

ELECTROPORATION OF SLICES OF SUGAR BEETS WITH RECTANGULAR PULSES*

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In the framework of a joint research project between SÜDZUCKER AG, Forschungszentrum Karlsruhe, and Lutz&Kern, since 2002 an electroporation device for sugar beets has been operated on site in a sugar factory. This device is equipped with two Marx generators delivering exponentially decaying pulses in the microsecond range to the sugar beets, /1/.

For the improved design of the next electroporation device, it is important to get a deeper knowledge of the dynamics of the opening process of pores in the cell membranes. Therefore, an arrangement for the application of rectangular pulses to slices of sugar beets has been set up.

During the application of the pulses, the current and voltage across the sample is acquired, Fig. 1. The current gives some information about the time constant for charging the membrane and the formation of the pores.

The pulses have been applied at repetition rates of several seconds to minutes. Between the pulses, measurements of the complex impedance at three discrete frequencies 500 Hz, 50 kHz, and 5 MHz have been performed. From these measurements, according to Angersbach et al. (/2/), the desintegration index of the cell membranes has been derived. Additionally, the phase angle between voltage and current at 50 kHz has been measured. It depends on the desintegration of the cell, too. Due to its simpler measurement set-up, the measurement of the phase angle at 50 kHz seems to be more suitable for the industrial application. Nevertheless, a comparison between the degree of the dejuicing and the value of the phase angle still needs to be done.

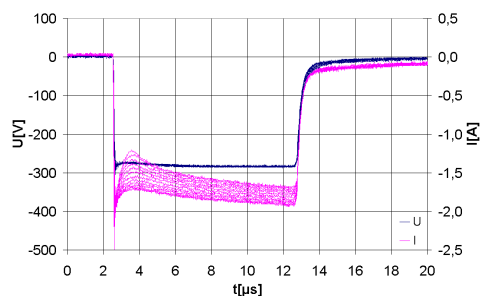


Fig. 1: Current and voltage across the sample.

1. M. Sack, C. Schultheiss, and H. Bluhm: "Triggered Marx Generators for the Industrial-Scale Electroporation of Sugar Beets", IEEE Trans. Industry Applications., 2005, p. 725-733.
2. Angersbach, Heinz, Knorr: „Elektrische Leitfähigkeit als Maß des Zellaufschlussgrades von zellulären Materialien durch Verarbeitungsprozesse“, LVT 42,1997, p. 195-200.

* Work supported by BEO, Projektträger des BMBF und BMWT der Bundesrepublik Deutschland.