CANNABIS

# RADIO FREQUENCY

## Microbial Disinfection

Radio Frequency (RF) is an electromagnetic energy that can be utilized to generate heat volumetrically and kill a broad spectrum of microbial pathogens. Contrary to conventional thermal processing, RF penetrates evenly throughout a product and the process final temperature can be precisely controlled. RF is a proven organic, non-ionizing process used to pasteurize and disinfect food products and leafy herbs, such as cannabis.

**Radio Frequency Processing**

Radio frequency (RF) is part of the electromagnetic spectrum covering frequency ranges from 3 kHz to 300 MHz. RF heating is defined as the dielectric heating of a material using a radio frequency field. Unlike conventional thermal processes, where heat is generated by an external source and is transferred gradually to the material moving from surface to center, dielectric processes generate heat directly inside the entire product mass – known as “volumetric heating”.

Once a material enters the RF field, existing ions and polar molecules in the material interact with the RF field, rotating and oscillating rapidly, to match the RF frequency. The electromagnetic field is absorbed by the material and converted into thermal energy due to molecular friction and rotation. Heat is generated throughout the product instantaneously and evenly. Volumetric heating is a unique characteristic of dielectric heating and RF processing.

RF heating is influenced primarily by the dielectric properties of a material when other conditions are kept constant. When the dielectric properties of a material are very low, that material will not interact with the RF field, thus no heat will be generated. The ability to selectively heat materials is a unique characteristic of RF processing which allows for the precise and targeted heating of a product, and avoids heating surrounding low dielectric materials, such as product packaging.

**Benefits**

Due to its volumetric and targeted heating mechanism, RF provides many operational and technical advantages:

- High-efficiency energy transfer
- Short process time
- Uniform heating within the product
- Instant and accurate process control
- Selective heating of materials
- Preservation of sensory, chemical, and physical characteristics of a material
- Environmentally friendly; no fumes released by the energy source
- Low maintenance equipment

**How RF Heating Works**

1. RF heating exposes dipoles (molecules with separated positive and negative charges) to an oscillating electric field, causing the dipole to continually align itself with the field.
2. Dipoles rotation and molecular rotation generate heat. With common foods as well as cannabis, the dominant dipole effected is free (unbound) water.
3. Other dipoles, such as fatty acids, amino acids, proteins, and phospholipids, are also affected and create heat, but with restricted rotations.

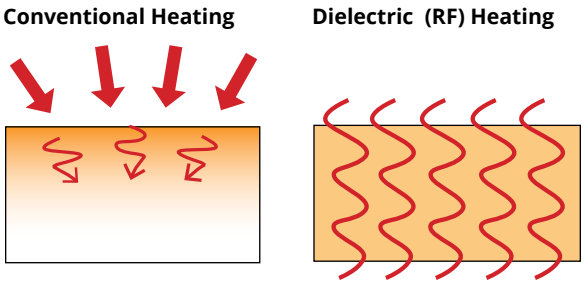


*Figure: Comparison of heating materials via traditional convection method versus radio frequency.*

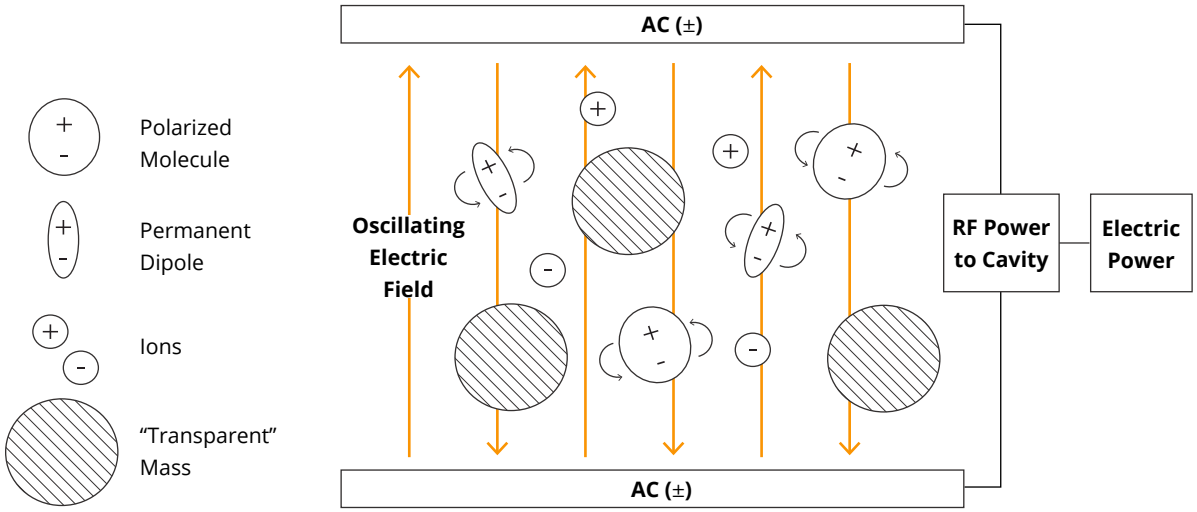


*Figure: Oscillation of Electric Field Resulting in Continual Realignments of Dipoles and the Generation of Heat*

**Classification of Radio Waves**

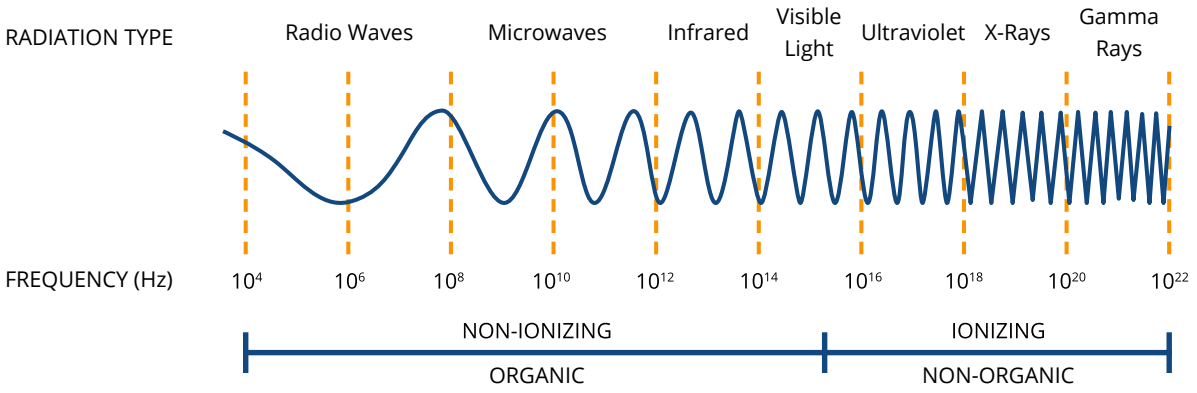


*Figure: Radio Frequency radiation consist of non-ionizing wavelengths.*

**Applications**

One of the earliest RF applications adopted by industry was for drying textiles. In the last 10 years, broader applications of this technology have been developed. Today, RF technology is a proven organic technology being used extensively across the following industries:

*Drying*

- Drying of textile fibers, yarns and fabrics (natural and mixed polymers, wovens and non-wovens)
- Drying, conditioning and gluing of wood materials and paper base substrates: paper, corrugated cardboard, carton tubes.
- Drying and thermosetting of resins, lacquers, paints and inks
- Final drying or partial drying of baked goods: sponge cakes, biscuits, crackers, cereals, etc.

*Tempering and Thawing*

- Defrosting and tempering of raw food materials: meat, fish, vegetable.
- Softening and tempering of food materials: butter, honey.
- Preheating of thermosetting powders and welding of thermoplastics.
- Sintering of ceramics and refractories: sanitary ware, pottery.

*Microbial Reduction and Pasteurization*

- Disinfection of cannabis and hemp.
- Microbial reduction and pasteurization of nuts and seeds: almond, cashew, hazelnut, brazilnut, sesame seeds, chia seeds
- Bacterial inactivation, pasteurization or sterilization of high moisture packed food products: fresh pasta, gnocchi, baked products, eggs.


*Radio Frequency Conveyor System for Textiles*

*Radio Frequency Conveyor System for Almonds*


*Radio Frequency Batch System for Cannabis*

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