Distilled beverage from spent coffee ground: Production and sensory analysis

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During the last years, the distillates industry has demonstrated large interest in producing new products from unusual raw materials that enable acquisition of different flavors, attracting new markets. Spent coffee grounds (SCG), the solid residues obtained during the processing of coffee powder with hot water or steam to prepare instant coffee, are coffee industry residues generated in large amounts but practically unused [1]. This residue presents a remarkable residual aroma of roasted coffee beans, being an interesting feedstock for the production of a new spirit. Alcoholic beverages produced from coffee beans can be found in the market, but a spirit produced from SCG can be considered as a novel beverage. The present study describes a procedure for the production of a spirit from SCG. Quantitative descriptive analysis was used to evaluate the sensory characteristics of this new spirit and the most important aroma descriptors contributing to sensory quality of the distillate were identified.

SCG were supplied by NovaDelta - Comércio e Indústria de Cafés, Lda (Campo Maior, Portugal). As soon as obtained, the material was dried at 60 ºC to 10% moisture content to be stored. A hydrothermal process was initially performed aiming to extract aroma compounds from SCG. To be used as fermentation medium, SCG extract was supplemented with 180 g/l sucrose and 175 mg/l potassium metabisulfite. *Saccharomyces cerevisiae* (RL-11) was the yeast strain used in the experiments. Fermentation assays were performed in a 6.5-L bioreactor containing 3.5 L of fermentation medium inoculated with an initial cell concentration of 1 g/l. Fermentations were maintained at 30 °C and 150 rpm. During the fermented broth distillation, samples of approximately 20 ml were recovered and the ethanol content in each one of them was determined. The fraction corresponding to the heart had its ethanol concentration corrected to 40% v/v by adding ultrapure water and was stored in glass bottles with caps and plastic coverings and maintained at room temperature for later sampling and sensory analysis. Total sugar content was determined by anthrone method. Ethanol concentration was determined by HPLC. The sensory analysis was developed by eight trained panelists from Apellation Orujo de Galicia (Galicia, Spain). The spirit evaluation by sensory analysis was performed by QDA methodology, and sensory descriptors in visual, olfactory and gustatory phases were generated.

SCG were initially submitted to a hydrothermal process aiming to extract aroma compounds. By performing this hydrothermal process, an extract containing only 3.4 g/l total reducing sugars was obtained. This extract presented a remarkable and pleasant aroma of coffee, very interesting for the spirit production. Thus, the fermentation medium was formulated with the aromatic SCG extract supplemented with sucrose. The kinetic behavior of sucrose consumption, ethanol production and cell growth of *Saccharomyces cerevisiae* RL-11 cultivated in this medium is shown in Fig. 1. As can be seen, the yeast was able to growth and produce ethanol from this extract with elevated yield (0.42 g ethanol/g sucrose) and productivity (0.77 g/l.h). At the end of fermentation, a fermented broth containing 9.1% v/v ethanol was obtained.
Fig. 2 shows the sensory descriptors identified in SCG spirit and their correspondent means of frequency and intensity obtained by the tasting panels. SCG spirit was characterized with 21 sensory descriptors, two in visual analysis, eleven in the olfactory analysis and eight in gustatory analysis. In the visual analysis, the two descriptors (clarity and brilliance) showed high intensity (86%) and frequency (100%).

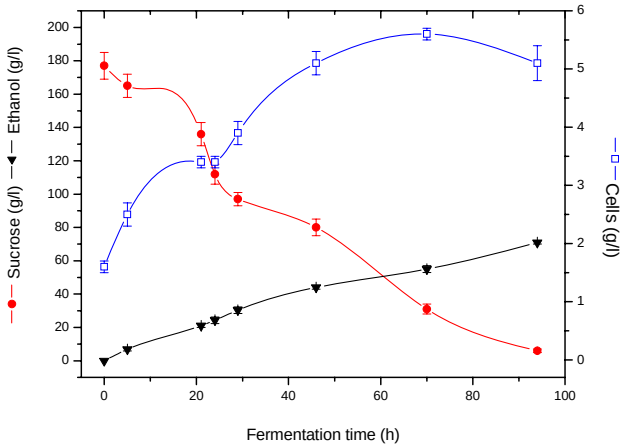

Fig. 1. Fermentation profile of ethanol production, sucrose consumption and cell growth of *S. cerevisiae* (RL-11) from spent coffee ground extract.

The highest intensity for olfactory analysis was found for coffee descriptor (61%), and the highest frequency (100%) was for coffee, finesse, elegance and frankly. Pungent and bitter showed the highest values for intensity (61% and 57%, respectively) and frequency (88%) for gustatory analysis. Such characteristics are typical of newly distilled spirits, and can be improved with the aging of the distillate [2].

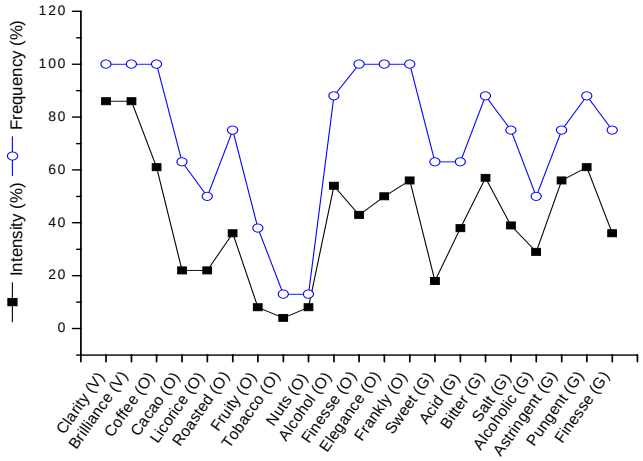

Fig. 2. Intensity (%) and frequency (%) of sensory descriptors for spent coffee ground spirit obtained by quantitative descriptive analysis. V: visual analysis; O: olfactory analysis; G: gustatory analysis.

Spent coffee ground was successfully used for the production of a spirit, which presented a remarkable aroma of coffee derived from the raw material. Despite the pungent and bitter taste, due to being a "new spirit", sensory analysis revealed features of a pleasant beverage, which can be further improved by aging the distillate. Production of this spirit is an interesting alternative for SCG reuse and to expand the distillates' market.

References

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