



Instituto Politécnico
de Castelo Branco

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**Research and development pilot-plant process
optimization: validation of alternative filling
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Research and Development Pilot-plant process optimization: Validation of alternative filling processes

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Relatório de Estágio apresentado à Escola Superior Agrária de Castelo Branco do Instituto Politécnico de Castelo Branco para cumprimento dos requisitos necessários à obtenção do grau de Licenciado em Engenharia Biológica e Alimentar, realizada sob a orientação científica do Professor Adjunto Doutor Ofélia Maria Serralha dos Anjos, do Instituto Politécnico de Castelo Branco e do Mestre Jean Christophe Lombard, director de pesquisa e desenvolvimento na The Coca-Cola Company.

Outubro de 2015

To Sevinç

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Research and Development process optimization: Validation of alternative filling processes in pilot-plant

André Filipe Ferreira Fonseca

Abstract

This report documents the work performed during an internship at The Coca-Cola Company, Brussels under the program Erasmus+. This internship constitutes the last step to complete a BSc on Biological and Food Engineering at the Polytechnic Institute of Castelo Branco.

The work developed aimed at the quality and standardization assurance of the final product, particularly in the production of beverages containing fruit pieces or pulp and on small scale production of carbonated beverages. The production time optimization was simultaneously targeted.

The report commences firstly with the characterization of the company and introduces key definitions on the soft drink industry followed by a brief description of the tasks assigned in the beginning of the internship. It subsequently reports, in detail, the results obtained in two of the assigned tasks.

On the first task, it was concluded that the time needed for the manual dosing of fruit bits and pulps into bottles would be reduced by 80% through the acquisition of an equipment capable of doing it semi-automatically. The automated dosing has other advantages associated, as for example the enhancement of uniformity between bottles and the possibility to use the dosing equipment for filling in some of the production of still beverages in the pilot plant. The search for an equipment capable of performing this task was fruitful and an assessment was conducted in order to test the equipment precision and accuracy. The results showed that the equipment is precise, but the ratio solid/liquid was not considered the ideal. Nevertheless, it was demonstrated that the method of stirring of the hopper of the equipment during the tests was inadequate and, thereby, the cause of ratio uniformity lack between samples and two ideal ways of stirring were found. The acquisition of the electric dosing unit was advised.

On the second task reported in this work, it was demonstrated that the use of a POM dispenser for carbonated beverage bottle filling presents several advantages when compared with the currently used system of Figals. The ergonomics and higher capacity are its major strong points. It was demonstrated that the equipment is capable of mixing carbonated water with syrups at a steady flow, and precise ratio. It was also determined that the temperature of the syrup before dispensing influences the final carbonation of the product. However, the tests conducted showed that the POM dispenser cannot fully replace the Figal system due to its carbonation limited range. The equipment was consequently validated for the filling of carbonated soft drinks targeting a carbonation level of 2.6 ± 0.2 (V/V).

Keywords

Soft drinks, Carbonated beverages, Fruit bits, Bottle filling, Standardization.

Optimização de processos em pesquisa e desenvolvimento: Validação de processos de enchimento alternativos em planta piloto

André Filipe Ferreira Fonseca

Resumo

Este relatório documenta o trabalho realizado durante um estágio na *The Coca-Cola Company*, Bruxelas sob o programa Erasmus+. Este estágio constitui a última etapa para a conclusão de uma licenciatura em engenharia Biológica e Alimentar no Instituto Politécnico de Castelo Branco.

O trabalho desenvolvido visou a garantia de qualidade e padronização do produto final, particularmente na produção de bebidas contendo pedaços de fruta ou polpa e na dispensa de bebidas carbonatadas em produções de pequena escala. A optimização do tempo de produção foi simultaneamente visada.

O relatório é iniciado com a caracterização da empresa e introduz definições chave sobre a indústria de refrigerantes, seguida por uma breve descrição das tarefas atribuídas no início do estágio. Posteriormente relata em detalhe os resultados obtidos em duas das tarefas atribuídas.

Na primeira tarefa, concluiu-se que o tempo necessário para a dosagem manual de pedaços de fruta e polpas em garrafas seria reduzido em 80% mediante a aquisição de um equipamento capaz de executar esta tarefa semi-automaticamente. A dosagem automatizada tem outras vantagens associadas como, por exemplo, o incremento de uniformidade entre garrafas e a possibilidade de usar o equipamento de dosagem para o enchimento, em algumas das produções, de bebidas não carbonatadas na fábrica-piloto. A procura de um equipamento capaz de realizar esta tarefa foi frutífera e uma avaliação foi conduzida a fim de testar a sua precisão e exactidão. Os resultados demonstraram que o equipamento é preciso, mas a relação sólido/líquido não foi considerada ideal. No entanto, foi demonstrado que o método de agitação do depósito do equipamento durante os testes foi inadequado, sendo a causa da falta de uniformidade entre amostras. Subsequentemente, duas formas ideais de agitação foram encontradas. A aquisição da unidade eléctrica de dosagem foi aconselhada.

Na segunda tarefa relatada neste trabalho, demonstrou-se que a utilização de um distribuidor POM para o enchimento de garrafas com bebidas carbonatadas apresenta diversas vantagens quando comparado com o sistema actualmente utilizado de Figals. A ergonomia e maior capacidade são os seus principais pontos fortes. Demonstrou-se que o equipamento é capaz de misturar água carbonatada com xaropes a um rácio e a um fluxo constante. Também se determinou que a temperatura do xarope antes da dispensa influencia a carbonatação final do produto. No entanto, os testes realizados demonstraram que o distribuidor POM não pode substituir totalmente o sistema Figals devido ao seu limitado alcance de carbonatação. O equipamento foi conseqüentemente validado para o enchimento de bebidas gaseificadas visando um nível de carbonação de $2,6 \pm 0,2$ (V/V).

Palavras chave

Refrigerantes, Bebidas carbonatadas, Pedaços de fruta, Enchimento de garrafas, Padronização.

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