

## Practice abstract 1

### Low oxygen juice extraction and mild preservation

#### Problem

Juice preservation typically involves application of heat treatment, which can lead to quality decline and undesirable changes in nutrition, taste, and structure. An alternative method called Pulsed Electric Field (PEF) offers a less heat-intensive approach. However, the application of PEF technology is currently limited to preserving high-quality juices and smoothies, with only a few machines commercially available. Traditional methods for juice extraction still prevail, sometimes incorporating aroma recovery during deaeration.

#### Solution

Designing a small-scale, mobile, and flexible unit for fruit processing involves integrating downscaled technologies to ensure ease of use across various locations, raw materials, and final product requirements. The FOX mobile unit is designed for extracting fruit juices and purees in an oxygen-reduced environment. This innovative extraction system is coupled to a gentle preservation - Pulsed Electric Field (PEF), ensuring improved quality, while offering maximum flexibility for various applications.

#### Benefits

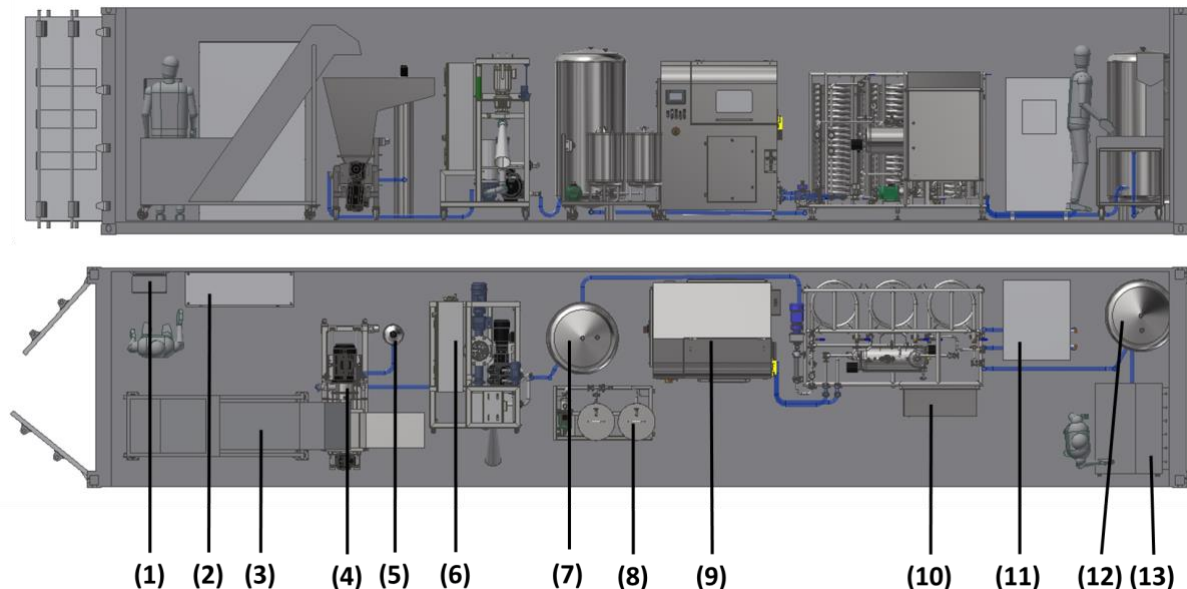
- The production line is automated and has a maximum capacity of 250 L/h, with the potential to be extended to 500 L/h.
- The processing line can process stone fruits like apples, pears, and quince, as well as berries such as strawberries, blackberries, raspberries etc.
- The unit is highly flexible and capable of producing juice ranging from slightly turbid to sauce and/or puree consistency.
- The yield of the unit varies depending on the desired consistency, with approximately 80% for almost clear apple juice.
- The juice is 100% directly pressed from fruit, with no additives, and has a fresh appearance, taste, and aroma, while keeping its nutritional quality.

#### Practical recommendations

The concept of the FOX mobile juice unit is shown in Figure 1.

- The processing line is designed for operation by a minimum of two people. One person should be responsible for operating the entire processing line from a control panel (1).
- Fruits and vegetables (or mixtures) are manually fed into the elevator (3).
- The elevator washes and transports the produce directly to the funnel of a multi-crush unit (4). In the multi-crush unit, fruits and vegetables are crushed in the presence of nitrogen to reduce contact with oxygen.

- The resulting mash is then transported to the vacuum spiral filter press (6).
- The juice is pulled out by the vacuum through the sieve surrounding the spiral filter press. The extracted juice is transported to a product buffer tank (7). When the tank is filled with over 50 L of juice, it is pumped from the tank into the LHS.
- The juice is pre-heated in the LHS (10) to the desired temperature (typically not higher than 40 °C) before being pumped into the PEF system (9).
- After the PEF preservation step, the juice is immediately cooled down to the desired temperature. Cooling the juice helps reduce thermal load and prevent loss of thermally sensitive compounds (usually below 20 °C).
- The cooled juice is collected in a second tank (12), referred to as the product tank.
- From the product tank, the juice can be pumped to the filling unit (13). The filling unit supports two options: (1) 5-L BAGinBOX or (2) diverse size glass bottles.



**Figure 1.** The concept of FOX mobile juice unit: (1) Control Panel, (2) Electric Cabinet, (3) Elevator, (4) Multi-crush unit, (5) Nitrogen bottle, (6) Vacuum spiral filter press, (7) Juice buffer tank, (8) Mobile CIP unit, (9) Pulsed electric field (PEF) unit, (10) Liquid handling system (LHS), (11) Cooling unit, (12) Juice storage tank, (13) Filling unit.

### Environmental impact

The environmental impact of the FOX mobile juice unit has been compared to conventional systems using traditional pressing and thermal pasteurization technologies. Both systems were operated at their optimal production capacity level. The main environmental impacts were linked to apple cultivation and energy usage for juice processing. The conventional system produced more waste (pomace) and had a lower juice yield compared to the FOX mobile juice unit. FOX mobile juice unit was 20% more environmentally friendly than a similar small-scale stationary processing

line. Changes in transportation and operation scenarios had minimal effects on environmental performance but reducing the distance of fruit transportation proved advantageous. Although the type of apple juice produced was the same, variations in extraction and preservation technologies resulted in differing quality.

### **Further information**

#### **Videos**

<https://www.youtube.com/watch?v= dnPNjSzA0k>

<https://www.youtube.com/watch?v=RN-j8xpGwrk>

<https://www.youtube.com/watch?v=kNOO6xRi6A8>

#### **Further readings**

Zdravkovic M., Snoeck E.R., Zicari A., Vranken L., Heinz V., Smetana S., Aganovic K. (2021). Sustainability assessment of mobile juice processing unit: Farmers perspective. *Future Foods*. 4, 1-8.

#### **Weblinks**

<https://foxlink.app/>

#### **About this practice abstract**

**Authors:** Milena Zdravkovic<sup>1</sup>, Kemal Aganovic<sup>1</sup>, Lucian Miron<sup>2</sup>

<sup>1</sup> German Institute of Food Technologies (DIL)

<sup>2</sup> European Federation of Food Science and Technology (EFFoST)