FACTORS AFFECTING COLOUR AND CLOUD STABILITY IN A WILDBERRY HERBAL DRINK

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

M Tech

In

Food Science

AT MASSEY UNIVERSITY, ALBANY, NEW ZEALAND

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2001

ABSTRACT

An investigation was undertaken into the stability of the natural colour, from anthocyanins, and cloud in a Wildberry Herbal fruit drink. The fruit drinks consisted of cloudy apple and berry fruit juice with natural herb extracts and flavours. The objectives of the research were to identify the cause of cloud instability and sediment formation in the drink; determine the effect of ascorbic acid, berryfruit juice volume, storage temperature and light on anthocyanin stability; investigate the use of stabilisers to prevent sediment formation and determine consumer acceptability of a modified drink. The cause of sediment formation was determined by analysing the contribution of the major ingredients to the total amount of sediment formed. To minimise the sediment, a range of commercially available polysaccharide stabilisers were added to the drink and the amount of sediment formed determined. A consumer sensory evaluation was undertaken to determine consumer acceptability of drinks in which stabilisers had been added to improve the cloud stability. The factors affecting the anthocyanin's in the drink were analysed using a fractional factorial experimental design. The effect of the commercial pasteurisation process on the colour was also investigated. The formation of sediment was identified as being the result of complexing between the unstable cloud of the cloudy apple juice and polyphenolics, including anthocyanins, in the berryfruit juice. No sediment formed during eight weeks storage when clarified apple juice was substituted for cloudy apple juice. The sediment was reduced by approximately 45% using stabiliser systems consisting of either xanthan or a xanthan/propylene glycol alginate mixture. Consumer sensory evaluation of the modified drinks found no significant difference in liking from the standard drink. The anthocyanin loss in the drink was found to be significantly affected by increased storage temperature. Elderberry juice was found to have better colour stability over blackcurrant juice. Pasteurisation did not initially affect the colour stability of the drink. It was recommended that the composition of the Wildberry Herbal drink remain unchanged. The product should be stored at as low a temperature as possible. The drinks should be cooled to ambient temperature as quickly as possible after the pasteurisation process.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr Marie Wong, for her advice and support throughout this project. Thanks also to IFNHH and IFS staff at Albany for their support.

I would like to thank the staff at Phoenix Natural Foods Ltd, especially Joe Egan, Roger Harris and Chris Morrison, for their support of this project.

Thank you also to Technology New Zealand for their financial support of this project.

I would like to extend my appreciation to Dr Don Stanton, ESR, for his help with the ascorbic acid analysis; Mr Steve Glasgow, Massey University, for his help with the rheological analysis; and Mrs Kathy Ruggiero, for her help with the statistical analysis.

Acknowledgement is extended to Bayer NZ Ltd., Bronson & Jacobs Pty Ltd., Christen Hansen, Directus International Ltd., ENZA NZ Ltd, Germantown Ltd., Hawkins Watts Ltd., Horticultural Marketing Ltd., Nutri-Zeal Ltd, Professional Herb Services and Salkat NZ Ltd. for supplying ingredients for this research.

Finally, thanks to my family for all their encouragement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

The non-alcoholic beverage market in New Zealand is worth $760 million a year (Vercoe, 1998). The fruit juice sector is worth approximately $80 million while the fruit drink sector is worth approximately $250,000 (Vercoe, 1998). The majority of fruit juices (91%) sold in NZ are shelf stable with the remainder having a limited shelf life and chilling requirement (Vercoe, 1998).

By value, orange juice is the leading fruit juice with approximately 46% of sales, followed by apple juice blends with approximately 36% of sales (Vercoe, 1998). Blended beverages have widespread consumer appeal as the blending process allows beverages to be developed which have unique flavours and colours (Hicks, 1990).

At present, the key driver of the beverage market is increasingly health conscious consumers who desire beverages which provide a myriad of health benefits and are perceived to help cope with consumers' busy lifestyles (Corbett, 2000). These drinks have been variously described as "new age" or "functional" beverages. Manufacturers are meeting the demand of consumers by providing an increasing range of products with "functional" ingredients such as herbs, vitamins and minerals.

These "functional" ingredients have been incorporated into many fruit juice based products in the New Zealand market; "Thextons" (Rio Beverages Ltd., NZ) fruit juice drinks include vitamins A, C and E and the herb Echinacea; Arano Fruit Juice Ltd. produces a chilled smoothie with Acerola and Echinacea; Frucor Beverages Ltd. produce "Muse", a combination of fruit juice, mineral water and herbs.

Phoenix Natural Foods Ltd. produces a range of blended fruit drinks each with a combination of herbs which have been traditionally used as therapeutic aids. The range includes an Apple and Guava, an Orange and Mango, and a Wildberry Herbal fruit drink.

The research for this project focuses on one of the drinks from this functional beverage range, the Wildberry Herbal fruit drink. This drink consists of a cloudy apple and berryfruit juice blend with herbal extracts and natural flavours. The Wildberry Herbal fruit drink is unique in the New Zealand market as it is the only fruit drink which has a cloudy apple and berryfruit juice blend. All other blended drinks on the market are made from a clarified apple juice base.

The Wildberry Herbal fruit drink is visually appealing as it is red in colour with a cloudy appearance. Cloud is important in a drink as it has been found that consumers desire cloud in certain drinks, such as fruit juices, and associate cloudiness with "naturalness" (Hicks,1990). The desirable colour of the drink is obtained solely from the berryfruit juice in the blend. Berryfruit juices contain anthocyanins, naturally produced compounds, which have an intense colour, most often red. As well as providing a very desirable colour, anthocyanins are also known to be powerful antioxidants. Much research is being undertaken into the ability of anthocyanins to be beneficial for certain health ailments (Smellie, 2000). Hence, the Wildberry Herbal drink not only has a blend of herbs which have been used as therapeutic aids but is also a source of anthocyanins, which are also thought to be beneficial to health.

This research focuses on three phenomena associated with the drink. The first phenomenon is that a sediment forms in the drink soon after pasteurisation. The second phenomenon is the loss of the bright red colour of the drink, obtained from the berryfruit juice, to a dark brown colour during storage. The third phenomenon to be investigated is the texture of the drink. It is desired that the drink's mouthfeel be improved to increase the "natural" juice perception of the drink.

Haze and sediment formation in fruit juices can be due to a number of chemical reactions, which produce insoluble complexes (Heatherbell, 1984). Proteins and phenolics present in blends of fruit juices can form insoluble complexes leading to an unsightly sediment. The loss of colour due to the degradation of red pigments (anthocyanins) in fruit products can be due to a number of factors including pH, temperature, oxygen concentration, ascorbic acid concentration and the presence of metals (Jackman & Smith, 1996). Addition of natural antioxidant compounds has

potential for providing more colour stable juices (Clegg & Morton, 1968; Shrikhande & Francis, 1974).

To minimise quality loss in the Wildberry Herbal drink the factors (composition, processing conditions) responsible for the observed changes must be first determined. Once these factors have been determined solutions to the problems can be proposed and tested. The aim was to be able to make recommendations on product formulation and processing conditions in order to (i) eliminate or reduce the sediment, (ii) stabilise the colour, (iii) to increase the body (texture) of the drink.

The primary objectives of this project were to:

(i) Identify the cause of the sediment formation in the Wildberry Herbal drink and potential ingredients for reformulation of the drink to reduce/eliminate the sediment formation.

(ii) Determine the effect of processing on colour stability.

(iii) Determine the effect of added antioxidants on colour stability.

(iv) Determine the acceptability of the texture of the drink to consumers and if necessary reformulate the drink to give a more acceptable texture.