Parameters of the *Piezodropper*

- droplets of **high uniformity** and quality
- excellent **long-time stability**
- **nozzle diameter:** 10-100 µm
- **droplet diameter***:* 10-100 µm
- **droplet volume:** 0.5-500 pl
- **droplet velocity:** ~ 2 m/s
- **droplet rate:** 0 (single shot) up to 3 kHz
- **viscosity:** < 100 mPa*s (d = 40 µm)
- **minimum volume** of liquid needed for droplet generation4,5 – 6,8 µl (depending on the type of ***Piezodropper***)
- **very easy to clean and dry** by pressing liquid continuously through the *Piezodropper* and drying with gas flow (1 bar)
- cleaning takes **only a few seconds**
- suitable for liquids such as water, 20 % glycerol, DMSO, 1 % Triton or suspensions of latex spheres in water
- **length of nozzle** below piezo 6-8 mm

Piezodropper computer controlled

The new ***Piezodropper*** developed in 2004 is fully computer controlled.
Using a graphical user interface or the ***Piezodropper*** software driver in your own C++ program you will be able to set the droplet rate, total number of droplets and size of droplets in a certain range of about 2 : 1 in diameter. Additionally you will be able to define special driving signals, durations and amplitudes.

Price

The price of the ***Piezodropper*** will be about 6000 Euros. This includes a computer plug in board, electronics, LED flash light, holder, glass vessel and software. (You would have to provide a Windows based PC.)

Contact

Dr.-Ing. Thomas Wriedt
Universtiy of Bremen
FB 4 / VT
Chemical Engineering
Badgasteiner Str. 3
D-28359 Bremen
Germany

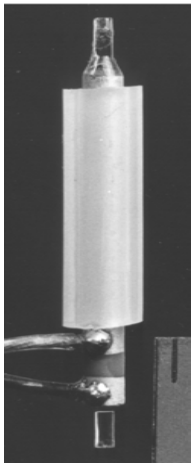
phone: +49-421-218 2507
fax: +49-421-218 5378
e-mail: thw@iwt.uni-bremen.de

http://diogenes.iwt.uni-bremen.de/vt/laser.html

(22.7.2004)

UNIVERSITY OF BREMEN

University of Bremen
FB4, Chemical Engineering



Piezodropper

Computer controlled Piezoelectric Droplet Generator

Introduction

The ***Piezodropper*** is a piezoelectric droplet-on-demand generator developed for microdosing applications. It consists of a borosilicate glass capillary with nozzle fitted to a piezoelectric tube.
The ***Piezodropper*** can be used as a versatile tool for dispensing applications and calibration of optical particle sizing instruments.
Typical fields of application are dispensing systems in pharmacy, molecular or cell biology, or the calibration of particle sizing instruments such as laser diffraction instruments or Phase-Doppler-Anemometers (PDA).

Working Principle

The main components of the ***Piezodropper*** are the glass capillary and the piezoceramic tube (fig. 1). The capillary is fixed within the tube by a two-component adhesive. The tip of the capillary has to be treated by an elaborate method to ensure the desired orifice diameter and a face of good quality. The former is crucial for correct droplet size, the latter for stable operation.
The piezoceramic tube is connected to an electronic high voltage signal generator. A high voltage pulse applied to the piezoceramic tube contracts the tube and thus the glass capillary so that a droplet is ejected from the nozzle. Amplitude, duration, type and frequency of the pulse can be set by the user using a WinXP program. The first three parameters are essential for stable operation of the generator and depend on the dispensed liquid and the used capillary. The frequency determines the droplet rate and can be varied from 0 (single shot) to 3 kHz.

Applications

Generation of small droplets of high uniformity, constant size and form in:

- Pharmacy
- Biotechnology
- DNA-Chips
- Optical particle sizing instruments

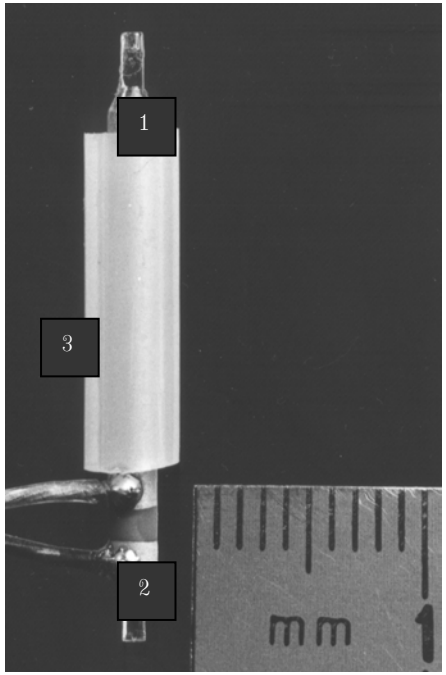


Fig. 1: Photo of a glass capillary (1) embedded in a piezoceramic tube (2). The PTFE-tube (3) protects from mechanical damage and provides electrical insulation.

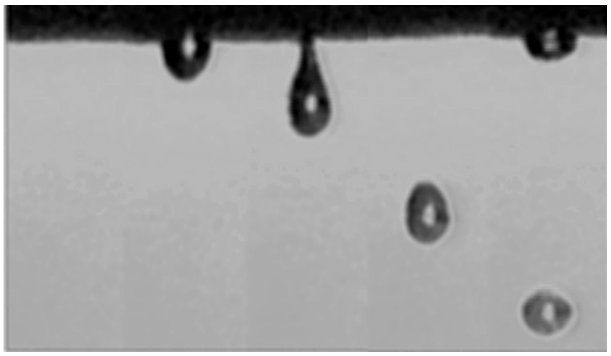


Fig. 2: Ejection of droplets through the nozzle. The photographs were made by stroboscopic illumination of the nozzle.

Experimental Results

The piezoelectric droplet generator is characterized by its high stability and reproducibility. Fig. 3 shows experimental results of the size distribution of droplets generated with the ***Piezodroppe****r* obtained by Phase-Doppler-Anemometry (PDA) measurements.
The data are based on 10,000 measured droplets. The long-time stability was analyzed for a duration longer then 100 hours.

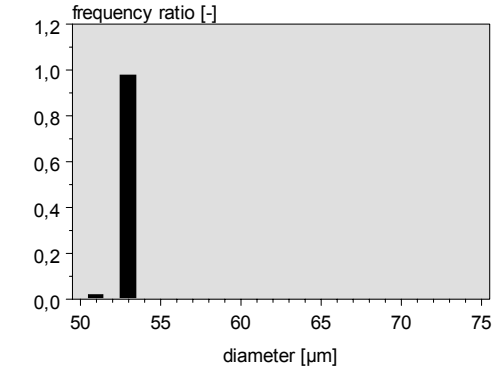


*Fig. 3: Distribution of droplet diameter generated with the **Piezodropper.***

The size of the generated droplets can be varied in a range of 10 to 100 µm by choosing a different orifice diameter. In a multiple ***Piezodropper*** setup the user can give the number of droplets for each capillary so a defined distributions of droplet sizes can be generated.

Tab. 1: Diameter and volume of water droplets, maximum volume flow rate at 1 kHz. Data based on 10,000 droplets.

droplet diameter [µm]	droplet volume [pl]	maximum volume flow rate [µl/min]
22.0 ± 0.7	5.5 ± 0.5	0.33 ± 0.03
51.0 ± 0.4	70.0 ± 1.5	4.2 ± 0.1
86.0 ± 0.8	333.0 ± 10.0	20.0 ± 0.6