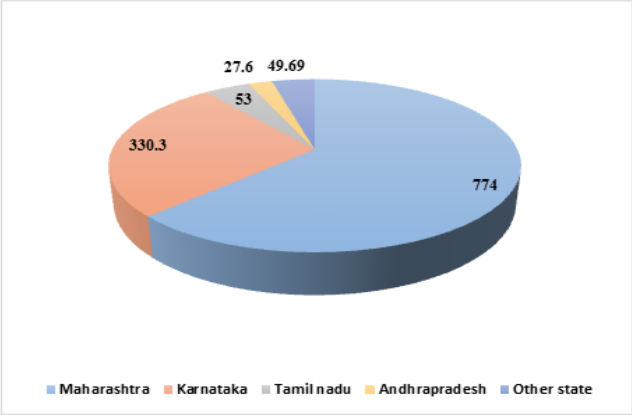

Fig.1Production status of grapes in India

Overall world production of grape is 75.8 million tons in 2016, in that 2.6 million ton grapes produced in India. Maximum grape production in India takes place in Maharashtra (774 thousand tons) state followed by southern states like Karnataka (330.3 thousand tons), Tamil Nadu (53 thousand tons) and Andhra Pradesh (27.6 thousand tons) Fig.1 shows the production status of grapes in India. The lifestyle of consumers around the world has changed. Large and complex economic, social, cultural and political movements have led to a strong tendency to change the consolidated consumption habits. The search for healthier life practices has led the industrial sector to develop health promoting products with convenience and high quality, besides adopting sustainable and clean processes. (Gabriela V. Amaral, 2017). Grapes also useful for indigestion, breast cancer, blood cholesterol, kidney disorders, antibacterial activity, protection against sunburns, skin softener, fight diabetes, immune system.

The fruit of the grape is a berry. Berries are attached to the stem. Many berries make up the cluster or bunch of grapes. The essential parts of the berry include the skin, pulp, and seeds. The skin consists of an outer layer covering the berry. It is made up of six to ten layers of thick walled cells. The outer surface of the skin is covered with a wax-like coating called the cuticle, which renders the berry waterproof. The main components in the skin are: coloring matter (red and yellow pigments), tannins, aromatic substances, and potassium and other minerals. Below the skin layer lies flesh

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or pulp which makes up most of the berry volume. Cells in the pulp have large vacuoles containing the cell sap or juice. When the berry is gently crushed, the fragile cells in the pulp are broken and the juice is released. This juice is commonly referred to as the free run (Murli Dharmadhikari 8 Jan 2018).

The seeds are localized in the center of the flesh. The berry contains two to four seeds. They are rich in tannin which is extracted during fermentation (in red wines). The grape juice consists of 70 to 80% water and many dissolved solids. These soluble solids include numerous organic and inorganic compounds. The important group of compounds, from the winemaking point of view. Sugars, organic acids, phenolic compounds, nitrogenous compounds, aroma compounds, minerals, pectic substances. In grapes, a large portion of the soluble solid is sugars. Glucose and fructose are the main sugars in the juice. The sugar content of the juice of ripe grapes varies between 150 to 250 g/L. The phenolic substances are primarily located in the seeds and skins of the berry. The juice contains a very small amount (3 to 5% of total phenol) their phenolic content is low, in the range of 100 to 250 mg/L. Many volatile odorous compounds are found in wine. These aromatic substances are derived from three major sources like grapes, fermentation, aging and maturation.

Grape pomace is the solid waste product left over from wine and juice processing and generally consists of pulp, skins and seeds. Depending other condition of the grape at harvest and the type of press used, 13.5–14.5% of the grapes crushed becomes grape pomace waste with extreme waste production as high as 20% (Russ and Meyer-Pittroff, 2004). Thus in the US alone, between 56 and 80 thousand metric tons (11.2 million metric tons worldwide) of pomace was generated as waste in 2005. The preservation of grapes by drying is a major industry in many parts of the world where grapes are grown. Drying practices vary with geographical locality and with the variety of grapes. Drying grapes, either by open sun drying, shade drying or mechanical drying, produces raisins. The drying of grapes under sheds is common practice followed in major raisin making sites of India like Sangli, Solapur and Nashik districts of Maharashtra and Bijapur district of Karnataka (Sharma,.2014)

II. VALUE ADDED PRODUCTS FORM GRAPES

2.1 Grape juice

Grape juice is traditionally extracted using a combination of elevated temperature and enzymes on grape must (BajardSparrow, Fauveau, Pellerin, and Fernandez, 2005; Morris, 1989). The enzymes break down the pectic and cellulosic components of the fruit and increase juice yield. They also play a role in releasing phytochemicals, like flavonoids, from the cell walls of grape skin. Various authors have studied the effect of enzymatic processing on grapes, with an increased focus on phytochemical content (BajardSparrow et al., 2005; Sreenath and Santhanam, 1992; Threlfall et al., 2005). Grapefruits show a high concentration and a great variety of phenolic compounds (Macheix et al., 1990). Thus, grape juice is a rich source of flavonoids and other phenolics in the human diet (Rice-Evans et al., 1996). Positive health benefits of the consumption of grape juice, such as improvement of the endothelial function, increase of the serum antioxidant capacity, protection of LDLs against oxidation, decrease of native plasma protein oxidation, and reduction of platelet aggregation, have also been reported (Chou et al., 2001; Dayet al., 1997; Keevilet al., 2000;OByrneet al., 2002; Steinet al., 1999) Grapes were halved and heated in stainless steel containers to minimize heating time. The container with the grapes was held in a water bath at 5 °C above the desired temperatures of 60, 75 and 90 C (only 90 C for Concord grapes). The heating time to reach the respective temperatures was 20 min (3 min). The total mass of grapes heated per test was approximately 500 g. For Thompson seedless grapes, juice was extracted from grapes after each treatment using a centrifugal juice extractor. A muslin cloth was used as a screen to reduce the pulp fraction of the juice. Due to the small size of the juicer, juice was extracted in two stages with fresh muslin cloth to negate the effect of caking on juice yield. The grape juice useful for Maintains Cholesterol Levels, Maintains Heart Health, Cures Digestive and Bowel Disorders, Boosts Immunity, Delays Ageing Signs, Prevents Cancers, Relieves Debilitating Headaches, Improves Metabolism, Regulates Periods, Maintains Bone Strength, Instant Energy Booster. Fig.2 shows the flow chart for the preparation of grape juice.

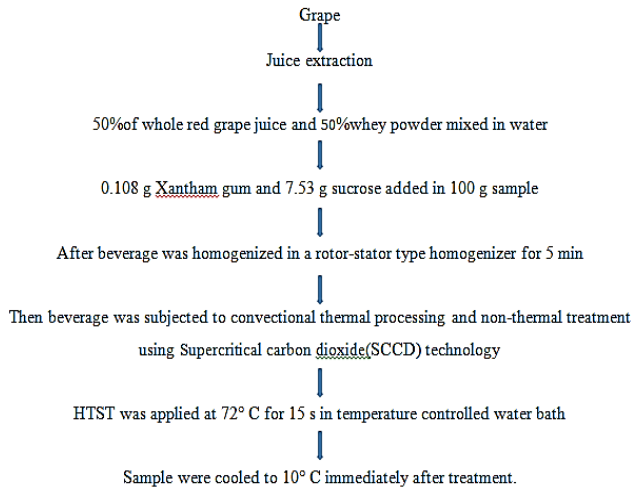

Fig. 2 Flow chart for grape juice:

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2.2 Grape vinegar:

The fermented fruit grape products – wine (alcoholic) and vinegar (alcoholic and acetic fermentations) – are also rich in polyphenols. Vinegar is a common food product that is widely available in the market. There are two types of vinegar, cider vinegar and normal vinegar. Cider vinegar is made from fruit juices (Madrera et al., 2010), whereas normal vinegar is made from raw plant materials, such as grains, apples, grapes or sugarcane (Junior et al., 2014). In addition to being consumed directly, vinegar plays an important role in the production of food products, as it is applied in a wide variety of products, including sauces, ketchups and mayonnaise. Cider vinegar is a highly beneficial drink, as it helps to promote different kinds of beneficial effects to consumers, such as having antidiabetic effects and lowering cholesterol levels in blood by inhibiting the oxidation of low density lipoproteins (LDLs), among other benefits (Salbe et al., 2009; Laranjinha et al., 1994) There are two main biotechnological processes involved in the production of vinegar, alcoholic fermentation (in the presence of yeast, e.g., Saccharomyces cerevisiae) and acetous fermentation (in the presence of acetic acid bacteria) (Budak et al., 2014; Ordoudi et al., 2014). Alcoholic fermentation is the conversion of sugar to alcohol, while acetous fermentation is the conversion of alcohol to acetic acid. There are two types of methods for producing vinegar, the conventional method (Orleans method) and the rapid methods (submerged and generator methods) (Dabija & Hatnean, 2014; Tan, 2005) There are a few types of vinegars, classified based on their raw materials and fermentation process. Rice vinegar is the aged and filtered product obtained from the acetous fermentation of sugars derived from rice. It is excellent for flavouring with herbs, spices and fruits due to its mild flavour. It is widely used in Asian dishes because it does not significantly alter the appearance of the food (Yano et al., 1997) According to Etherton et al. (2004), bioactive compounds affect physiological or cellular activities, resulting in beneficial health effects. Bioactive compounds promote better and more effective health benefits compared to nutrients (Etherton et al., 2004). Bioactive compounds are claimed have the ability to modify the risk of disease rather than prevent diseases. Vinegar has high antioxidant activity, antimicrobial properties, antidiabetic effects and therapeutic properties (Budak et al., 2014), which could offset the development of the above mentioned diseases. The Food Safety and Standards Authority of India (2012) states that vinegars are products obtained by the alcoholic and acetic acid fermentation of any suitable medium such as fruit, malt, or molasses, with or without the addition of caramel and spices. They shall not be fortified with acetic acid. The acidity, calculated as the acetic acid content, shall not be less than 3.75% (m/v), the total solids (m/v) shall not be less than 1.5%, and the total ash content shall not be less than 0.18% (Food Safety and Standards Authority of India, 2012). Fig.3 shows the process flow chart for Vinegar production.

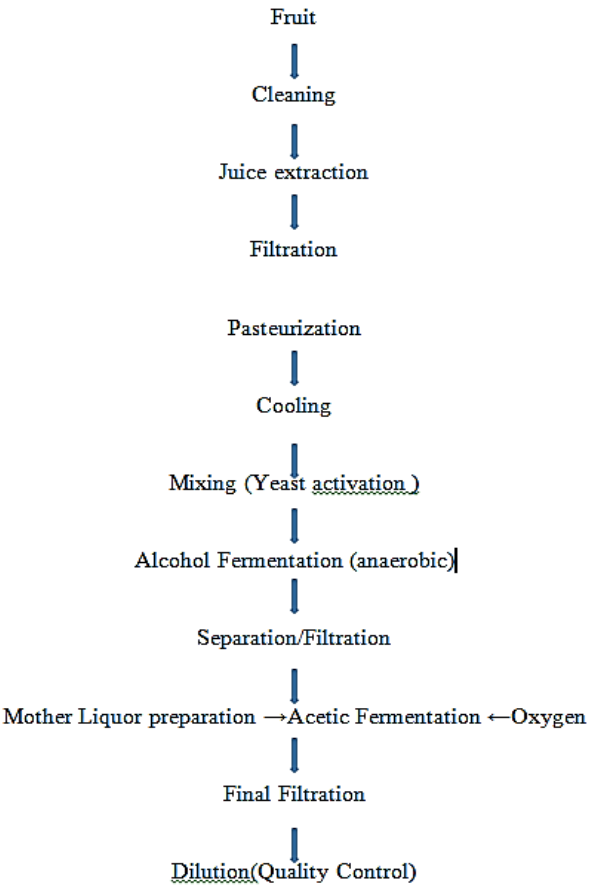

Fig. 3 Process flow chart for vinegar preparation (Simon Hailu et al., 2012)

2.3 Grape wine

Red wine contains antioxidants, called flavonoids, which reduce the risk of coronary heart disease by decreasing the bad cholesterol (low-density lipoprotein-LDL), and boosting the good cholesterol (high-density lipoprotein-HDL). Research has shown that a daily dose of red wine is linked to, on average, a 12% increase in HDL (Catanese, 2013) Heart disease can be preventable and controllable through healthy diet and lifestyle choices. With moderate red wine consumption, the risk of death by heart disease and heart attack can be reduced by 30–50% (Catanese, 2013) The production of grape wine involves the following basic steps: crushing the grapes to extract the juice, bulk storage and maturation of the wine in a cellar, clarification and packaging. Fig. 6 shows the flow chart for preparation of

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grape wine. Although the process is fairly simple, quality control demands that the fermentation is carried out under controlled conditions to ensure a high quality product. (Yarrow, 1988). Wines made with indigenous or 'wild' yeast are perceived to be more complex by showing a greater diversity of flavors, however, the chemical basis for the flavor characteristics is not yet defined. Pairs of wine were prepared from the same must and subjected to similar fermentation conditions in the wineries of origin, except for the mode of inoculation. Reference wines were made by inoculation with a Saccharomyces cerevisiae starter culture whereas companion wines were allowed to undergo fermentation with the indigenous micro flora. Of all wine chemicals analyzed, only yeast-derived volatile fermentation products showed significant differences between the yeast treatments. Inoculated wines were associated with the esters, ethyl hexanoate and 3-methylbutyl acetate and formed a clear cluster by principle component analysis. By comparison with inoculated wines, 'wild' yeast fermented wines showed high variability in volatile compounds that contribute to wine aroma with higher concentrations Varela et al.,2009). Fig.4 shows the process flow chart for the grape wine production.

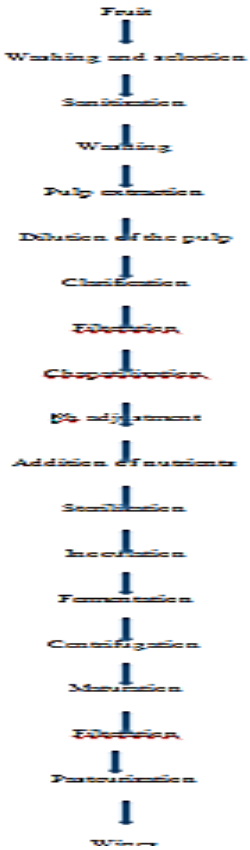

Fig. 4 Flowchart for preparation of wine from grapes

2.4 Grape jam:

Grapes are using as fresh fruit (table grape) and processed fruit such as jam, grape juice, jelly, molasses, and raisins). Grapes, considered as a rich source of polyphenolic compounds, have tremendous potential for use in the development of such products (Threlfall et al., 2005) Jam and fruit preserves are made from fresh, frozen, concentrated, or previously canned fruit that is cooked with sugar (and added pectin, if required), until enough water has evaporated and it gels. The total soluble solids (TSS) should be >65 %.(Leslie et al.,). Fig. 5 shows the process flow chart for grape jam processing.

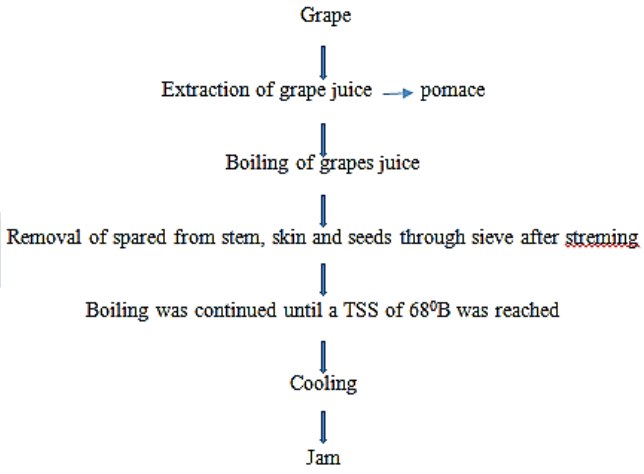

Fig.5 Process flow chart for grape jam processing (Anamaria pop et,al, 2017)

2.5Resins

Resins play important role in controlling the Diabetes, exercise, and sugar metabolism. About 382 million people had diabetes worldwide and more than 60% lives in Asia, also 20.8 million people in the United States, 48 million in Europe have diabetes, a serious, life-long condition. There is also a rising prevalence of type 2 diabetes mellitus in children and adolescents. Overall, the risk of death among people with diabetes is about twice that of people without diabetes of similar age. Diabetes also increases the risk of heart disease, and complications include damage to the retina, kidneys, and peripheral nerves. Controlling blood glucose levels and keeping these closer to normal values lowers the risk of disease and death from complications. Because dietary carbohydrates have the most direct impact on blood glucose levels, controlling the amount of carbohydrate consumed per meal is the focus of diabetes nutrition management.

Dipping of grape bunches in solution of 15 ml ethyl oleate and 25 g potassium carbonate/l for 2- 4 minutes is common practice. Some commercial grape drying oils are available in the market and extensively in use. The dipping durations

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significantly affected the moisture content, colour intensity other quality attributes

Drying of grapes varies in different parts of the world, depending on the cultivation Conditions. There are three main methods that are used in raisin production; sun drying, shade drying, and mechanical drying. The sun drying method has several disadvantages including, the possibility of environmental contamination due to dust and insect infections, physical microbial deterioration caused by rain, and color deterioration due to intense solar radiation. Fig. 8 shows the grape resins produced by solar drying method. Moreover, removal of contaminants (e.g., small stones, soil, leaves, dust, etc.) collected for the period of raisin gathering is tedious during the raisin cleaning process (Kumar. 2013) hence, using this method, raisins of low quality are produced due to uncontrolled drying conditions and environment. In recent years, new methods of indirect solar drying have been developed there is a lack of research and development on rehydration phenomenon during the washing step. Because of an increases in the moisture content of the dried product during the washing, especially when the grapes have been partially dried or washed off before packaging, one additional step, finish drying is needed in order to control the amount of the moisture content. The efficiency and quality of the post-drying operations are significantly influenced by chemical properties like sugars, carbohydrates, fat, protein, vitamin, minerals and physical properties like size, shape, sphericity, bulk density, true density of the dried grapes.Fig.6 shows the grape resins.

Fig.6 Grape resins

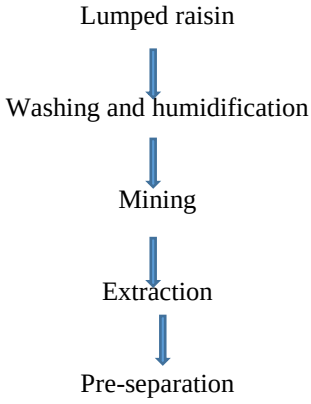
2.6 Preparation of grapes pekmez:

Pekmez produced for a long time in Turkey, is one of the most common names of a concentrated and a shelf-life extended form of grape juice produced by boiling without the addition of sugar or other food additives (Gokcen et al.1982). Therefore, it can be assumed to be a natural food containing natural sugars such as glucose, fructose and minerals (Kaya and Belibagli 2002).

The grape juice was concentrated to 76%total soluble solids by vacuum. Gelling treatments were designed to produce a solid pekmez by adding high or low methoxyl pectinsor carboxy methyl cellulose (CMC). It was found that sufficient gelling could be achieved using less than 0.5% CMC and 1% for either pectin. Also, a desirable white color was obtained with 1.5% soapwort juice and 3% egg white with the combination of1% pectins (Batu 1990; Tosun and Ustun 2003). The research was carried out to evaluate gelling and bleaching agents for white solid pekmez production. Grape juice with 26°B total soluble solids was used for the production of pekmez. Acidity was reduced with the application of sterile white soil containing 70.4% $CaCO_3$, followed by tannin–gelatin clarification and filtration. Pekmez is produced from the juices of fruits such as grape, water melon, apricot, prune, mulberry and sugar beet, all of which contain sugar. However, the grape is the most common fruit used in processing pekmez in Turkey. It is produced by concentrating juice up to 70–80% total soluble solids (TSS) content (Batu 1991). Pekmez is consumed mainly at breakfast, particularly in winter, sometimes by blending with sesame paste instead of jam or honey. Sesame paste is made from ground, hulled, dry roasted sesame seeds and is a popular food in Turkey (Alpaslan and Hayta, 2002).

Pekmez contains approximately 293 kcal/l00 g of energy and is also an important source of organic acids and mineral materials. It also contains100 mg/kg iron and 4000 mg/kg calcium. Grape juice and pekmez contain high amounts of glucose and fructose in almost equal quantities; no sucrose and very small amounts of proteins are present (Artık and Velioglu 1993). Because most of pekmez carbohydrates are in the form of glucose and fructose, it easily passes into the blood without digestion. This is of nutritional importance, especially for babies, children, sportsmen and in situations demanding immediate energy (Batu 1993; Tosun and Ustun 2002). Fig.7 shows the process flow chart for Pekmez preparation. Fig.8 shows the grape pekmez.

Lumped raisin



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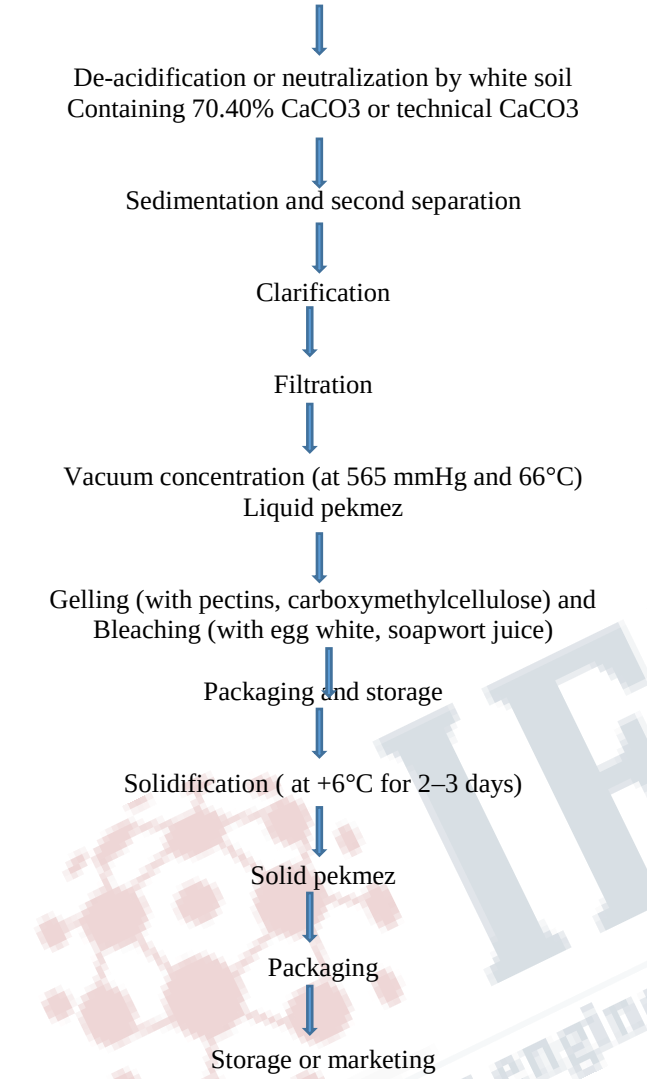

Fig. 7 Flow chart for preparation of pekmez

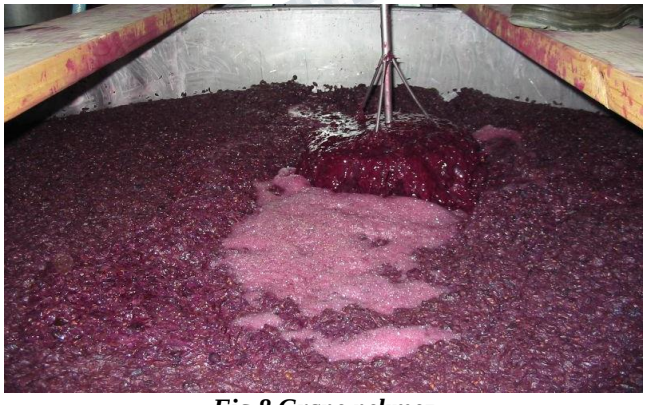

Fig.8 Grape pekmez

III. CONCLUSIONS

India's grapes production is higher in the world; hence its market value in India is less. Grapes constitutes maximum post harvest losses. Value added products such as juice, vinegar, jam, wine, pekmez and resins increases the economic value of the grapes. These value added products highly accepted in all over the world by consumers in every group. These value added products have high medicinal uses such as controlling diabetes. Shelf life of the value added products are higher than fresh grape fruits. Grape products are available throughout the year. Which increases the economical level of the farmers hence the value added product preparation from grape is beneficial.

REFERENCES

1. Amaral, G. V., Silva, E. K., Cavalcanti, R. N., Martins, C. P., Andrade, L. G. Z., Moraes, J.and Silva, M. C. (2017). Whey-grape juice drink processed by supercritical carbon dioxide technology: Physicochemical characteristics, bioactive compounds and volatile profile. Food chemistry, 239, 697.

2. Batu, A. (2005). Production of liquid and white solid pekmez in Turkey. Journal of Food Quality, 28(5-6), 417-427.

3. Batu, V. (1993). A generalized two-dimensional analytical solute transport model in bounded media for flux-type finite multiple sources. Water Resources Research, 29(8), 2881-2892.

4. Budak, N. H., Aykin, E., Seydim, A. C., Greene, A. K., &Guzel-Seydim, Z. B. (2014). Functional properties of vinegar. Journal of Food Science, 79(5).

5. Catanese, M. T., Uryu, K., Kopp, M., Edwards, T. J., Andrus, L., Rice, W. J., & Rice, C. M. (2013). Ultrastructural analysis of hepatitis C virus particles. Proceedings of the National Academy of Sciences, 110(23), 9505-9510.

6. Dabija, A, andHatnean, C. A. (2014). Study concerning the quality of apple vinegar obtained through classical method. J Agroaliment Process Technol, 20(4), 304-310.

7. Dharmadhikari, M. (1994). Composition of grapes. Vineyard Vintage View Mo State Univ, 9(7/8), 3-8.

8. DAY, J. S., GOULD, K. S., and JAMESON, P. E. (1997). Vegetative architecture of Elaeocarpushookerianus. Transition from juvenile to adult. Annals of botany, 79(6), 617-624.

9. Gokcen, N. A. (1982). Multicomponent regular solutions. ScriptaMetallurgica, 16(6), 723-727.

10. Higgins, L. M., and Llanos, E. (2015). A healthy indulgence? Wine consumers and the health benefits of wine. Wine Economics and Policy, 4(1

11. Junior, F. R. L., Osiro, L., and Carpinetti, L. C. R. (2014). A comparison between Fuzzy AHP and Fuzzy TOPSIS methods to supplier selection. Applied Soft Computing, 21, 194-209.

12. Keevil, J. G., Osman, H. E., Reed, J. D., and Folts, J. D. (2000). Grape juice, but not orange juice or grapefruit juice, inhibits human platelet aggregation. The Journal of nutrition, 130(1), 53-56.

13. Kris-Etherton, P. M., Lefevre, M., Beecher, G. R., Gross, M. D., Keen, C. L., and Etherton, T. D. (2004). Bioactive compounds in nutrition and health-research methodologies for establishing biological function: the antioxidant and anti-inflammatory effects of flavonoids on atherosclerosis. Annu. Rev. Nutr., 24, 511-538.

14. Laranjinha, J. A., Almeida, L. M., and Madeira, V. M. (1994). Reactivity of dietary phenolic acids with peroxyl radicals: antioxidant activity upon low density lipoprotein peroxidation. Biochemical pharmacology, 48(3), 487-494.

15. Macheix, J. J., &Fleuriet, A. (1990). Fruit phenolics. CRC press.

16. Madrera, R. R., Lobo, A. P., and Alonso, J. J. M. (2010). Effect of cider maturation on the chemical and sensory characteristics of fresh cider spirits. Food research international, 43(1), 70-78.

17. Paranjpe, S. S., Ferruzzi, M., and Morgan, M. T. (2012). Effect of a flash vacuum expansion process on grape juice yield and quality.

18. Razavi, S. M., Najafi, M. B. H., and Alaee, Z. (2007). The time independent rheological properties of low fat sesame paste/date syrup blends as a function of fat substitutes and temperature. Food Hydrocolloids, 21(2), 198-202.

19. Rice-Evans, C. A., Miller, N. J., and Paganga, G. (1996). Structure-antioxidant activity relationships of flavonoids and phenolic acids. Free Radical Biology and Medicine, 20(7), 933-956.

20. Russ, W., and Meyer-Pittroff, R. (2004). Utilizing waste products from the food production and processing industries. Critical reviews in food science and nutrition, 44(1), 57-62

21. Salbe, A. D., Johnston, C. S., Buyukbese, M. A., Tsitouras, P. D., & Harman, S. M. (2009). Vinegar lacks antiglycemic action on enteral carbohydrate absorption in human subjects. Nutrition research, 29(12), 846-849.

22. Simon Hailu, ShimelisAdmassu and Yogesh Kumar Jha (2012)'Vinegar Production Technology, An Overview', Food Process Engineering Program, Department of Chemical Engineering, Addis Ababa University, Ethiopia beverage & food world

23. Stein, R. T., Sherrill, D., Morgan, W. J., Holberg, C. J., Halonen, M., Taussig, L. M., & and Martinez, F. D. (1999). Respiratory syncytial virus in early life and risk of wheeze and allergy by age 13 years. The Lancet, 354(9178), 541-545.

24. Tosun, I., & Ustun, N. S. (2003). Nonenzymic browning during storage of white hard grape pekmez (Zile pekmezi). Food Chemistry, 80(4), 441-443.

25. Threlfall, A. G., Pilkington, L., Milsom, K. M., Blinkhorn, A. S., and Tickle, M. (2005). General dental practitioners' views on the use of stainless steel crowns to restore primary molars. British dental journal, 199(7), 453-455.USDA (2006) Production status of grapes.

26. Varela-Lema, L., Fernandez-Villar, A., and Ruano-Ravina, A. (2009). Effectiveness and safety of endobronchial ultrasound–transbronchial needle aspiration: a systematic review. European Respiratory Journal, 33(5), 1156-1164.

27. Vickers, J., and Yarrow, G. (1988). Regulation of privatised firms in Britain. European Economic Review, 32(2-3), 465-472.

28. Yano, M., Harushima, Y., Nagamura, Y., Kurata, N., Minobe, Y., and Sasaki, T. (1997). Identification of quantitative trait loci controlling heading date in rice using a high-density linkage map. TAG Theoretical and Applied Genetics, 95(7), 1025-1032.