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Vinegar: a traditional functional food

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Abstract

Vinegar having near about 5% acetic acid incorporated in water. Traditionally vinegar implemented in food preservations applications. Vinegar production mechanizations assortments implementation of wooden carks, traditional process (Orleans), Generator process for operation of submerged fermentation. Incorporation of Acetobacter species for transformation of ethyl alcohol into acetic acid. Vinegar has numerous medicinal as well as theoretic potentials. It has great influence on brain. Physical as well as chemical attributes of vinegar are analyzed. The aim of this article are to study historical aspects, chemical formulation during fermentation, production methods and mechanizations, varieties, functional parameters, safety, quality control and electrochemistry application.

Keywords: *Vinegar, Acetic acid, Functional properties, Mechanization, AAB.*

Introduction

The vinegar is introduced over the world before 10,000 previous year (Tan 2005; Johnston and Gaas 2006). From nearly about 5000 years vinegar is comes in differential flavors as well existing in market as profitable product. The references from Hippocrates and Old Testament show that the wounds were cured medically by the use of vinegar. Sung Tse, who had used a vinegar and sulfur as a hand sanitizer for prevention of various infections (Budak et al. 2014). Poison ivy, high fever, stomachache, croup and dropsy were cured by

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U.S. medical practitioners by the application of vinegar in 18th century. In year 1778 Durande determined glacial acetic acid from vinegar as well as in 1814 Berzelios performed an examination of acetic acid. After that in 1832 Schutzenbach formed a technique called generator process to manufacture vinegar, it produces vinegar within 3-7 days. In 1955, Hromatka designed a technique for vinegar production called as a submerged acetification which uses stirring and aeration system to form vinegar speedily (Tan 2005).

Traditionally vinegar is generated from raw products holding starch as well as sugar. In two stage fermentation initially ethanol is produced and after that acetic acid is produced. In a traditional method vinegar production takes elongated time interval for fermentation nearly about 30 days as well as it act as starter culture in vinegar production at commercial platform, commercial production is completed in 24 hours. Fruit juices, apple, coconut, plum, tomato, grape and potato are used to produce traditional vinegar. In environment acetic acid bacteria is present everywhere which may spread in food material containing saccharidesas well as in form of fermented material elongating alcohol. Diversities of acetic acid bacteria have been observed in altered types of vinegars including rice, industrial vinegar, traditional balsamic, red wine, white wine, spirit and cider which are formed by submerged culture elongated continues air supply (Bhat et al.. 2014).

Vinegars are generally implemented for preparation of mayonnaise, pickling of fruits as well as vegetables, mustard, salad dressings as well as additional food condiments. It is incorporated in food practices for enhancement in taste as well as purposeful properties (Tan 2005). Many nutritional researchers promotes to regular consumption of bioactive substances. In various scientific and lay publications the purposeful food properties of vinegar have been reported. The functional healing characteristics of vinegar consist of antioxidant activity, prevention of cardiovascular disease, blood pressure reduction, cardiovascular disease,

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lessening in the effects of diabetes, antibacterial activity and increased vigor onwards completion of exercise (Kondo et al.. 2001). Babylonians started marketing of vinegar in global market having numerous flavors like honey, fruit, malt, apple cider from 6th century. Mazza and Murooka (2009); Ou and Chang (2009) are reported importance of vinegar with health attributes therefore, demand on vinegar is enhances globally.

Tan (2005); Bhat et al., (2014) proposed the combination of acetic acid as well as yeast (produced due to longer fermentation times having harmless slime) called as *mother* of vinegar. For preservation purpose most of commercial vinegar producers are pasteurize as well as filtration vinegar before start packaging operation to protect from forming. Some time it is also found that while storage there is chances of producing *mother* and it is also found that is nontoxic in nature. The tart flavor, overpowering smell as well as sharp odor of vinegar is due to volatile natural acids are present within acetic acid results to such things (Johnston and Gass 2006). Except this vinegar having various constituent like vitamins, minerals, amino acids, as well as phenolic compound and nonvolatile natural acids (Natera et al.. 2003; Morales et al.. 2002).

Each and every country is having there differential standards behind presence of % of acetic acid in in different types vinegar follows as United States optimum 4% , European region 4%-7% (distilled vinegar) as well as apple cider vinegar and wine vinegar optimum limit is 5%-6% . On the basis of production method as well as raw material vinegars are classified in two strata following as herbal/organic as well as fruit vinegar. White vinegar is comes under the category of herbal vinegar because of garlic, basil, cinnamon, clove, tarragon as well as nutmeg are incorporated at the time of seasoning process. Fruit wine taken raw for development of fruit vinegar as raw material. Earlier, vinegar is produced as per regional preference as well as availability of raw material (Johnston and Gass 2006: Bhat et al.. 2014; Budak et al.. 2014).

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Background and historical aspects of vinegar

Transformation of ethyl alcohol towards acetic acid with incorporation of species of bacteria named as *Acetobacter* it is results to production of vinegar. Hence, any material which containing saccharides having potential to produce vinegar undergone fermentation treatment having differential concentration combination of alcohol and water. It is physical appearance is totally depends on raw material as well as conditions of fermentation and production method. According to information provided by vinegar institute, vinegar is invented over 10,000 years back. Although, use of flavored vinegar has been invented, manufactured and consumed over 5,000 years back. Vinegar is globally oldest cooking material and also act as food preservative (class 1 preservative). Now a days there are large number of varieties of vinegar is existing in market but, it is not new BC 6 centuries, Babylonians manufactured vinegar having various flavors (honey, rice, malt etc.). In 1100 "Albucases" proposed a statement colorless vinegar essential minimal fire for distillation .In fifteen century statement is given by scientist named as "Basilius Venlentinus" a weak vinegar gives a strong final quality. In the time period of 1650 to 1700 Gerber introduced the theory related to enhance the productivity of wine vinegar with application of distillation process. The chemist named as Stahl in the time interval of eighteen century invented sour principle of vinegar of acetic acid (Tan 2005).

Production Percentage and Uses of vinegar

As per the information given by Tan (2005), Sale is enhanced 15% within the time interval 2000-02 .If we compare it to other sauces, wine, meat marinades vinegar is stronger competitor. In 2003 meeting of vinegar institute, sale is enhanced 29% as compared with last nine years. As per the survey peoples prefers bottled vinegar. As per all statistical data analysis it is found that there is continues enhancement in sale of vinegar.

Chemical reactions during vinegar production

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Scientist named as 'Dobereiner' proposed a theory of production of acetic acid from ethyl alcohol as per the given Figure 1 (Bhat et al.. 2014). Basically, for formation of acetaldehyde, two ions of hydrogen and also lose two electrons to dehydrogenation of alcohol. After that Hydrogen ions are link with oxygen to production of H2O to formation of aldehyde with incorporation of hydration. Finally, at the time production of acetic acid is undergone two ions of hydrogen as well as two electrons by conversion of aldehyde dehydrogenase to acetaldehyde as per Figure 1 (Tan 2005).

Mechanization of vinegar production

A raw material which containing starch having potential to undergone fermentation process through ethanol as well as acetic acid fermentations (Morales et al. 2001). Vinegar is probably used for numerous application of product development (Tan 2005; Bhat et al. 2014). While, Production first stage is transformation of sugar present in fresh material to alcohol with inoculation of yeast. Remaining alcohol is get reacted with acetic acid with incorporation of AAB (acetic acid bacteria) up to final fermentation is undergone (Gullo and Giudici 2008). Numerous method of vinegar making are existing nonetheless, probably two methods are probably used in commercial production of vinegar.

Tesfaye et al. (2002) proposed that many modern equipment are introduced in market to enhance production as well as interval of time in commercial level. Actually it this system the rate of conversation ethanol to acetic acid is speeds up with incorporation of acetic acid bacteria (AAB). Among two first one is "Surface method" in this method wood shavings are used in fermentation process as per Figure 2. Acetic acid bacteria (AAB) culture is survive and results to acceleration in rate of fermentation (supplies oxygen by the surface). Second method is follows as "submerged fermentation" the specialization of this method is regular

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supply of oxygen is regulate commercial production rate in large scale ` 2 (Garcia-Parilla et al. 1997)

Production Methods

Orleans Process

Orleans process is known as French process because, since 1670 it is implemented for vinegar production in small scale as well as large one. It takes longer time duration for production therefore, known as slow process. Important thing about this process it takes optimum for fermentation if wine containing less than 5% alcohol. If alcohol content is present below 5% then it should be called as: spirit vinegar". In that case phosphates as well as nitrogen containing material incorporated with mash. Bhat et al. (2014) was proposed that orleans process is finest process of vinegar production in case of production of table vinegar (Bhat et al.2014). Wood barrel is used for completion of this process which having specification like while fermentation it is mandatory barrel is fulfilled with fermenting liquid up to 75% of the total volume (Bhat et al.2014: Tan 2005). At the lower position of wooden barrel kept small holes above liquid level, holes are quite exposed as well as enclosed with mash screen. After that newly produced (fresh) vinegar (20-25%) is incorporated in barrel (Bhat et al. 2014; Tan 2005; Budak et al. 2014).

Reason behind incorporation of fresh vinegar is follows acidification of liquid in barrel at minimum development of acetic acid bacteria (Cruess 1958). Due to generation of mucus layer on upper side of liquid within wooden barrel acetic acid bacteria is settled down. Tan (2005) proposed that for production of vinegar by orleans method it takes near about 30-90 days with implementation of 70ºF- 85ºF. After completion of standard time period as recommended 1/4-1/3 of final production is advantageous for marketing purpose after

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bottling as well as providing initiate storage conditions. To reduce risk of oxidation addition of alcohol sources is mandatory (Cruess 1958).

Generator fermentation process

A fermentation system which is introduced for vinegar production in nineteen century Trickle method. Today generator method as well as quick method is update names of this method. It is introduced German scientist named as Schutzenbach in 1832 (Tan 2005; Bhat et al. 2014). Beach wood, charcoal, wood shaving as well as coke are used as non-compacting in generation fermentation system, acetic acid bacteria is produce a gunge layer around non-compacting material shows in figure 3. Wooden discordant bottom or floor which having 2000 cubic feet capacity in which non-compacting material is crammed. Fermenting liquescent is circulated over crammed material, within that system flow rate of air is continuously in progress (Tan 2005).

The rate of oxygen flow is effects time needed for production as well as final products quality, Continuous oxygen supply is minimize fermentation time interval (Cruess 1958). Lower oxygen concentration means lower acetic acid production. Figure 4 indicates oxidation as well as improper temperature combination thoroughly scrutinised by generator (Tan 2005). Total fermentation procedure for production of vinegar is take near about 72-168 hours. 2/3 portion of total vinegar production introverted from tank also add mash enlarge mash in fermentation tank (Cruess 1958). Acidification temperature for fermentation is 70°F (21.1°C). Minimum temperature for fermentation in generator process is 85-90°F (30-32.20°C) (Tan 2005). Optimum temperature is needed for activation of *Acetobacter* is near about 86°F (30°C). To minimize delinquent of over warmness as well as subsequent deactivation of acetic acid bacteria temperature monitoring is needed (Bhat et al. 2014).

Submerged fermentation process

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Now a days most popular as well as productive (high yielding) vinegar production method is submerged fermentation method speciality of this process fermentation conditions are able to monitored viz, continues air supply, stirring, heating and may more (Tan 2005). Submerged fermentation process is probably implemented in commercial vinegar production, it is cheapest production method as compare with other existing method. Mash is stimulated continuously as well as continues supply of air is needed for completion of this process (De Ley et al.1984). For regulating minimum temperature within fermenter heat exchanger is incorporated inside the fermenter through fermentation process (De Ory et al. 1999). Irregular sequence of acetification is constituent of fermentation system, after completion of each and every sequence of acetification volume of acetic acid is released and collected for bottling purpose and remaining volume is get replaced by mash (De Ory et al. 2004). Allgeier and Hildebrandt (1960); Tan (2005) proposed 86°F (30°C) is most common temperature for production of quality vinegar (11%-12%) at commercial level. Sometime acetic acid bacteria is get scratched due to enhancement in temperature over 86°F. Fermentation condition is effect on acetic acid bacteria (AAB) as well as acetic acid bacteria (AAB) is impacts on final volume of acetic acid (Fregapane et al. 1999).

Turbine mechanism

Turbines are used for inhalation of continues air supply inside the tank through liquid. Turbines systems are monitored by autonomously with incorporation of electronic media. Vinegar is driven out from machine as well as after completion of this operation machine is fulfilled with wine. This kind of turbines systems are implemented in commercial vinegar production for those kinds of industries wanted to achieve production of 50,000 litres of vinegar/annum (Tan 2005; Hailu et al. 2012; Bhat et al. 2014).

5.1.3.2 Venturing air system

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As alternative to turbines which having near about similar specifications and available in cheapest cost and size reduction format. Venturi air system is implemented for pumping of alcoholic liquid then, release it in tank which is made by stainless steel. Air is immersed with involvement ofair nozzle, which through air to liquid. Air bubbles having similar specification in dimensional format turbines bubble (Hailu et al. 2012). For completion of complete treatment venturing air system is take near about 30 times more time than turbine system, but if looking towards quality attributes it has good sensorial as well as nutritional rich as compare with turbines. Because of low amount of supply of air is not effect on loss of flavor (Kocher et al. 2006). Vinegar obtain from these machines is always having good characteristics in all kind of manner as fruitier. The changes are comes after manual monitoring of acetic acid level with pump. Operation of replenishing is completed with outermost pump (Bhat et al. 2014). The machine is convenient to use, it comes in variable formats which is having capacity of 20 litres- 66 litres. Venturi air system is used over the world for vinegar produced who wanted to take production in all scales (Tan 2005; De Ory et al. 2004).

Important factors of vinegar production

Raw material

Numerous raw material is incorporated in system of vinegar production viz, liquid (alcohol rich), *Acetobacter,* AAB, oxygen, fruits, herbs as well as seasoning agent (Tan 2005).

Alcoholic liquid

Wine as well as beer are most probable alcoholic material which is used for in diluted custom for production of vinegar. In addition to that alternatives to beer as well as wine many

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other raw material are already existing in system viz, rice, sugarcane, malt undergone with fermentation treatment to achieve alcoholic liquid. After collection of alcoholic liquid some treatments are given before starting vinegar production follows as pasteurization as well as filtration (Hailu et al. 2012; Kocher 2006).

Flavor enhancing agent

For production of flavoured vinegar herbs as well as fruits having numerous specific functionality are incorporated in vinegar production system. Category of herb tarragon, garlic, basil are implemented. Apple, pomegranate, lemon as well as cherries are incorporated (Tan 2005; Hailu et al. 2012).

Acetic acid bacteria (AAB) role in fermentation

As per table 1 *Acetobacteriaceae* domestic is origin of acetic acid bacteria (AAB) bacterial division. Acetic acid bacteria(AAB) having special characterization as it is obligate aerobes having strain may be gram negative or gram variable with catalase is having positive as well as oxidase having negative. Rods are non-performing in nature and having shape like ellipsoidal (Sengun and Karabiyini 2011).Minimum temperature range for activation Acetic acid bacteria (AAB) is 25 °C to 30 °C as per figure 2. Preferable pH range is 5.0-6.5. It is reported that acetic acid bacteria (AAB) have the potential to restrict acidic conditions within pH 5.0 (Trcek et al. 2000; Gullo and Giudici 2008). As per Table 1 in commercial vinegar production two main species of AAB are incorporated in system are *Acetobacter*and*Gluconobacter*. It accelerates rate of production rate of industrial vinegar.

Acerobacter Oxidizes alcohol favorably terminated above glucose. Genus named as *Glucanobacter* potent to oxidize glucose briskly as compare with ethanol (Budak et al. 2014; Yamada 2000; Gullo and Giudici 2008). For the production of numerous types of vinegar

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differential species of acetic acid bacteria (AAB) are used table 1. While production of vinegar AAB needs oxygen to activate. For production of traditional vinegar "slower surface method" is probably used. For progression of AAB needs proper initiative contact between air and liquid as per figure 3. Submerged fermentation method is implemented for production of industrial vinegars, acetic acid bacteria (AAB) are incorporated via oxygen by regular air circulation with help of spreader in acetifying solution (Fern´andez-P´erez et al. 2010). At the time of production of vinegar fermentation is takes place in that process many organic acids are produce i.e., Acetic, citric, formic, lactic, malic, succinic, and tartaric acid (Sengun and Karabiyikli 2011).

Yeast

Yeast is important parameter of vinegar production it directly influences on rate of fermentation, flavor of wine as well as impact on final flavor of vinegar. The term yeast is said to be unicellular ascomycetous fungi having potential to reproduce by vegetative expansion. Yeast is not expands by sexual reproduction (Bhat et al. 2014). Sugar incorporated in alcoholic fermentation system as substrate, conversion of sugar into ethanol is takes place in influation of yeast *(Phylum Ascomycota*) (Rainieri and Zambonelli 2009).Yeast has great potential to endure acidity results to yeast is suggestively survive as well as growth is also observed in many kind of juices made from fruits. Because pH values of respective juices are below tolerance limit. Substrates incorporated in fermentation system mainly belonging to monosaccharides family viz, glucose, fructose as well as mannose (Bhat et al. 2014). Two molecules of pyruvate comes under glycolysis operation is known as Emdben-Meyerhof-Parnas pathway (EMP pathway). At the time of ethanol production molecules of pyruvate are reduced. Carbon dioxide is also reduced by enzymes pyruvate decarboxylate as well as alcohol dehydrogenase (Bhat et al. 2014). After completion of total process ethanol yield was

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about 65% against monosachharides substrates. But, productivity is get reduced up to 60% because of defeat of glucose. Production of vinegar on commercial scale, *Saccharomyces* species of yeast is implemented because they having higher potential to ferment sugary substrates, obtained sugary mass after fermentation process not impacts to alcohol content (Fleet 2003). *Syccharomyces cerevisiae* has potent to enhance production in anaerobic conditions. Starting culture of saccharomyces species influences on sensorial attributes including flavor and flavor retention time of final product, *Saccharomyces cerevisiae*or and *Saccharomyces bayanus* are most general species incorporated in cider vinegar production.

Definite yeast strain is responsible for ethanol, sugar, tannin, ester, methanolic, volatile acid as well as quality attributes during fermentation of apple juice. Kocher et al. (2006) reported that while transformation of sugarcane juice into ethanol with incorporation of *saccharomyces cerevisiae*. Previously produced vinegar is used for furthermore process of vinegar production (transformation of ethanol into acetic acid) with incorporation of bagasse, corn cobs, wood shavings, wood carks as well as charcoal (coke) functioning as adsorbed in fermentation system and entangled cell of *Acetobacteraceti*. Adsorbed incorporate in fermentation system having stability to produce cane vinegar in 28 days of time period through submerged fermentation method containing acidity ranges 5.9-6.7%.

Quality Characteristics of vinegar

The quality of vinegar is totally depend on process treatment that we promote at the time of production as well as depend on raw material incorporated in medium. The speed of fermentation is effect on sensorial properties of vinegar. As per some researchers opinion there is no difference in vinegar which is obligated from differential fermentation speeds. Professionals are always perceive valuable sensorial differences between two differential processes named as submerged culture and generator process (Tan 2005; Bhat et al. 2014).

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Aromatic characters of vinegar and quality evaluation

Aromatic characters of vinegar having numerous range of values which is obtained from physicochemical as well as sensorial attributes (Carnacini et al. 1992). For evaluation of quality of vinegar differential analytical attributes are estimated as well as sensorial evaluation. Presence of aromatic compound results to good quality of vinegar (Bhat et al. 2014). To evaluation of quality of vinegar many methods of evaluation is incorporated i.e., principal component analysis, cluster analysis (CA) as well as linier discriminant analysis (LDA) are implemented on vinegar which is produced by submerged fermentation in which wooden carks are incorporated in medium for fermentation .

To evaluate methanol, 1-propanol, ethyl propionate, 3-methyl-1-butanol, 2-methyl-1-butanol, acetoin, praline, as well as total acidity-oxidation gas chromatography (GS) and high performance liquid chromatography (HPLC) are used (Bhat et al. 2014). In wine vinegar five kinds of organic acids are present. Near about fourteen volatile compounds are present in in white vinegar in both terminology with aging or non-aging process (Morales et al.2001). In distilled vinegar acetic acid and as well as ethyl acetate are most probable compound which is present in wine as well as distilled vinegar respectively.

Influence of vinegar on brain

Sphingolipid is basic as well as important component of constructive block of brain tissues. Fukami et al. (2010) reported that AAB is having stability to produce originator of sphingolipid named as alkali stable lipids (ASL). AAB have potential to produce ASL therefore, dihydroceramide is part of AAB. It is observed that experimental rat afterward dealing up to 10 days the effect of dementia is on regular basis enhancement in connective ability happened. After that, signposted that due to ASL pheochromocytoma (PC12) in nurite is enhances also, dihydroceramide is having compelling impact. Fukami et al. (2009) and Fukami et al. (2010) reported that ingestion of vinegar is might be results to enhances mental

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ability of human brain as well as potent working ability of brain. As per other studies it is also hypothesized combination of sialic acid and oligosaccharides gangliosides were produced. Sometimes it's also found that ceramide stands to enhance Alzheimer tolerant symptoms.

Security of vinegar

Thousands of year back peoples are using vinegar as ingredient/component of food due to such kinds of reason use of vinegar is safe by general level. Till date there is a rare case in this obligated bad influence of vinegar on human health or mainly on gastro intestinal tract of human. In one case it is found that a women having age 39 is consumed rice vinegar by proportion of 1tsp directly results to inflammation of oropharynx as well as class b damage is causes in cardiac area and esophagus (Chung 2002). Injuries due to consumption of vinegar are very rare but main thing is that in this it gives notice to other consumers.

Inflammation in esophageal region is regulating chances of getting carcinogenic disorder. But, as we studied earlier research it is also found that vinegar is alterably used for curing esophageal carcinogenic disorder (Xibib et al. 2003). Laryngospasm and subsequent vasovagal syncope is causing due to consumption as well as aspiration of vinegar on unintentional basis that could be determined extemporaneously (Wreen et al. 2006). 28 year old women is consuming apple cider vinegar on regular basis 250 mL from last 6 years results to causing hypokalemia. Now a days in so many investigation it observed that vinegar is having potential to cure many diseases so before consuming make sure proper recommended amount as well as see previous background of vinegar.

Chemical analysis of vinegar

pH

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Association of analytical chemists (2000) reported method of pH analysis, Mechanization are as follows as take 10 gm of vinegar and miscellaneous with 100 mL deionized water then start centrifugation on 200 rotation per minute (rpm) for 20 minutes of time interval. Take supernatant from centrifugation tube then with help of pH meter or in alternation of that pH strips are used for evaluation (Adebayo-Oyetoro et al. 2017).

Titratable acidity

The acid content of vinegar was estimated by help of titration assembly (Radiometer Copenhagen). To evaluation of acidic content of vinegar it is recommended take results in triplicate. Following specification are needed 0.1 N NaoH solution as well as 8.4 is final point for acetic acid measurement (Association of analytical chemists 2000; Adebayo-Oyetoro et al. 2017). Tan (2005) reported formula for titratable acidity analysis as:

$$\text{Titratable acidity (TA \%)} = \frac{\text{(ml of NaOH) x (N of NaOH) x (60.05)}}{\text{10 x Sample Weight}}$$

Total phenol

Folin-ciocalteaus method which is comes under spectrophotometry is used for evaluation of total phenolic content in vinegar. For total phenol content reading is takes in triplicates (Adebayo-Oyetoro et al. 2017). Take 2 mL sample of vinegar then mixed with 50% ethanol having 50 mLl H3PO4 then transfer total volume in centrifugal tube which having volume of 15mL and keep it overnight in vibrating shaker at 200 rotation per minute (rpm), after completion of previous operation keep this solution at 4,500 rotation per minute (rpm) for 10 minutes (Tan 2005). Keep the solution at room temperature for 24 hours then take absorbance with help of UV-VIS scanning spectrophotometer. Take reading twice of each cuvette then, plot graph against standard curve (Adebayo-Oyetoro et al. 2017).

Physical analysis of vinegar

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Specific gravity

Specific gravity of vinegar is estimated for fastest measurement of alcohol content present in vinegar. It is calculated with help of equipment named as hydrometer. Implementation of this equipment gives accuracy in results because while estimation reading of each sample should have to take three times (Tan 2005).

Colour measurement

Colour measurement is get done with help of photometric colour index Association of analytical chemists (2000). Minolta Chroma MeterCR-210b is used for measurement of colour which having colour parameters as (lightness L*, a* and b*) then paralleled with standard (ceramic plate is used as standard).

Sensory analysis

Testing Panel

In a testing panel of sensory analysis nine nonsmokers, the age between 25 and 45 years old are selected. It is mandatory for panelist having practical and theoretical working out familiarity in sensory analysis. From all of this six are professional tasters and by more than 5 years' experience in tasting vinegars. As per Akinjayeju (2009) panelist have to express their judging skills as well as their potential to evaluate material (Tesfaye et al. 2002).

Standard tasting cup

For undertaken performance of study Tesfaye et al. (2002) suggested standard cups which is used for tasting of vinegar. Cup is made up of obscure glass which results to non-responsible for response of panelist.

12.3.3.Preparation of vinegar sample

Tesfaye et al.. (2010) proposed to start tasting procedure as per given protocol three vinegar sample is used. In this three sample each of them having different specification as

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well as named as i.e., OA, OB and OC. To take extension from vocabulary list, 11 varieties of vinegar sample is taken as representative alternately one synthetic vinegar is also taken. If we want to study components of trustworthiness for that we have to take 12 representative vinegar sample.

Protocol for tasting procedure

First of all we have remove lid covering from upper position of cup. Inoculate liquid within cup for 10 seconds, Ascent cup to regulate moisture to innermost area of cup having sample. Take smell of sample from middle portion of cup, Make sure that mark the place where pungent smell is most immersed. Rotate direction of cup towards 45° for preferable rotation of nose (Adebayo-Oyetoro et al.. 2017). Encouragement is going slowly, not became resultant up to implementation of own criteria.Time of evaluation with olfactory organ is not more than 15 seconds. If panelist is not able to make own design in that case take pause before trying newly. Finally through sample away and smell empty cup (Tesfaye et al. 2010; Bhat et al. 2014).

Descriptive sensory analysis of vinegar

Tesfaye et al. (2010) proposed for evaluation of vinegar sample profile method is preferred. The strength of every component was listed on nanostructured line having length 10 cm having characteristics of unnoticeability as well as heavy-duty rigidity at both points respectively (Tesfaye et al. 2010).

Varieties of vinegar

Vinegar having lots of health benefits, convenient for cooking parameters. High salt consumption results to blood pressure problems due to tangy taste of vinegar minimize use of vinegar, also various soups, Chinese food, salad dressing etc. Vinegar is available in lots of varieties in all over the world having different speciality and different characteristics depends upon country to country (Crisco Company 2005; Tan 2005; Bhat et al. 2014).

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White wine vinegar

White vinegar is most frequent kind of vinegar probably used in Italy and Turkey for household purposes. It is composed by ethanol which is obtain by fermentation of grain and sometime obtain from acetic acid made up on lab scale fermentation. Again, it is diluted with water. Whenever, it is used as cooking complement it gives much harsh flavour, as a cleaner it having great results around household level. It is made up from fruits, *Gluconocebacter europaeus* and *Gluconocebacter xylinus* AAB species are probably used for vinegar production as per table 1 (Tan 2005; Bhat et al. 2014).

Apple Cider Vinegar

Table 1 shows apple cider vinegar is prepared by apple. It is most frequent type of vinegar which is consumed not only in United States but also over the world. This vinegar having little citrus, tartaric also some fruit flavor used for cooking purpose (Tan 2005). It is generally used for enhances flavor of genuine cooking items like for salad dressing, marinades, condiments. *Acetobacter aceti, Acetobacter intermedius, Acetobacter pasteurianus, Gluconacetobacter Europaeus, Gluconacetobacter Hansenii, Gluconacetobacter xylinus* AAB bacterial species are used for production of apple cider vinegar(Budaket al. 2014).

Wine Vinegar

Wine vinegar is kind of vinegar which is introduced by Germany. Japan is most common regions frequently use wine vinegar. It is prepared by mixing red and white wine. Wine vinegar having extra flavor as compare to other ones due to infusion of clean raw hears, low moisture herbs as well as freshly harvested berries. Creative cooks often infuse wine vinegars with extra flavor by tucking in a few sprigs of well-washed fresh herbs, dried herbs, or fresh berries. Wine vinegar having natural touch of flavor of raspberry (Bhat et al. 2014).

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Assurance of good quality wine evaluate by final quality of vinegar. For preparation of good quality wine vinegar good quality wine (aging is takes place in containers of wood for large year of time period). Red wine is used for production of wine vinegar, *Acetobacter pasteurianus, Gluconacetobacter europaeus, Gluconobacter oxydans* are AAB bacterial species used for production of vinegar (Tan 2005; Budak et al. 2014).

Rice Vinegar

Generally, it having clear as well as pale yellow color. It is firstly introduced by Japan as per table 1. Where for preparation of sushi is use in high amount. Whenever we are check the chemical composition of rice it contents sugar. This sugar is used for the rice vinegar production, aged, filtration occurred, finally vinegar obtain (mild),It having organoleptic flavor it provides good emphasize to ginger or cloves, Occasionally sugar is incorporated. Rice is mainly classified into two main varieties white and black resulted to that rice vinegar also comes in two varieties, it is probably consumed in China. Vinegar (white rice) is frequently used in southern China and Asian region for Chinese food preparation. It is used for dressings of salads. Both varieties of vinegar are strapping than white vinegar. Its flavor because of fusion of sweet and tart, *Acetobacter pasteurianus* species of AAB used for vinegar production (Budaket al. 2014).

Malt Vinegar

It is made from malt and it has dark-brown in colour. It is mostly produced in the region of England, is reminiscent of deep-brown ale. Generally production of malt vinegar starts basically with the germination or sprouting kernels of barley. Germination develops suitable environment for the activation of enzymes into degradation of starch. As the degradation starts the sugar is finally convert into brewing (product) to malt occupied alcohol content, *Acetobacter pomorum* is incorporated at the time of production as per table 1 (Tan 2005).

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Balsamic vinegar

It have brown appearance as well as it is something sweaty and salty as per sensorial attributes. For production of balsamic vinegar white coloured trebbiano grape are used after that aging is takes place in wooden barrels. Among all the vinegar gourment balsamic vinegar is near about 100 years old, Italy is most productive region, *Acetobacter intermedius, Gluconacetobacter hansenii, Gluconacetobacter xylinus* AAB species implemented in production (Budaket al. 2014; Crisco Company 2005; Tan 2005).

Cane vinegar

It is also known as "Kibizu". For production of cane vinegar fermented sugarcane are preferred as well as it has slight cool, amusing **s**weet flavor Bhat et al. (2014); Budaket al. (2014) proposed Philippine is most probable area who consumed this vinegar for cooking purpose, *Gluconacetobacter entanii* AAB used for production as per table 1.

Champagne vinegar

Crisco Company 2005 proposed champagne vinegar is made up of moisture free white wine which is extracted from chardonnay as well as pinot noir variety of grape. Both varieties of are used for production of champagne vinegar. In way of appearance it don't having bubbles formation in visual inspection spectrum. France and United States are leading producer of champagne vinegar *Gluconacetobacter entanii, Acetobacter pomorum* are used for vinegar production (Cruess 1958).

Coconut vinegar

It is made up from coconut therefore results to low-slung acidity. It have musty flavour, it is famous for its awesome aftertaste. While preparation of "Thai dishes" coconut vinegar is incorporated, Southern Asian countries are leading producer (Tan 2005; Cruess 1958).

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Distilled vinegar

Table 1 represents, it is made up from grains it is clear in visual spectrum. It is preferred for pickling processing. Harsh in nature. *Acetobacter pomorum* AAB species used for production. United States is leading producer of distilled vinegar (Cricso Company 2005).

Sherry vinegar

For production of sherry wine fermentation is takes place under fully heated atmosphere in wooden barrel in direct contact with sun, sherry wine is used as raw material. Spain is leading producer of sherry vinegar, it is nutty-sweetish in taste (Budaket al. 2014; Tan 2005).

Beer Vinegar

Vinegar is made from beer as raw material substitute. United Kingdom, Germany, Austria as well as Netherland are most Productive regions over the world map. Final sensorial attributes of vinegar is dependent on beer quality and raw material substitute used for beer production. It having malty taste. Similar kind of fermentation treatments are provided for wine as well as beer vinegar for transformation of ethanol into acetic acid (Bhat et al. 2014).

Therapeutic Potential of Vinegar

Damages/injuries curing effect

Vinegar is having antimicrobial activity it results to inhibit microbial flora which impact badly on fresh injuries. Samad et al. (2016)is reported that vinegar is help to inhibition against burns. AAB species named as *Acetobacter xylinum* restoration of tissues of rat. Sugiyama et al. (2009) proposed regular consumption of vinegar via oral way, it is helpful for tempering of muscle impairment through regular judicious workout after inflammation operation.

Natural sanitizer or disinfectant

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Vinegar is containing acetic acid, it having acetic pH due to this it is act an antifungal as well as antimicrobial agent. Acetic acid is insert directly into cell membrane of micro-organism results to facilitation of microbes present in surface (Johnston et al. 2009). The efficiency of vinegar for inhibition of micro-organism is depend upon the following factors are as follows as microbial species, temperature gradient, pH, attentiveness of acetic acid as well as strength of ions. Acetic acid is having more stability as organic acid as comparative to other one i.e., lactic, citric and malic acid (Budak et al. 2014). It is probably recommended for inhibition *of Escherichia coli* O157:H7 as well food borne bacteria. There is close relation between denture stomatics and *candida albican*. Pinto et al. (2008) has been analyzed that if 10 mL vinegar is mixed with 90ml of water and spread or smoke overnight results to destruction of *C.albican*. Mota et al. (2014) said that if 4 mL of apple cider vinegar is taken and then it mixed with 96 mL of water it shows antifungal parameters against *Candida spp.*

After 30 minute of time interval. Therefore, vinegar is used as cleansing agent in more probable circumstances. Vinegar is having inflammatory actions against mucous membrane. Vinegar was recommended for curing of fungal infection over nail, wart as well as septicity caused by microbes (Johnston et al. 2009). For treating against burn infection caused by bacteria. The origin of vinegar (cellulosic substances) is taken place. Each and every mycobacteria is able to survive because of toughest layer lipid-based cell walls, it is killed by treatment of vinegar (Budak et al. 2014). To inhibit fungal growth, wood vinegar (waste utilization of byproduct of wood) is preferred, for effective inhibition of fungus maintenance of temperature within pyrolysis. The effectiveness of wood vinegar is totally depend on regulation of temperature during pyrolysis (Oramahi and Yashimura 2013).

The post-harvesting is one of the most important process which plays important role in products quality, nutritional attributes of product as well as consumer acceptance in

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market, vinegar as well as acetic acid treatment have been implemented to meat to maintain color, flavor, texture as well as nutritional attributes (Johnston 2009). Acetic acid is used to inhibition of *Escherichia coli, Salmonella typhimurium and Listeria monocytogene* in lettuce (Ramos et al. 2014).

It is observed that while post-harvest treatment of fruits is ongoing there is risk of fungal conidia occurrence on the outermost surface of fruits to minimize such kind of problems fumigation technique is implemented. To disintegrate outermost layer (membrane) of conidia, dissociated acids which is obtain from vaporization of vinegar, it having great penetration power. Fumigation treatment with incorporation dissociated acids obtain from vinegar to prevent fruits after post-harvest operation is works a lot to minimize the losses as well as maintain sensorial properties of fruits, dissociated acid of vinegar (obtained by vaporization) is alternated option for sodium hypochlorite as well as liquid sterilizers (Sholberg et al. 2000). Tzortzakis et al. (2011) reported fumigation treatment of vinegar on tomatoes is effects on enhancement in lycopene content as per earlier as well as there is no bad impact is observed on firm index and acid concentration of tomato. Vinegar has potential either it is in liquid otherwise vapor format, effectively inhibit *Klebsiella pneumonia* on garden-fresh coriander which results to contamination.

Enhancement of lipid profile and destroys gathering of fats

If on the regular basis dietary cholesterol will make enhancement in cholesterol and triacylglycerides amount in liver, which having stability to create health problems in huge basis like atherosclerosis and hypertension. Fushimi et al. (2006) reported that for reduction of formation of triacylglycerides in liver in very cheap cost and remove on regular basis. Consumption of vinegar with food items by elimination of hepatic glutathione (GSH), catalase (CAT) (Chou et al. 2015). In Vinegar the presence of acetic acid is results to lots of

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work, it throttle sterol controlling of continues obligation of protein (SREBP) gene appearance in mRNA (messenger RNA) as well as it helps to reduce level of ATP citrate lyase (ATP-CL). When acetic acid is consume directly or indirectly by human body it will helps to enhance alternative oxidase (AOX) inheritable factor expression, it is directly results to improves corrosion of fatty acid . Samad et al. (2016) reported that acetic acid is not only help for destruction of cholesterol and fatty acid for the proper functioning of liver, but also it helps for enhancement of lipolysis. For promoting lipid oxidation of after injection of vinegar, it produce ameliorate blood lipid profile with enhancement of carnitine level (Moon et al. 2010).

Kondo et al. (2009); Johnston (2009) reported humans and animals both are affected by acetic acid consumption which results to reduction in level of serum triacylglycerides. Lee et al. (2013); Seo et al. (2014) proposed regular consumption of tomato vinegar beverage results (TVB) to reduction in concentration of triglyceride as well as cholesterol also lessen plasma free fatty acid within human liver. Tomato vinegar beverage is also having potential to LDL-cholesterol concentration Nandasiri and Vasantha Rupasinghe (2013) as well as started destruction of fatty panels which is started emerging in arteries. Enhances level of HDL-cholesterol within total cholesterol (Lee et al. 2013; Derakhshandeh-Rishehri et al. 2014; Park and Lee 2013). Regular consumption of vinegar is effects on enhancement in concentration of fecal triglyceride which is assistances to blooming out cholesterol over the body (Lee et al. 2013; Chou et al. 2015). Consumption of acetic acid as well as pomegranate vinegar is plays important role in reduction of plasma as well as triglyceride concentration in human body (Ok et al. 2013).

Vinegar decreases hyperglycemic concentration as well as enhances insulin emission

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In market many types of existing vinegar are already having stability to reduce glycemic index as well as postprandial blood glucose of human blood i.e., apple cider vinegar Hlebowicz et al. (2007), ginsam vinegar Johnston and Gass (2006) as well as traditional vinegar (TV) Seo et al. (2014). It is also help to increase insulin production (Derakhshandeh-Rishehri et al. 2014). Liquid portion of nypa palm vinegar it enhances insulin serum concentration with increase in manufacturation of beta cells as well as enhancement in rate of beta-cells production. Vinegar is having stability to deactivate the undesirable impact of streptozotocin, chemical substance which is use to boost diabetes in rats, because it is not permit to produce beta-cells. Vinegar consumption results to enhancement in postprandial blood drift proportion it directly impact on enhancement in functioning of vascular activity as well as endothelial function.

At the time of skeletal muscle activities are undergone subquently also helps to enhance insulin activity in blood. When activity of insulin in skeletal muscles is going on it gives indication of insulin activity is getting stimulate therefore it stands for ability of vinegar for increase in glucose acceptance (Mitrou et al. 2015). Vinegar consumption is stands for resulting in proper digestion of carbohydrate (Samad et al. 2016). The process of carbohydrate digestion is as follows breakdown of disaccharides to monosaccharaides (Hlebowicz et al. 2007). Instead of that vinegar enhances level of glucose as well as amount of glucose -6-phosphate Budak et al. (2014); Petsiou et al. (2014); Johnston and Buller (2005) is enhances in liver and skeletal muscle area which having potential to rate of glycogen repletion (Hlebowicz et al. 2007). Supplementation of vinegar in recommended proportion influence to reduction postprandial glucose level (O¨stman et al. 2005). Budak et al. (2014) experimented supplementation of vinegar is influence on reduction of postprandial hyperglycemia only in food which is having higher glycemic index (HGI) not over lower glycemic index (LGI). Johnston et al. (2009) was reported consumption of 10 gm of vinegar

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to reduction in postprandial blood glucose concentration as compare with 2 gm as well as 20 gm. Time interval of vinegar consumption is also effects on postprandial blood glucose level as gap of 2 hours is observed best results as compare with 5 hours of time interval. While reduction of hypertension acetic acid has potential to destruct emission of rennin also results to reduction of angiotensin I (Johnston 2009). Acetic acid is also having stability to destruct angiotensin-conversing enzyme (ACE) Baba et al. (2013); Nandasiri and Vasantha Rupsinghe (2013); Samad et al. (2016) which is results to reduction in level of plasma angiotensin II (Kondo et al. 2009). Acetic acid works for improvement in vasodilation because of destruction of durable vasoconstrictive angiotensin II (Nakamura et al. 2010).

Destruction of proliferation and disappears apoptosis within carcinogenic cells in human

The vinegar which is made by rice is called as Kurosu and Izumi, in case if unpolished rice which is used for vinegar production, it showed anti-carcinogenic attributes. It having stability to disappear carcinogenic cells with obstructing differentiations of carcinogenic cells of human body with implantation of necroptosis and stimulating apoptosis (Baba et al. 2013; Johnston et al. 2009). As per the research on kurosu is having stability to disable carcinogenic cells in differential parts of human body (i.e., colon, lungs, breast, bladder as well as prostrate carcinoma cells). Vinegar is helps to diminish the effect of oesophageal cancer (Budak et al. 2014).

Kurusu was helps to repair DNA as well as non-living carcinogenic cells.To detect the carcinogenic cells, the acetic acid present in vinegar is helps for detection of carcinogenic cells. As per histopathological examination it is possible to detect difference between normal tissues and malignant tissues with helps 5% acetic acid. Limpaphayomet al. (2014) reported that acetic acid is helps to detect visually cervical cancer protection. Vinegar having very

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strong cancer detective properties which is very cheaper in cost as compare to already existing in market. 5% of acetic acid is helps to detect oral cancer and it is don't having any side effect on human health (Bhalang et al.. 2008).

Medicinal Potential of Vinegar

Anti-infective effect

The father of modern medicine was reported that vinegar is having stability to fight against foreign organism which comes from outside source and having infective properties. Vinegar is used for cleansing agent, repair ulcer and deactivation of wounds. Famous old medicine named as oxygen (honey+ vinegar) is recommended for determining cough of hippocrates (Johnston et al. 2009). Composition of oxymel are as follows take 4 parts of virgin honey mixed up to comes in one phase with 1 part of white vinegar, then absorbed under variance of paper pulp (Johnston and Gass 2006) . As per the scientific research it is shows that vinegar having antimicrobial potential as well as it is commonly used as food preservative (Sengum and Karpinar 2011; Entani et al. 1998; Vijayakumar and Wolf-Hall 2002).Vinegar is context generally for inhibition of wound. Acetic acid present in vinegar having potential to inhibit growth of huge amount of microbes like Escherichia coli, 4^{th} division Enterococcus as well as *Bacteroides fragilisbacteria* also having some potential to inhibit growth of *Staphylococcus aureous* with *pseudomonas aeruginosa.* Takano-Lee et al. (2004) reported vinegar having low affection potential against inhibition of lice or destruction of incipient of eggs (Conzuelo-Quifada et al. 2003). Johnston and Gass (2006) reported potential of vinegar with specification 2% acetic acid having pH 2 to fighting against otitis bacterial mass-media as well as granulose myringitis. Inflammation of skin as well hairs on the surface of dented cochlear is because of low pH of acetic acid solution (Dohar 2003)

Anti-tumorous effect

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Sugar cane vinegar (kibizu) is having characters to inactivate leukaemic cells of human being. In Japan vinegar is made from rice is used for stop the uncontrolled cell division which results to cancer. In case ethyl acetate concentrate of cane sugar vinegar mix with drinking water up to 01%w/v, it destruct incidence as well as bifurcation of azoxymethane reduces colons in male body which results to uncontrolled division experimented on same characteristics living thing. After continues consumption of vinegar by 40days it reduce the tumor size as compare with before starting consumption (Johnston and Gass 2006). It's continues consumption enhances lifecycle because of tumor recession, rice vinegar is helps to inactivation of cytotoxic activity of couples of cell (Seki et al. 2004). Differential vinegar which is existing in market is rich source of polyphenol (Johnstonand Gass 2006). The substance which is estimated from plant (use for vinegar production) having potential to resist against oxidative stress. Ingestion of polyphenols in regular basis stands for good antioxidant activity and reduces the uncontrolled cell division (cancer) (Nishino et al. 2005).

Anti-glycemic effect

Vinegar is having ability to prevent glycemic index of human blood, it is firstly reported in 1988 (Ebihara and Nakajima 1988). It is experimentally proofed by Ebihara and Nakajima (1988), when 10% solution of corn starch is taken by rat, after some frictional time injection of 2% acetic acid solution, its results to reduction in blood glucose level (Xibib et al. 2003). If consumption rate of sucrose by human body is 50g then it's found that in research 20% reduction when incorporated with 60 ml of strawberry vinegar (Ebihara and Nakajima 1988). After some years it is again found that if, white vinegar having 5% acetic acid is used for flavor enhancement in salad, this salad was taken as breakfast with bread (containing

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50gm carbohydrate), due to incidence of acetic acid in diet it reduces glycemic ratio of blood (Brighenti et al. 1995).

For preparation of salad dressing for flavor enhancement vinegar is preferred having specification of 7 pH, it is produced with incorporation of 1.5 gm of sodium bicarbonate in 20 mL of white vinegar. Alternatively if solution of salt is taken having specification of 1.5gm Nacl is incorporated with 20 mL water, it doesn't having beneficial impact on reduction in blood glucose (Brighenti et al. 1995).Johnston and Gass (2006); Leeman et al. (2005) reported 20gm of vinegar is recommended of disease free 18 years human above to maintenance punctuality in meal time as well as showing reduction in blood sugar.

Cardiovascular threats curing effect

As per researchers found that near about 20 mm Hg reduction in systolic blood pressure as per the experiment is undertaken on spontaneously hypertensive rat (SHR) on laboratory scale, the experiment is follow as on continuous basis up to six weeks incorporate vinegar or else acetic acid(0.86 mmol) with lab scale diet. Alternately similar experiment was undertaken with incorporation of lab scale diet with distilled water, but there is no evidence found regarding reduction in blood pressure (Trinidad et al. 1996). Systolic blood pressure reduction is term which is related with decrease in plasma rennin as well as plasma aldosterone meditation up to (35% to 40% as well as 15 to 25% respectively) as compare with non-experimental SHR. As per other scientific research it is found that vinegar is having potential to inactivate or cure rennin-angiotensin media within unhypertensive Sprague rats (Honsho et al. 2005).

The previous experiment is not performed on human, therefore there is no authentic clue behind vinegar consumption leads to reduction in blood pressure. As per Kondo et al. (2009) for assimilation of calcium dietary acetic acid which is present in vinegar is

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incorporate the spiritual role therefore, unfettered rennin angiotension media (Porsti et al. 2004). In experimental rats acetic acid is promotes absorption as well as retaining rate of calcium. Alternately in human rate of absorption is not takes place. For that much potentials is needed for calcium absorption as well as reduction in blood pressure (Trinidad et al. 1996). It is also unknown that chronic vinegar consumption leads to reduction in heart related diseases in humans.Johnston and Gass (2006) reported that as per the observation at 'Nurses Health' study the consumption combination of vinegar incorporated in salad dressing and oil in continuous basis (5-6 meal interval over a week) it minimize cardiovascular fatal ischemic disorder. Regular consumption of mayonnaise in salad dressing no observation is recorded yet about minimization of cardiovascular disorder. The combination of vinegar dressing with oil is content alpha-linolenic acid it has potential impact on human health to reduce cardiovascular disorder. Same in the case of mayonnaise, it also content alpha-linolenic acid but it don't shows any potentials like combination of salad dressing and oil (Budak et al. 2014).

Antimicrobial potential

Vinegar has antimicrobial potential therefore, it used for numerous applications. It has been implemented in cleaning purpose, removal of fungus which attacks on nail, head lice, wart as well as ear contagion (Rutala et al. 2000; Dohar 2003).Many food consumers normally use vinegar for food preservation purpose to obstructdevelopment of food borne pathogens (Rauha et al. 2000). Acetic acid is present in vinegars as organic acid results to penetrate outermost membrane of cell of microbes and microbial inhibition is takes place (Johnston and Gass(2006); Bjornsdottir et al. 2006). The temperature conditions, pH, bacterial species as well as ionic potential of acetic acid is effect on antimicrobial potential of vinegar (Entani et al. 1998; Chung et al. 2002). Many types of organic acids are present in

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fruits, after consumption towards excessive limit is impact on human health in bad manner (Fang and Hsueh 2000; Sengun and Karapinar 2011).

Antioxidant effect

The reason behind causing aging, cancer as well as brain hemorrhage is effect of reaction of oxygen with lipids, protein as well as DNA (Buonocore et al. 2010; Maes et al. 2011). Johnston and Gass (2006); Fern´andez- Mar et al. (2010); Ramadan and Al-Ghamdi (2012) are reported consumption of food which having much bioactive compounds is reduces effect of free radicals on human health and minimize chances of disintegrative impact. Numerous bioactive compounds is present in vinegar like polyphenols as well as vitamins in release oxidative strain (Johnston and Gass 2006; Nishino et al. 2005). Grape vinegar is having phenolic compounds Garcia-Parrilla et al. (1997); Budak and Guzel- Seydim (2010), sherry vinegar Alonso et al. (2004), traditional balsamic vinegar Plessi et al. (2006); Johnston and Gass (2006), and apple cider vinegar Budak et al. (2014) respectively. Budak and Guzel-Seydim (2010) proposed that vinegar which is prepared by grape as raw material in that case, traditional vinegar is content chlorogenic and syringic acids as compare with commercial one. Chlorogenic as well as syringic acids are ironic component of outmoded grape vinegar (grape wine as raw material) as compare with commercial grape wine vinegar (Budak and Guzel-Seydim 2010). But if looking towards catechin content commercial vinegar is rich source as compare with outmoded one. Oxygen Radical Absorbance Capacity (OARC) as well as Trolox Equivalent Antioxidant Capacity (TEAC) of outmoded 10.50 μmol/mL TE (trolox equivalents) and 13.50 mmol/L respectively in old-moded grape wine vinegar(Budak and Guzel-Seydim 2010).

Applicationof vinegar in electrochemistry

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The cell of air battery in consist of vinegar water (acetic acid) at innermost region. Due to presence of H+ and acetate– ions produced in innermost area of battery produced because of dissociation of frail acid results to enhancement in conductivity of current. Combination of salt water and vinegar water results to upbeat focus of LED. After moment in this solution there is no change is observed in electrical conductivity as well as in upbeat of LED. Salt water and vinegar water combination is shows great electrical conductivity as compare with only salt water battery cell. Vinegar and salt water combination cell battery is shows great efficiency.as compared to only salt water cell battery. If other cell battery is rather than vinegar and salt water kept for 24 hours shows reddish oxide exterior covering on copper but, in case of vinegar and salt water combination does not shows thus kind of stuff. It shows that great conductivity of electronic transfer over the cell (Chasteen et al. 2008).

Conclusion

Production of vinegar is taken over global level having differential raw material, bacterial species as well as production mechanization. Acetic acid is potential component of vinegar act as class one preservative as well as act as food preservative. Vinegar has long traditional history by differential useful parameters. Vinegar have many bioactive component results to heath benefit by consumption. Functional medicinal as well as therapeutic potential like anti-carcinogenic, anti-glycemic, anti-cardiovascular, antioxidant, antimicrobial. Many research results to report promote additional health benefit, consumption of vinegar on daily foundation helps to cure low glucose disorder. Due to presence of phenolic substance promotes antioxidant action, results to reduction risk of cancer. Differential vinegar varieties having different impact on human health as well as body metabolism.

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Table 1: Vinegar Varieties, Bacterial Species and Popular regions

Varieties	Raw material	Bacterial species	Most Productive region	References
Apple cider vinegar	Apple	*Acetobacter aceti, Acetobacter intermedius, Acetobacter pasteurianus, Gluconacetobacter europaeus, Gluconacetobacter hansenii, Gluconacetobacter xylinus*	Over the world	Budaket al. 2014; Trcek 2005;Trcek et al. 2000;Haruta et al. 2006; Gullo et al. 2006;Vegas et al. 2010; Gullo and Giudici 2008
Balsamic vinegar	White trebbiano grape	*Acetobacter intermedius, Gluconacetobacter hansenii, Gluconacetobacter xylinus*	Italy	Haruta et al. 2006;Gullo et al. 2009; Budaket al. 2014; Tan 2005
Beer vinegar	Beer	*Acetobacter pomorum, Acetobacter obiediens, Gluconacetobacter entanii*	Germany	Sokollek et al. 1998; Budaket al. 2014
Cane vinegar	Cane sugar	*Gluconacetobacterentanii*	Philippines	Sokollek et al. 1998; Sch¨ulleret al. 2000; Budaket al. 2014
Champagne vinegar	Chardonnay or pinot noir grapes	*Gluconacetobacter entanii, Acetobacter pomorum*	France, United states	Sokolleket al. 1998; Sch¨ulleret al. 2000
Coconut vinegar	Coconut	*Gluconacetobacter entanii, Acetobacter obiediens*	Southern Asia	Sokollek et al. 2000; Tan 2005
Distilled vinegar	Grains	*Gluconacetobacter entanii*	United states	Sokollek et al. 1998; Crisco Company 2005:Tan 2005
Fruit	Citrus	*Acetobacter pomorum*	Austria	Sokollek et al. 1998; Crisco

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vinegar	fruits			Company 2005
Kombucha vinegar	Scoby	*Acetobacter pomorum, Acetobacter obiediens, Gluconacetobacter entanii*	Japan	Sokollek et al. 1998, Crisco Company 2005
Malt vinegar	Malt	*Acetobacter pomorum*	England	Sokollek et al. 1998; Crisco Company 2005
Potato vinegar	Potato	*Acetobacter obiediens*	Over the world	Sokolleket al. 1998; Sch¨ulleret al. 2000
Wine vinegar	Red wine	*Acetobacter pasteurianus, Gluconacetobacter europaeus, Gluconobacteroxydans*	Japan	Gonz´alez et al. 2005; Vegas et al. 2010; Haruta et al. 2006
Rice vinegar	White rice	*Acetobacter pasteurianus*	United states, Taiwan	Sch¨ulleret al. 2000; Crisco Company 2005; Tan 2005
Sherry vinegar	Sherry wine	*Acetobacter obiediens, Acetobacter pomorum*	Spain	Budak et al. 2014; Crisco Company 2005
Spirit vinegar	Spirit	*Gluconacetobactereuropaeus*	Germany	Budak et al. 2014; Crisco Company 2005
Tarragon vinegar	Garlic, basil	*Acetobacter pomorum, Gluconacetobacterentanii*	United states	Sokolleket al. 1998; Sch¨ulleret al. 2000; Crisco Company 2005
White vinegar	Fruits	*Gluconacetobactereuropaeus, Gluconacetobacterxylinus*	Turkey, Italy	Gullo et al. 2006;Vegas et al. 2010; Crisco Company 2005

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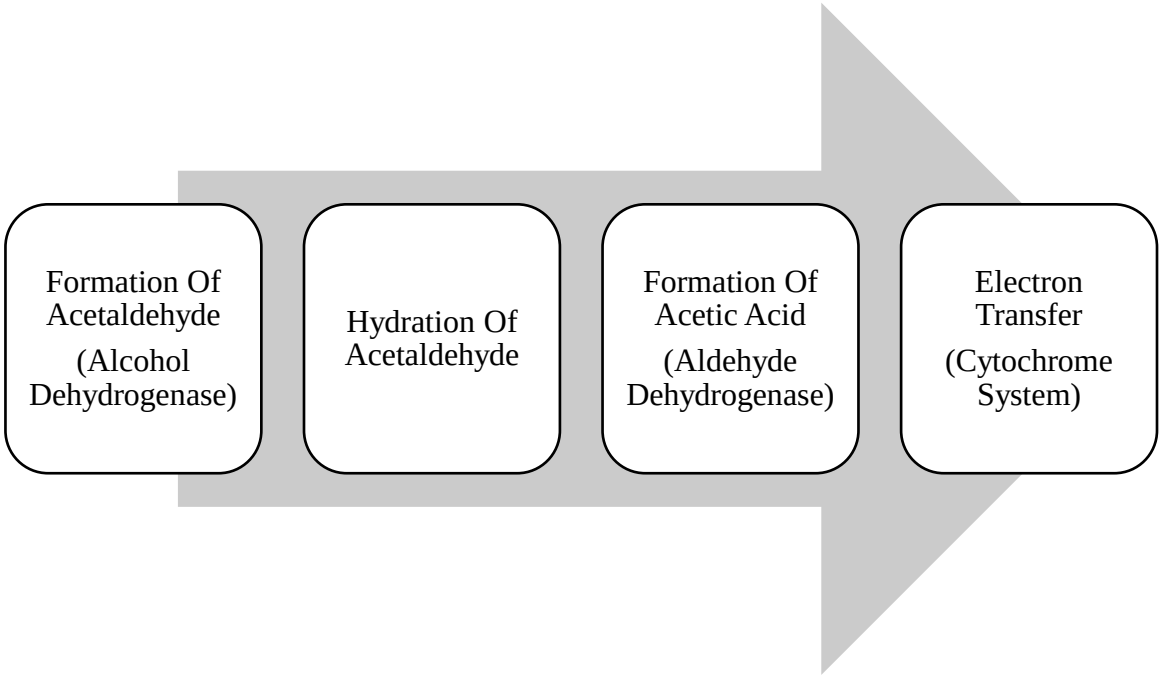
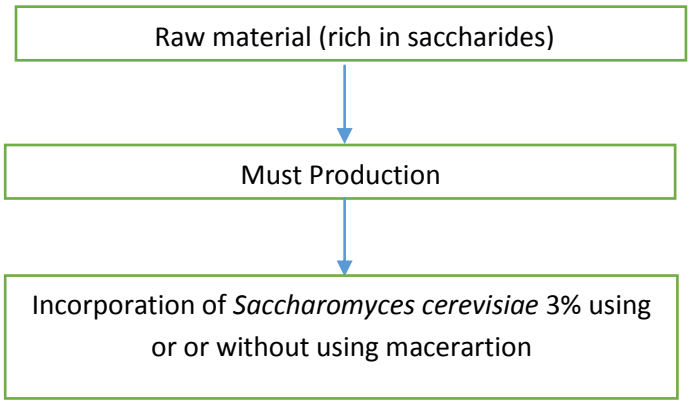


Figure 1: Chemical Reactions during fermentation

Source: Tan (2005)



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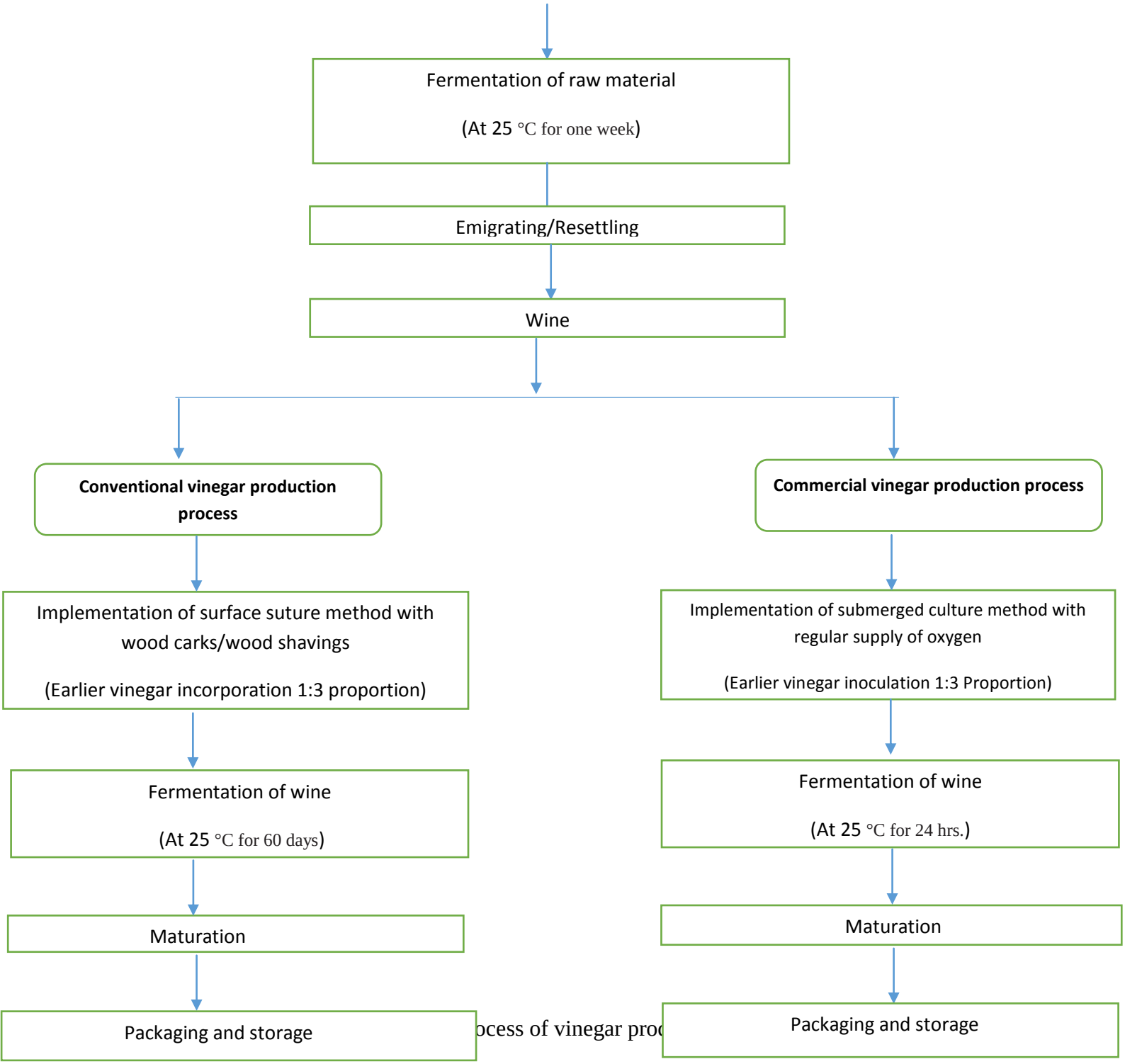

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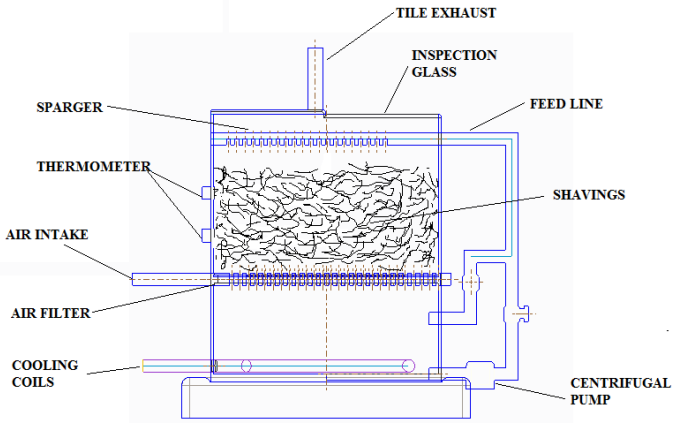

Figure 3 Vinegar production Generator

Source: Tan (2005);Bhat et al.(2014)