

# Supplementary Information

## Surface Response Based Modeling of Liposome Characteristics in a Periodic Disturbance Mixer

<sup>1</sup> Department of Electrical Engineering, École de technologie supérieure, 1100 Notre Dame-West, Montreal, Quebec, Canada; ruben.lopez-salazar.1@ens.etsmtl.ca, vahe.nerguizian@ens.etsmtl.ca

<sup>2</sup> School of Engineering and Sciences, Tecnológico de Monterrey, Av. Eugenio Garza Sada 2501 Sur, Monterrey, N.L., Mexico; A00800468@itesm.mx; sergio.camacho@tec.mx

<sup>3</sup> Department of Engineering, Universidad Autónoma de Querétaro Cerro de las Campanas s/n, Santiago de Querétaro, Qro., México; luzmsr@ieee.org

<sup>4</sup> Department of Mechanical Engineering, Khalifa University, Abu Dhabi, UAE; anas.alazzam@ku.ac.ae

<sup>5</sup> Department of Biological Sciences, Université du Québec à Montréal, 141 Président-Kennedy, Montreal, Quebec, Canada; bergeron.karl-frederik@uqam.ca; mounier.catherine@uqam.ca;

<sup>6</sup> Department of Mechanical and Industrial Engineering, Concordia University, 1515 Saint Catherine West, Montreal, Quebec, Canada; ion.stiharu@concordia.ca

\* Correspondence author: ion.stiharu@concordia.ca; Tel.: +1-514-848-2424 Ext. 3152 (I.S.)

### 1. List of Abbreviations and Symbols

The next tables show the abbreviations and symbols used in the manuscript.

**Table S1** List of abbreviations.

Abbreviation	Meaning
ANOVA	Analysis of Variance
CCCR	Central Composite Circumscribed Rotatable Design
DHP	Dicetyl phosphate
DLS	Dynamic Light Scattering
DMPC	1,2-dimyristoyl-sn-glycero-3-phosphocholine
DoE	Design of Experiments
FRR	Flow Rate Ratio
LNP	Liposome Nanoparticles
MHF	Micro Hydrodynamic Focusing Mixer (MHF)
NTA	Nanoparticle Tracking Analysis.
OFAT	One Factor At the Time
PDI	Polydispersity Index
PDM	Periodic Disturbance Mixer
PDMS	Polydimethylsiloxane
SE	Standard Error

**Table S2** List of symbols.

Symbol	Meaning
$Q_{as}$	Flow of aqueous solvent.
$Q_{os}$	Flow of organic solvent
$\rho$	Flow Density
$p$	Pressure
$u$	Flow Velocity
$\mu$	Dynamic viscosity
$F$	Outer forces
$D$	Mutual diffusion coefficient
$c$	Concentration
$\sigma_0$	Standard deviation at the beginning of the mixing channel
$\sigma$	Standard deviation in the cross-section
ME	Mixing efficiency

## 2. Nanoparticle Tracking Analysis (NTA) Results

To compare with Dynamic Light Scattering (DLS) measurements and obtain a visual representation of the particles' Brownian motion, we used Nanoparticle Tracking Analysis (NTA) to characterize representative samples. This method gives a number-based particle size result. The difference in size is related to particle mobility. More mobility corresponds to a smaller sized particle. DLS and NTA measurements are shown in **Table S3** as well as the NTA videos reference.

**Table S3** DLS vs. NTA measurements.

Video Name	Flow Conditions		DLS		NTA		
	FRR	TFR (mL/h)	Z-Average (nm)	PDI	Mean (nm)	Mode (nm)	SD (nm)
Video S1	1	18	184.7	0.045	189.8	130.0	68.5
Video S2	9	18	64.28	0.194	63.5	40.0	55.7

## 3. PDM Performance under Different FRR conditions

The next set of videos shows the PDM performance under different FRR conditions. Fluids flow from left to right. On the top channel, ethanol is injected while at the bottom, one water is injected. The next table shows the video reference as well as the flow conditions of such videos.

**Table S4** Video names and flow conditions.

Video Name	FRR	TFR (mL/h)
Video S3	1	18
Video S4	3	18
Video S5	5	18
Video S6	7	18
Video S7	9	18
Video S8	12	18

