ABSTRACT

Studies On The Maturation Of Jamaican Rum

Ian Leighton Thompson

This work

(i) documents the changes in constituents during the maturation (aging) of Jamaican rum in charred and decharred oakwood barrels,

(ii) investigates methods of promoting and accelerating the maturation process, and

(iii) proposes mathematical models for the changes that take place during aging.

This thesis has been organized in three (3) sections - Parts I, II and III - which present the literature review, results and discussion, and experimental respectively.

Part I (Chapters 1-4) is dedicated to the literature survey which explores rum production, rum flavour, the distinction between aging and maturation, oxidation of lignin and analysis of alcoholic beverages.

All the results of the experiments carried out in this study are presented and discussed in Part II. Chapter 6 reveals the changes in chemical composition and sensory properties during the traditional aging of Jamaican rum. The ester and fixed acid content of rum aged in both charred and decharred barrels were found to increase linearly (at + b) over the aging period; while the change in colour, extract (total solids), tannins, volatile and total acids were each found to be best described by a power functionality (at^b) for both barrel types. From the sensory analysis, it was found that rum aged in charred barrels was rated as being more mature than rum aged in decharred barrels.

The characteristic changes in specific volatile congeners during traditional aging are documented in chapter 7. It was found that the acetaldehyde, methanol and ethyl acetate content increased linearly with time, while the acetic acid content followed a power functionality for both charred and decharred barrels. During non-traditional maturation, hydrogen peroxide (0.106M) and copper (II) ions (5ppm), when added in combination, caused the most significant increase in the volatile congeners of rum.

The changes in specific non-volatile phenols (namely gallic, vanillic and syringic acids, vanillin and

syringaldehyde) are reported in chapter 8. It was found that of the phenols monitored, only the gallic acid content increased linearly. All the other phenols were

found to vary exponentially ($a - b.e^{-kt}$) for rum aged in both charred and decharred barrels.

During non-traditional maturation, the addition of hydrogen peroxide to rum being stored in 5L oak cask, or with roasted oak chips, produces more phenolic acid than aldehyde. Addition of both hydrogen peroxide (0.106M) and copper (II) ions (5 ppm) caused the most dramatic increase in non-volatile phenolic content.

This work has successfully demonstrated that the development of certain constituents (namely chemical groups of similar compounds, specific volatile congeners and non-volatile phenols) and the sensory characteristics of Jamaican rum may be adequately described and characterised by the mathematical models developed. These are the first models to be developed which describe the aging of Jamaican rum and may be used as tools to predict constituent concentration during aging.

A mechanistic model which explains the appearance of non-volatile phenols in Jamaican rum has also been proposed and provides another hypothesis on the degradation of lignin. It proposes that the appearance of C_6-C_1 phenols in Jamaican rum is due partly to the oxidation of C_6-C_3 phenols (which occur in a parallel fashion) and partly to extraction.