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The product-friendly preservation of beverages – testing under hygienic conditions

Pressure change technology – PCT for short – makes it possible to preserve fruit juices as gently as possible and to extract valuable ingredients. Fraunhofer IGB has developed the process through to final industrial application. Apart from the food preservation applications, the experts also use the technology to obtain extracts and active ingredients from plant, microalgae and microbial cells. A research facility for the purpose of testing the technology under strict hygienic conditions is now in operation. This will be presented to specialists at a colloquium on June 21, 2016.

Microorganisms cause the spoilage of fresh foodstuffs. For a longer shelf life, microorganisms must therefore be inactivated or their reproduction must be inhibited. Chemical preservatives, which are mainly used today, may cause allergic reactions; their acceptance as food additives has consequently decreased. Due to greater health and environmental awareness, the requirements relating to the quality of our food have also changed. Today, a growing number of consumers demand safe and, as far as possible, "clean" foodstuffs in their natural state and without artificial additives. As a rule, beverages are currently treated with thermal processes. However, not only the microorganisms are killed by pasteurization and especially by heat sterilization: heat-sensitive and nutritionally relevant ingredients such as vitamins or proteins are also destroyed. And besides this, taste and color are affected.

Pressure change technology (PCT) is a physical process for the product-friendly preservation of liquid foodstuffs. In recent years, the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB has investigated the process, which is also called "cold pasteurizing", and has further developed it through to application maturity. In the EU-funded project "PreserveWine", for example, the addition of sulfur dioxide to the wine was considerably reduced by using PCT. "We have shown that the color of PCT-treated wine is preserved, even over longer periods of time, and that flavor is not affected," says Dr. Ana Lucía Vásquez-Caicedo about the research findings.

Pressure change causes cells to burst

In pressure change technology the liquid to be preserved is enriched and mixed with a chemically inert gas, for example nitrogen or argon. If the pressure is increased to up to 500 bar, the dissolved gas diffuses through the cell membrane into the microorganism cells. If the pressure is then abruptly lowered, the gas – including that within the cells – regains its original gaseous state, thus expanding and causing the cells to burst.

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"The process does not require any chemical additives, and since the foodstuffs do not have to be heated, the biological function of the ingredients is fully retained," explains Dr. Ana Lucia Vásquez-Caicedo. A further advantage of the new technology is that, at the same time, it has a conserving effect in two different ways: On the one hand, the microorganisms are destroyed. On the other, the working gas acts as a protective atmosphere and prevents atmospheric oxygen from damaging sensitive ingredients.

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PCT research facility under hygienic conditions

On the basis of years of research and project work, Fraunhofer IGB experts have now built a PCT testing facility in which they can investigate the process for the stabilization and preservation of any liquid products and can determine the optimum parameters in each individual case. The facility is located in a cleanroom technical center (Class E cleanroom), so that the investigations take place under hygienic conditions without risk of contaminating the product.

The PCT research facility can treat up to four liters of liquid per minute continuously. The process is suitable for all beverages that are normally pasteurized, i.e. fruit and vegetable juices or concentrates, and also alcoholic beverages, milk products, plant extracts and suspensions containing active substances, e.g. cosmetic and pharmaceutical preparations. Additionally, for basic testing – for example, at a customer's location – a flexibly configurable and mobile PCT lab plant is currently being constructed.

Cell disruption for the product-friendly release of ingredients

Pressure change technology does indeed destroy the cells, but it does not change their ingredients, so this opens up a further field of application for the technology. Plant or microbial cells can be disrupted to release valuable intracellular metabolites. Fraunhofer IGB researchers have already tested the process for microalgae cells and extracted high-quality fatty acids for dietary supplements and pigments for cosmetics.

"If we then also combine the PCT process with high-pressure extraction, we can obtain omega-3 fatty acids with much greater energy efficiency than previously, yet achieving at least the same quality," Vásquez-Caicedo adds. The high-pressure extraction does not require the use of any solvent. That is good both for the environment and for the preparation of the extracts.

Formal inauguration

On June 21, 2016 the 1st Technical Colloquium "Current and Future Applications of High-Pressure Technologies in the Food Industry" will present current results and future possibilities of this and related high-pressure technologies. The PCT plant will be inaugurated in conjunction with the colloquium, during a subsequent visit of the plant.

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For further information and preliminary program

www.igb.fraunhofer.de/en/pctcolloquium

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We very much hope that you will include the presentation and demonstration in your events calendar.

You are cordially invited to the inauguration of the plant.

If you are interested please contact us by e-mail
(to: claudia.vorbeck@igb.fraunhofer.de).



At Fraunhofer IGB the preservation of beverages and liquid foodstuffs, and also cell disruption, can be tested under hygienic conditions using the PCT research plant.

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