

Effect of Clarifying Agents (Gelatin and Kaolin) on Fruit Wine Production

Awe, S

Department of Biosciences and Biotechnology, Kwara State University, Malete, Nigeria

Corresponding author email id: asflor5@yahoo.com

Abstract – The aim of the present study was to compare the effectiveness of gelatin and kaolin in clarifying wine variously produced from locally available fruits (Pawpaw, Pineapple, Cashew and Banana). Absorbance measurement (470nm) was used to determine the level of clarity for twenty (20) days. The results shows that pawpaw wine values of absorbance ranged from 0.05 to 0.30 (AU) for gelatin, 0.07 to 0.32 (AU) for kaolin while 0.1 to 0.25 for the control. Pineapple wine values ranged from 0.05 to 0.28 (AU) for gelatin, 0.07 to 0.30 (AU) for kaolin while 0.70 to 0.29 for the control. The values for Cashew ranged from 0.05 to 0.25 (AU) for gelatin, 0.07 to 0.27 (AU) for kaolin while 0.08 to 0.24 (AU) for the control, Banana wine values also ranged between 0.04 to 0.35 (AU) for gelatin, 0.06 to 0.38 (AU) for kaolin while 0.11 to 0.30 (AU) for the control. Banana wine was the most cleared with absorbance of 0.04 AU. The quality evaluation of the final wines produced revealed that gelatin was a better clarifier than kaolin.

Keywords – Absorbance, Fruits, Gelatin, Kaolin, Wine.

I. INTRODUCTION

Clarifying agents or fining is the addition of a reactive or adsorptive substance to remove or reduce the concentration of one or more undesirable constituent for the purposes of enhancing clarity, color, aroma and/or stability modification (Bruce *et al.*, 1995). According to Berry, (2000) fining is a product that when added to wines alters its clarity to create an adsorbent, enzymatic or ionic bond with the suspended particles, making them a larger molecule that can precipitate out of the wine easier and quicker. Unlike filtration, which can only remove particulates such as dead yeast cells and grape fragments, fining is effective in removing soluble substances such as polymerized tannins, coloring phenols and proteins. The use of fining agents speeds up the process at lower cost. White wines are fined to remove particles that may cause the wine to brown or lose color and heat-unstable proteins that could cause the wine to appear hazy or cloudy should it be exposed to high temperatures after bottling this procedure helps also to remove active haze precursors, decrease the potential for haze formation during storage and provide a more limpid juice (Hsu *et al.*, 1990). Furthermore, there is the added benefit of reducing the amount of bitter, astringent tannins which makes these wines smoother and more approachable sooner after bottling and release. Mierczynska and Smith (2015) reported that clarifying wine is an essential quality attribute that is recognized and valued by consumers while the impact of practices on the concentration and composition on wine making was reviewed by Smith *et al.* (2015).

Throughout history a wide range of substances have been used as fining agents, the most commonly-used fining

agents perform their tasks by attracting the positively and negatively charged particles in the unclear wine as they, the fining agents, also have positive and negative charges. Examples include gelatin, casein, albumin, kaolin, bentonite (-), sparkolloid (-), gelatin (+) and egg white (+), and silicon dioxide or kieselsol (-). They work by adsorption: condensing and holding a gas or soluble substance upon their surfaces. Bentonite is probably the choice of most winemakers, as it is easy to prepare and use. It is very effective in dragging out yeast, tannins and other stubborn protein-based particles that may want to linger after fermentation (Berry, 2000).

During the last years conventional clarification process has been replaced by the use of ultrafiltration membranes (Alvarez *et al.*, 1998). However clarification of juice by ultrafiltration alone does not remove active haze precursors, allowing haze formation during storage. Bentonite, Polvinyl polypyrrolidone (PVPP) and activated charcoal are used to eliminate natural polyphenols present in the fruit juice (Kwang-Sup *et al.*, 2004). It was also claimed that gelatin, contrary to PVPP which eliminate all fruit juice polyphenols, would only eliminate post-bottling haze forming polyphenols (Siebert and Lynn, 1997). For that reason gelatin is a frequently used clarifying agent by fruit processing industries at the present.

The objective of the present work was to compare the efficiency of gelatin and kaolin in clarifying fruit wine.

II. MATERIALS AND METHODS

Wine Samples

Pawpaw, Cashew, Banana and Pineapple wine were produced in the laboratory of the Department of Microbiology University of Ilorin, Ilorin, Nigeria using *Saccharomyces cerevisiae* purchased from E. C Kraus USA as a fermenting organism (Bisson and Butzkc, 2007). Ten Kilogram (10 kg) each of peeled, ripe, fresh and healthy fruits was blended with a sterilized blender to obtain the fruit pulp. The fruit pulp was mixed with warm water 45°C (in the ratio of 1:2) to obtain the 'must' needed for wine production. The must was sterilized with sodium metabisulphate solution to remove microbial contaminants. Standardized campden tablet, 30% sucrose and yeast nutrient were added to the must and allowed to stay for 24 hours, after which yeast was added (Berry, 2000).

Fermentation Process

Standardized amount of yeast was sprinkled over the surface of each must in a fermenting jar. The inoculated must was covered with muslin cloth and incubated at room temperature (29 ± 2°C). The fermenting must was aerated daily by stirring twice to encourage yeast multiplication

(Berry, 2000). Aerobic fermentation was terminated after 6 days and the must was sieved to remove the shaft and debris of the crushed fruits. The filtrate obtained after sieving the must was transferred into anaerobic fermentation jar and incubated at room temperature. An air trap was fixed to the fermenting jar to indicate the end of fermentation. Campden tablet was added to the filtrate to supply sulfur dioxide gas. Fermentation was terminated after six weeks and the wines were racked. Three gallons each of the wine samples were set aside and used for the clarification test using kaolin and gelatin while natural clarity was used as control.

Preparation of Fining Agent

Gelatin and Kaolin slurry was prepared as clarifying agents by dispensing 15g of each clarifier (Gelatin and Kaolin) in 475 ml of boiling water and allowed to mix for 2 minutes to form slurry separately such that, the resultant mixture was very smooth and free of lumps. They were then assessed individually as clarifiers by adding 10ml of each slurry to 1 gallon of the wine samples. Another set of wine samples were allowed to age naturally and were used as control (Fessler, 1988).

Measurement of Clarity

Clarity of the wine samples was determined at a five-day interval for a period of 20 days using a spectrophotometer. Twenty five (25) ml of each samples were dispensed without agitation of the storing containers, into an 100ml conical flask from which the cuvette was filled and OD of each recorded.

Statistical Analysis

The data was analyzed using standard computerization Statistical Package for Social Sciences (SPSS) version 11. ANOVA, post-hoc test for comparison between control and treated rats in all groups were carried out and value expressed as mean \pm SEM. P values less than 0.05 were considered statistically significant.

III. RESULTS

Figure 1 showed the effect of clarifying agents (gelatin and kaolin) on Pawpaw wine after 20 days of storage, while Figure 2 showed the effect of clarifying agents on Banana wine for same numbers of days. The effect of clarifying agents on Cashew wine and Pineapple wine are shown in Figures 3 and 4 respectfully for storage period of 20 days.

Gelatin was found to be the best clarifying agent for all wine samples compared to kaolin and the controls. Kaolin showed better clarity when compared to control in all wine samples except for Pineapple wine which showed same level of clarity on day 20.

The turbidity observed on zero days may be due to the addition of the fining agent slurry as compared to the control.

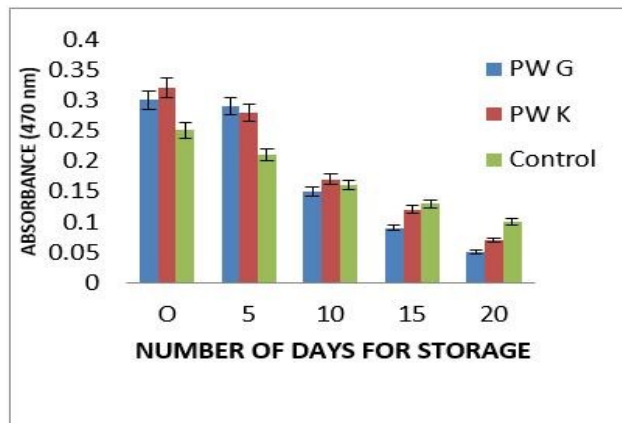


Fig. 1. Effect of clarifying agents on Pawpaw wine

Key: PWG = Pawpaw wine + Gelatin, PWK = Pawpaw wine + Kaolin.

The values are the Means \pm SD (range) for three readings. Significantly different from the control, $p < 0.05$.

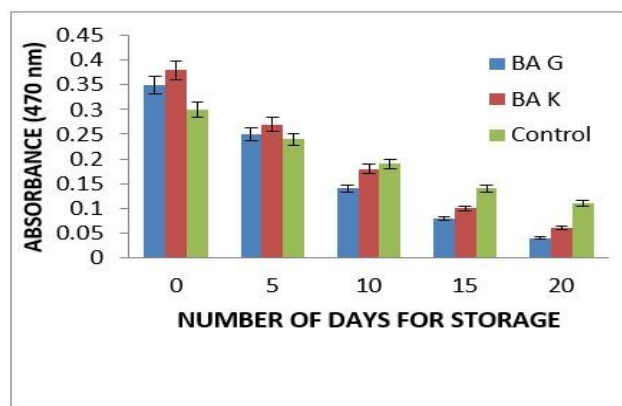


Fig. 2. Effect of clarifying agents on Banana wine

Key: BAG = Banana wine + Gelatin, BAK = Banana wine + Kaolin.

The values are the Means \pm SD (range) for three readings. Significantly different from the control, $p < 0.05$.

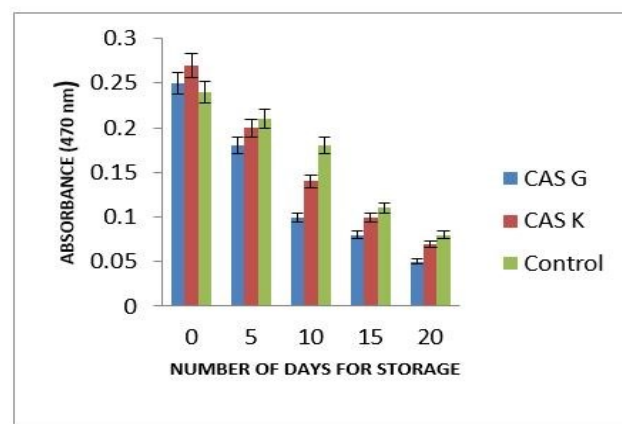


Fig. 3. Effect of clarifying agents on Cashew wine

Key: CASG = Cashew wine + Gelatin, CASK = Cashew wine + Kaolin

The values are the Means \pm SD (range) for three readings. Significantly different from the control, $p < 0.05$.

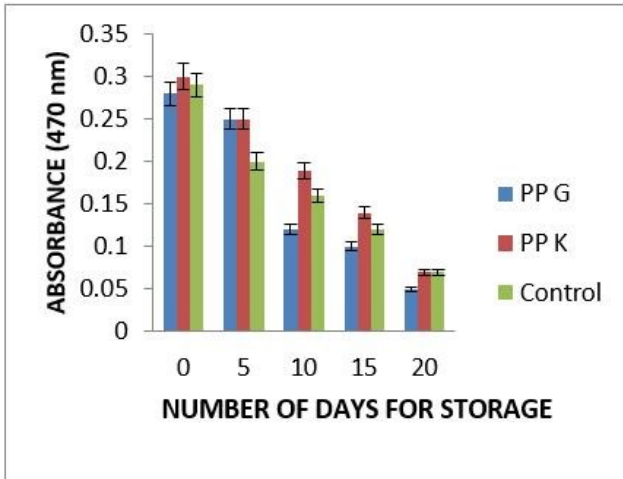


Fig. 4. Effect of clarifying agents on Pineapple wine

Key: PPG = Pineapple wine + Gelatin, PPK = Pineapple wine + Kaolin

The values are the Means \pm SD (range) for three readings. Significantly different from the control, $p < 0.05$.

IV. DISCUSSION

Fining agents work on the principle that all of the particles responsible for the clouding or haze in a wine or beer have an electrical charge (Terry, 2003). Gelatin is colloidal in nature and primarily has a positive charge; it attracts tannins which are primarily negatively charged. In binding to the negatively charged particles the combined weight increases resulting in settling to occur. Once this neutralization has occurred the turbid particles tend to agglomerate which in turn cause them to settle out. The effect of gelatin clarification depends on polyphenols to particles ratio (Benitez, 2007). Clarifying of wine result showed that the use of gelatin was the best fining agent of larifying the wine samples (Figure 1, 2, 3 and 4). The use of clarifying agent is usually to hasten the production process; however, it often alters the chemical composition of the wine (Bisson and Butzkc, 2007). Kaolin is clay used the same way as bentonite, it is effective in dropping out yeast cells and excessive tannin making the wine more stable in warmer storage temperature. Additionally, it is used to reduce harshness in the wine's bouquet and to lighten its colour.

In normal wine production process, aging without clarifying agent is preferred as a means of clarifying the wine. Gelatin is basically used for clarification and reduction of overly astringent wines. It is also used prior to fermentation, to reduce astringency and improve clarity. For these reasons, gelatin is a frequently used clarifying agent by fruit juice industries.

In the case under study, gelatin and kaolin clarification was mainly attributed to interaction with colloidal particles.

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