Determination of Minimum Food Preservative Combination Levels for Fruit Juices

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Introduction

Higher levels of food additives than the maximum permitted levels are used by the food manufactures. According to Sri Lankan Food Act, These permitted levels of food additives are higher than the international standards (reference). Especially, in fruit juice manufacturing high levels of food preservatives are used. Different studies have shown that higher levels of food preservatives may cause health hazard such as gastric irritation, allergic conditions, asthma conditions and long term consumption may lead to cancers and genetic disorders in babies (Freedman, 1980). Developed countries are more concerned about the residual effect of food additives. Due to the fact that the residual level of food preservatives of Sri Lankan products is higher than the international standard, those products are failed at the export market. This study was conducted to find out the minimum levels of preservative combinations that minimize the risk to human health with respect to fruit juice preservation.

Methodology

The study was carried out at Microbiological Division of the Research and Development Department, Expolanka (Pvt) Limited. Two experiments were conducted during this study. Experiment I was conducted to evaluate the minimum inhibitory concentrations of food preservatives for selected microorganisms. Series of different concentrations of Sodium metabisulphite, Potassium sorbate and Potassium benzoate solutions were produced and pH was adjusted to 3.3. All the prepared preservative solutions were filter sterilized. Disk diffusion method was used to investigate the minimum inhibitory concentration of above preservatives against the *Lactobacillus acidophilus*, *Aspergillusniger*, *Staphylococcusaureus*, and *Saccharomyces spp*. Minimum inhibitory concentrations of three preservatives were defined for the tested microorganisms.

In second Experiment, the effectiveness of these minimum inhibitory concentrations of preservatives in preservation of fruit juices was determined. Mango, wood apple, mix fruit, lime and guava juices were used to meet the fruit juice specification given in the food act and SLSI guideline. Two preservative combinations were used by combining minimum inhibitory concentrations of preservatives. Sodium metabisulphite (SMS) with potassium sorbate (PS) and Sodium metabisulphite with potassium benzoate (PB) were combined and these combinations were assigned to all the fruit juice samples.

Combination 01: Sodium metabisulphite 25 ppm + Potassium Sorbate 150 ppm
Combination 02: Sodium metabisulphite 25 ppm + Potassium Benzoate 60 ppm

All the samples were incubated at 25 ^{o}C for 14 days as per the food act. Total plate count and yeast and mould (Y/M) were enumerated using the standard method as described by the Sri Lanka Standard Institution (SLS 516 part 2). The data obtained in the present study was statistically analyzed with analysis of variance (ANOVA) using Minitab 16 statistical package. Pair wise comparisons were done by tukey at 5% significance level.

Result and Discussion

Table 1 shows the minimum inhibitory concentration of preservative against the tested microorganisms.

Table 1. Minimum preservative concentrations for different microorganism.

	Concentration of Preservatives (ppm)			
Preservative	*Saccharomyces*	*A. niger*	*S. aureus*	*L. acidophilus*
SMS	25 ppm	20 ppm	25 ppm	25 ppm
PS	150 ppm	120 ppm	150 ppm	150 ppm
PB	60 ppm	48 ppm	60 ppm	60 ppm

The minimum inhibitory concentration of preservative against the tested microorganism are as follows (Table 2).

Table 2. Most effective minimum preservative levels.

Preservative	Minimum preservative level mg/kg (ppm)
SMS	25 mg/kg (ppm)
PS	150 mg/kg (ppm)
PB	60 mg/kg (ppm)

Carr and Davies (1971) found sulfur dioxide incorporated into growth medium (pH 3.4) at 25 mg/ liter was sufficient to kill a culture of *S. cerevisiae* (105 cells/ml) after 8 hr at 25 ^{0}C. Combined activity of Sodium metabisulphite with Potassium sorbate and Sodium metabisulphite with Potassium benzoate are effective and efficient in preserving fruit juices produced in both laboratory and the manufacturing unit. TPC and yeast and mould count in the samples complied with the requirement of Food Act and Sri Lankan Standard.

Conclusions

This study showed that preservative levels commercially used can be further minimized. Better preservation was achieved with Sodium metabisulphite at 25 mg/kg concentration. The highest efficient control of microbes was achieved at 150 mg/kg concentration of Potassium sorbate and 120 mg/kg Potassium benzoate. Combinations of Sodium metabisulphite with potassium benzoate and Sodium metabisulphite with Potassium sorbate showed same results in both laboratory trial and in the factory trial. The investigated combinations of preservatives are efficient and effective in preservation of fruit juices for six month period. Therefore, these two preservative combinations can be suggested to apply in fruit juice manufacturing processes where all the requirements of good manufacturing practices are implemented.

References

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