Contribution ID: **983** Type: **Oral Presentation**

Electroporation of cellular membranes for the enhancement of mass transfer in biological media: mechanism and technological applications

Tuesday, 23 May 2023 08:40 (40 minutes)

Cellular membranes serve as selective barriers for regulation of molecular transport between interior and exterior of cells. Under the effect of electric field pulses of very short duration (from several hundred of nanoseconds to several milliseconds) with pulse amplitude from 100-300 V/cm to 100-300 kV/cm, the biological membrane is electrically pierced and loses its semi-permeability temporarily or permanently. The electrical permeabilization of biological membranes (called electroporation) may be reversible or irreversible. It was shown that electroporation can serve to introduce into cells or extract from cells small and/or large molecules. This phenomenon has been applied to amplify the insertion of nucleic acid molecules in genetic modifications, to enhance drug transport in cancer treatment or for the killing of microorganisms. Electroporation can also be used to enhance extraction of valuable cell compounds (polyphenols, carbohydrates, proteins,..) from biological media (plant tissue and biomass materials). Biological tissue with electroporated cell membranes, but with a preserved cell wall network, is selectively permeable. For the purpose of mass transport, electroporated cell tissue presents a porous network with improved permeability and diffusivity characteristics.

This lecture presents the mechanisms of cell electroporation, its impact on the physical properties of biological media, and gives examples of mass transfer enhancement in electroporated cell network. Different methods to detect and quantify electroporation phenomena in porous network of biological tissue are presented. Impacts of electroporation on the mechanical, diffusional and electrophysical properties of biological media are illustrated by numerous examples. Physical models of liquid expression and compounds diffusion in compressible electroporated biological tissue are presented. Several innovative green technologies based on the pulsed electric energy induced electroporation are presented, including selective extraction, filtration, pressing, and drying of plant materials and biomass.

Participation

In-Person

References

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

France

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary author: VOROBIEV, Eugene (Université de Technologie de Compiègne)

Presenter: VOROBIEV, Eugene (Université de Technologie de Compiègne)

Track Classification: (MS24) Invited and Plenary Sessions