The use of ultrasound in drying process allows the processing time and energy consumption to be reduced, and the quality of the product to be preserved.

Power ultrasonic plate-transducers introduced on the market by PUSONICS represent a sustainable technological novelty capable of transmitting sonic and ultrasonic energy through air. Ultrasound is deemed an appealing green method for drying heat-sensitive materials, where micro-vibrations could prevent spoilage due to damaging high temperature levels. Ultrasonic dehydration performed via air-borne radiation or in direct contact with the materials has proven to be an effective procedure by applying the PUSONICS plate-transducer technology.

ULTRASOUND ASSISTED CONVECTIVE DRYING

High-intensity airborne ultrasound introduces pressure variations at gas-liquid interfaces that increase the evaporation rate of material moisture. Moreover, in forced-air drying systems the ultrasonic wave produces an oscillating-velocity effect, which can increase the drying rate at stable air velocity. In addition, high-intensity airborne ultrasound causes micro-streamings at the air/material interfaces that reduce the diffusion boundary layer, increasing mass transfer, and accelerating diffusion. Also ultrasonic vibrations produce a kind of “micro-sponge” effect that favours the quick migration and the release of the moisture.
NEW ULTRASONIC TECHNOLOGY FOR DRYING:

With the introduction of the novel plate-transducer technology for air-borne applications by PUSONICS SL, new possibilities for enhancing drying have been opened up. These devices are characterized by higher electro-acoustic efficiencies compared with former sound sources, and have already shown promising results in several drying operations.

- Forced-air drying assisted by air-borne ultrasound
- Ultrasonic drying by applying ultrasound in direct contact with the material.
- Use of an air-borne ultrasonic transducer as a fluidized bed dryer

The simultaneous combination of ultrasound and other drying methods such as forced-air at low temperature, electromagnetic microwaves, infrared, etc., has also shown to be a promising avenue to enhance drying.

**Forced-air drying assisted by air-borne ultrasound**

The ultrasonically assisted forced-air drying could be applied in two different ways, one in hot-air convective drying by using moderate temperatures and another in low-temperature drying (below and above product’s freezing point) at atmospheric pressure by intensifying and accelerating the process.

**Ultrasonic Dehydration by direct contact**

Ultrasonic vibration applied via direct contact between vegetable samples and an ultrasonic plate radiator.

The good acoustic impedance matching between the vibrating plate of the transducer and the material favours the deep penetration of acoustic energy and increases the effectiveness of the process. This results in quicker and deeper moisture release from the product. In addition, it is possible the production of ultrasonic cavitation inside the liquid that may help to the separation of the moisture strongly attached.
EFFECTS ASSOCIATED TO ACOUSTIC ENERGY

The ultrasonic drying process is low energy consuming, and the product qualities are very well preserved.

Ultrasound does not lead the product being heated to significant temperature increases. As a consequence, the use of ultrasonic waves either to dry heat sensitive materials or to perform drying processes at low temperature constitute a sustainable and energy efficient method.
References

