Abstract Title

Assessing SonoVue “Lifespan”: Efficient Use of Microbubbles in Research

Objectives

Assessment of the temporal stability of activated SonoVue microbubbles using a large dataset to support efficient experimental planning and improve understanding of their physicochemical behavior.

Methods

The SonoVue microbubble suspension (0.016% v/v) was introduced into a flow system at the focal spot of a single-element transducer and exposed to ultrasound (PNP = 600 kPa, f_o = 1.05 MHz, PRF = 10 Hz, total sonication time = 13.8 ms, 10,000 impulses)**.** Acoustic emissions were recorded with a 3 MHz matrix array probe (Vermon). Measurements were performed for 3 SonoVue vials activated 0, 16, and 86 days before sonication. For each vial, 12 independently prepared samples were analyzed, each sonicated 80 times, yielding 960 measurements per time point.

Results

Based on data from the matrix array probe, three metrics were compared: Energy, Normalized Cumulative Energy, and Cavitation Dose (SCD_har, SCD_ultra, ICD). Mean total acoustic energy increased by 40% at day 16 and decreased by 80% of the day 0 value at day 86**.** The temporal energy distribution during sonication (Normalized Cumulative Energy) remained nearly identical across all time points. The ultraharmonic cavitation dose (SCD_ultra), reflecting stable microbubble oscillations, increased by 50% at day 16 and decreased to 78% at day 86**,** while still detectable. Harmonic cavitation dose (SCD_har) decreased to 65% of the initial value at day 86.

Conclusions

SonoVue microbubbles retained acoustic properties for at least 16 days post-activation, with substantial loss by day 86. Stability was confirmed across many independent samples. Intermediate time points are needed to determine destabilization onset. Microbubbles remain usable for at least 16 days in non-sterile experiments, potentially reducing waste from unused vial portions.

Acknowledgements

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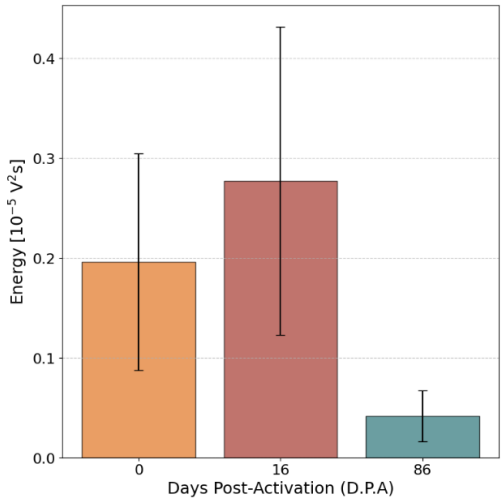
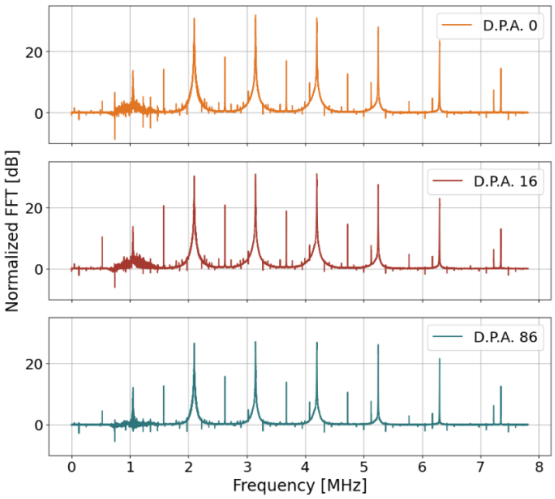
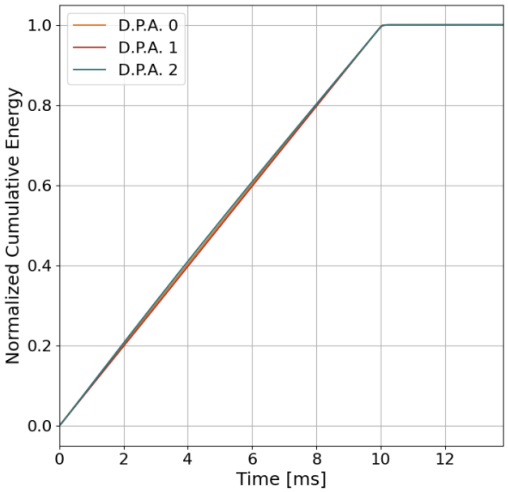
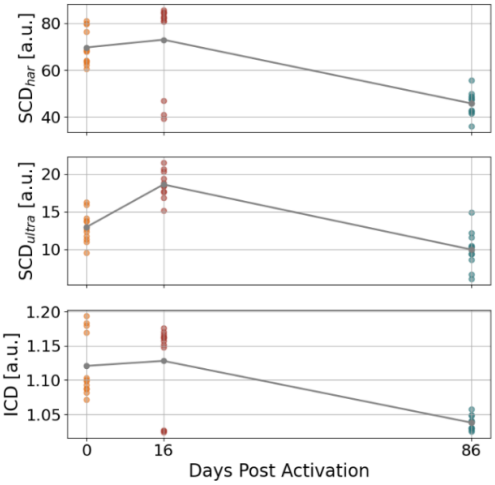

Energy [10^{-5} V^{2}s]
0.0
0.1
0.2
0.3
0.4
0
16
86
Days Post-Activation (D.P.A)


D.P.A. 0
D.P.A. 16
D.P.A. 86
Normalized FFT [dB]
20
0
0
1
2
3
4
5
6
7
8
Frequency [MHz]


D.P.A. 0
D.P.A. 1
D.P.A. 2
Normalized Cumulative Energy
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
Time [ms]


SCD$_{har}$ [a.u.]
40
60
80
SCD$_{ultra}$ [a.u.]
10
15
20
ICD [a.u.]
1.05
1.10
1.15
1.20
0
16
86
Days Post Activation