



Irradiation of cane sugar spirit

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Abstract

The present study deals with the effect of irradiation on the gas-chromatographic profile of irradiated cane sugar spirit irradiated in glass containers in the presence of oak chops with doses of 0–10 kGy. Volatile constituents were analyzed in a CG gas chromatographer with a flame ionization detector using a Megabore CG-745 column. The results are discussed considering the contribution of irradiation to the quality of the spirit and the contribution of the irradiated oak wood. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Cane sugar spirit; Ionizing radiation; Gas chromatography; Flame ionization detector

1. Introduction

The use of Co-60 ionizing radiation to improve the quality of Brazilian cane sugar spirit is examined. Cane sugar spirit (Brazilian production: 1.2×10^9 l/year) is prepared by the distillation of the fermented beverage produced by yeasts on glucose solutions (Novaes, 1996). Alcoholic beverages can be irradiated for different purposes, such as sterilization measure to terminate fermentation and provide stability, to change a wine's normal characteristics or to accelerate ageing. In the ageing process for brandies, improved flavor is associated also with extraction of material from oak containers (Urbain, 1986). Some substances can be considered as references of the ageing process, like the methanol decrease, the increase of ethyl acetate, acetaldehyde and 1,1-dietoximethane (Puech, 1983). During ageing, a reduction of acids and aldehydes and

the increase in the esters content generally occurs (Rigott, 1989). However, some phenolic compounds coming from the wood are incorporated progressively to spirit (Puech, 1983). Apparently, irradiation of oak wood shavings permits easier extraction and improves brandy flavor (Urbain, 1986).

2. Materials and methods

2.1. Material

Cane sugar spirit recently distilled, alcoholic grade between 38° and 54°, was obtained from the Department of Sugar and Alcohol Technology, ESALQ, University of Sao Paulo.

2.2. Methods

Samples of cane sugar spirit in glass containers in the presence or absence of oak shavings were irradiated with doses of 0, 2, 5 and 10 kGy in a ⁶⁰Co Gammacell 220 at a dose rate of ~7.7 kGy/h. Volatile

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constituents of samples of 1 μ l were analyzed in a CG-90 gas chromatograph with a flame ionization detector, using a Megabore CG-745 column, flux of nitrogen (carrier gas), 7 ml/min, air 300 ml/min and hydrogen 30 ml/min. The temperatures of the column, the injector and the detector were, respectively, 40°C, 150°C and 180°C. The colour degradation of the samples that were in contact with the oak wood was measured in a Shimadzu UV1601 spectrophotometer.

3. Results and discussion

Whereas higher alcohols are dominant flavor volatiles of brandy and whisky, ethers largely contribute to sugar cane spirit (Puech, 1983). Previous chromatographic profiles of standard samples of volatile com-

ponents of sugar cane spirit gave information about the nature of the constituents. The results of the present chromatographic analysis showed the increase of the small peaks that appear before the main ethanol peak as a consequence of irradiation, as can be seen in Fig. 1. It is probable that acetaldehyde, acetone and ethyl acetate were involved. Fig. 2 presents the results of the chromatographic runs of samples that were irradiated in the presence of oak shavings. In this case, apparently, there are no differences between irradiated and unirradiated samples in the region around the ethanol peak. However, a new peak seems to be detected at a higher retention time. The spectra of absorbance as a function of dose for the samples that were in contact with oak wood are shown in Fig. 3.

Irradiation of brandy with a dose of 0.1 kGy is reported to produce a flavor equivalent to that obtained with 3 years of normal ageing (Urbain, 1986).

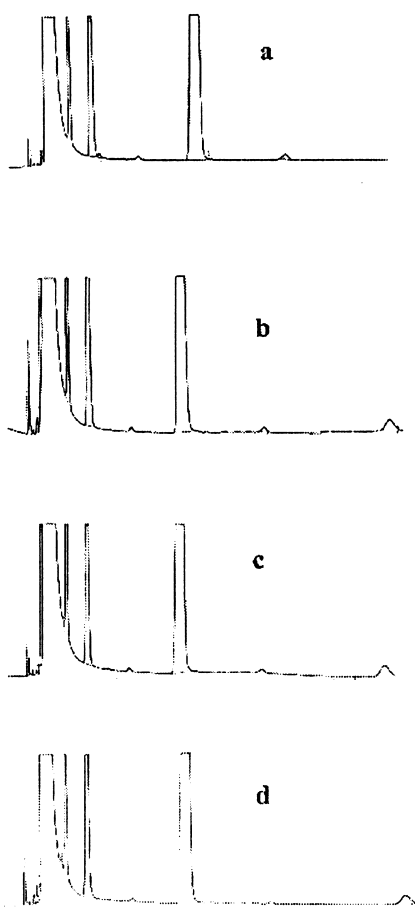


Fig. 1. Chromatographic profiles of cane sugar spirit (a) unirradiated; (b) irradiated with 2 kGy; (c) 5 kGy and (d) 10 kGy.

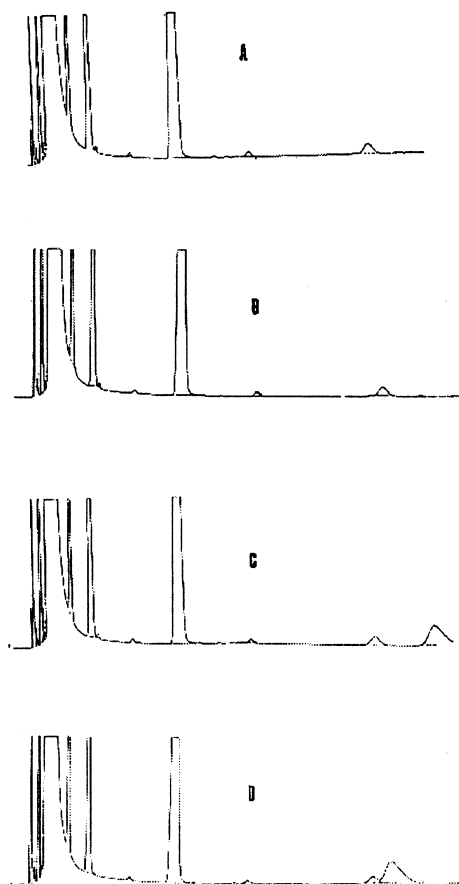


Fig. 2. Chromatographic profiles of cane sugar spirit (A) unirradiated; (B) irradiated with 2 kGy; (C) 5 kGy and (D) 10 kGy in the presence of shavings.

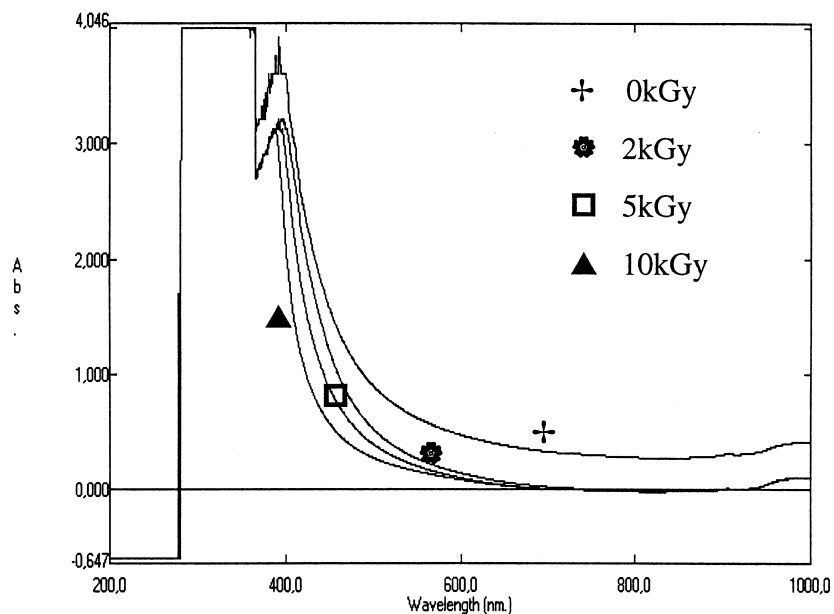


Fig. 3. Absorbance vs wavelength of cane sugar spirit samples irradiated in the presence of oak shavings.

More analysis must be done in order to clarify the role of irradiation in the development of some characteristics of ageing of alcoholic beverages.

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