nanomake-L™: India’s first automated microfluidic platform for mRNA LNPs

User-friendly microfluidic platform designed for the rapid optimization and formulation of nanomedicines

nanomake-L™
Microfluidic platform for nanoformulations

info@amarbiosystems.com

+91 22 62255000

www.amarbiosystems.com

LinkedIn

Valson Compound, L.B.S. Marg, Bhandup (W), Mumbai - 400078

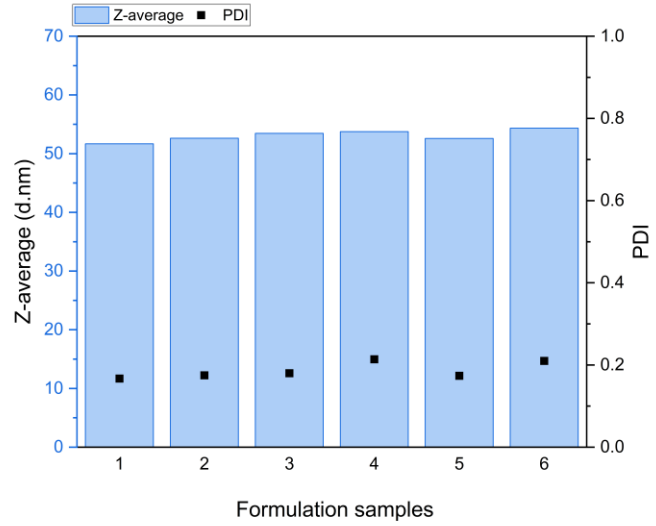
Specifications

- **Flow rate:** 100 µL/min to 50 mL/min
- **No. of Pumps**: 3
- **Syringe sizes:** 500 µL, 1, 2.5, 5, 10 mL
- **Microreactor:** Multi-use microreactor
- **Nanomaterial**: Lipid, Polymer, Emulsions
- **Controls**: Total flow rate, flow ratio, sample volume, in-line dilution
- **Temperature**: Ambient to 60°C (optional pre-heater)

nanomake-L™
Microfluidic platform for nanoformulations

nanomake-L™ for preparation of lipid nanoparticles

Fig. A



Lipid composition	DOTAP: DSPC: CHOL: DMG PEG 2000 50: 10: 38.5: 1.5
Organic solvent	Ethanol
Aqueous phase	Citrate buffer (50 mM, pH 3)
Total flow rate	6 mL/min
Flow rate ratio (Org./Aq.)	1:3

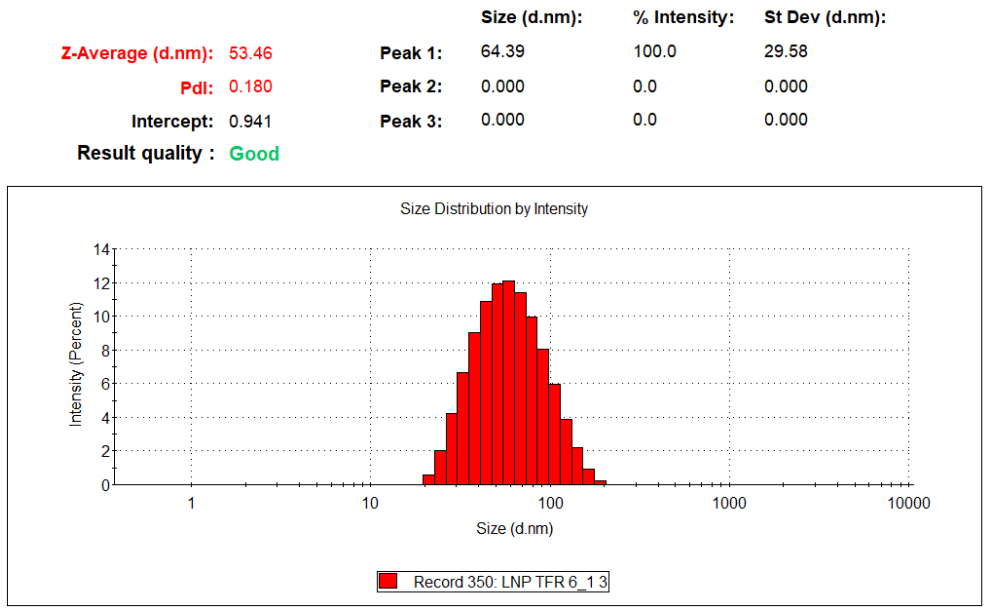


Fig. (A) shows the robustness of nanomake-L™ in preparation of lipid nanoparticles. The Z-average (diameter-nm) and PDI of the formulation was 53.46 nm ± 0.96 and 0.180 ± 0.02 respectively.

nanomake-L™ for preparation of lipid nanoparticles

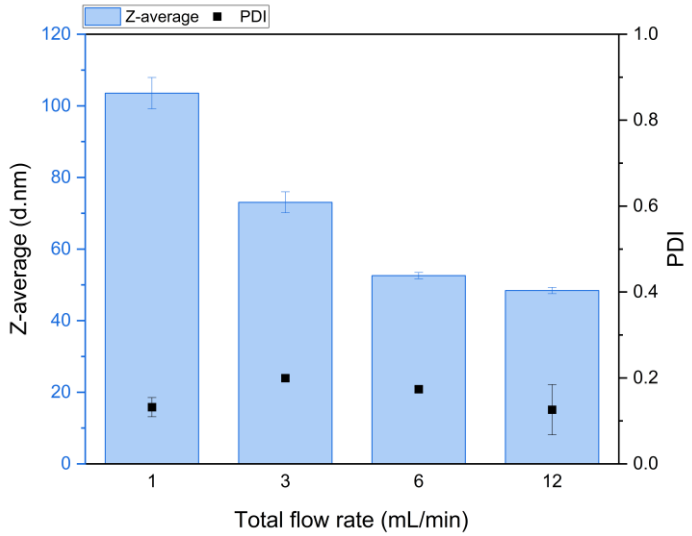


Fig. B

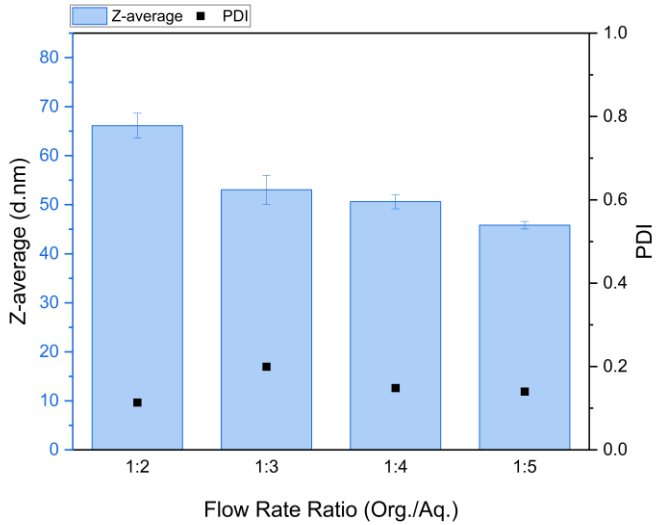


Fig. C

Fig. (B) and (C) show the effect of different flow rate ratios and flow rate on the average diameter and PDI of the prepared nanoparticles. All formulations were prepared in triplicate.

Lipid composition	DOTAP: DSPC: CHOL: DMG PEG 2000 50: 10: 38.5: 1.5
Organic solvent	Ethanol
Aqueous phase	Citrate buffer (50 mM, pH 3)

mRNA Integrity Assessment – nanomake L™

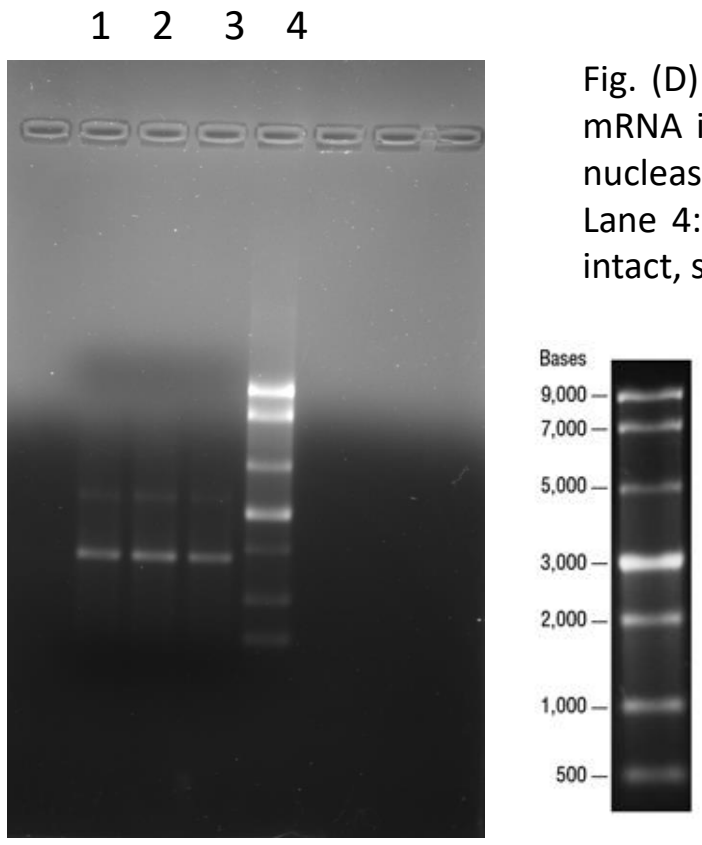
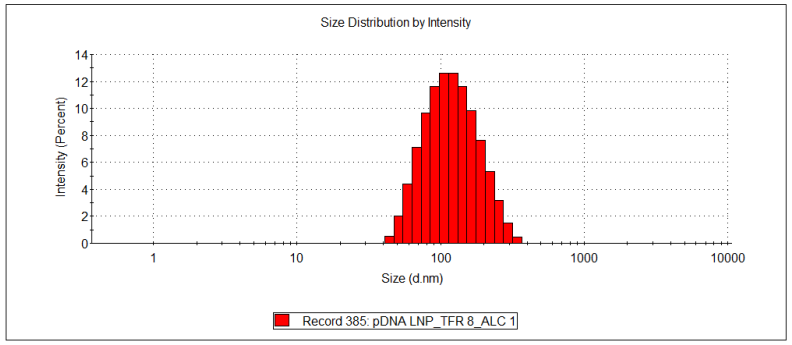


Fig. (D) is a 1% agarose gel prepared in 1X TAE. Lane 1: mRNA control, Lane 2: mRNA in nuclease-free water pumped through nanomake L™, Lane 3: mRNA in nuclease-free water pumped through nanomake L™ post system wash function. Lane 4: ssRNA Ladder (New England Biolabs). mRNA bands (Lane 2 and 3) are intact, similar to control (Lane 1).

1 – Control mRNA
2 – mRNA Before system wash
3 – mRNA After system wash
4 – ssRNA Ladder

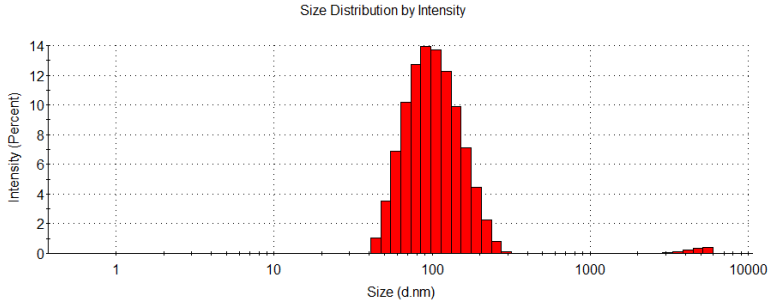
nanomake L™ for preparation of lipid nanoparticles

		Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm): 110.6	Peak 1:	128.4	100.0	55.72
PdI: 0.191	Peak 2:	0.000	0.0	0.000
Intercept: 0.939	Peak 3:	0.000	0.0	0.000
Result quality : Good				



Lipid composition	ALC-0315: DSPC: CHOL: DMG PEG 2000 50: 10: 38.5: 1.5
Organic solvent	Ethanol
Aqueous phase	Citrate buffer (50 mM, pH 3)
pDNA	DENV1 (4.4 kb), 100 µg
N/P	6
Total flow rate	8 mL/min
Flow rate ratio (Org./Aq.)	1:3

		Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm): 96.30	Peak 1:	108.2	98.9	42.60
PdI: 0.168	Peak 2:	4766	1.1	757.1
Intercept: 0.945	Peak 3:	0.000	0.0	0.000
Result quality : Good				



Lipid composition	ALC-0315: DSPC: CHOL: DMG PEG 2000 50: 10: 38.5: 1.5
Organic solvent	Ethanol
Aqueous phase	Citrate buffer (50 mM, pH 3)
pDNA	mRNA (1 kb), 60 µg
N/P	6
Total flow rate	8 mL/min
Flow rate ratio (Org./Aq.)	1:3

The size and PDI of the LNPs was determined through Dynamic Light Scattering.

nanomake L™ for preparation of lipid nanoparticles

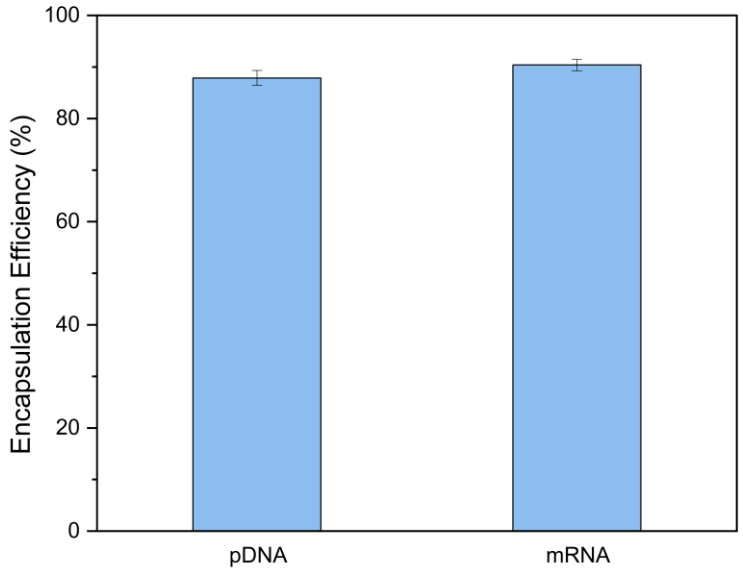
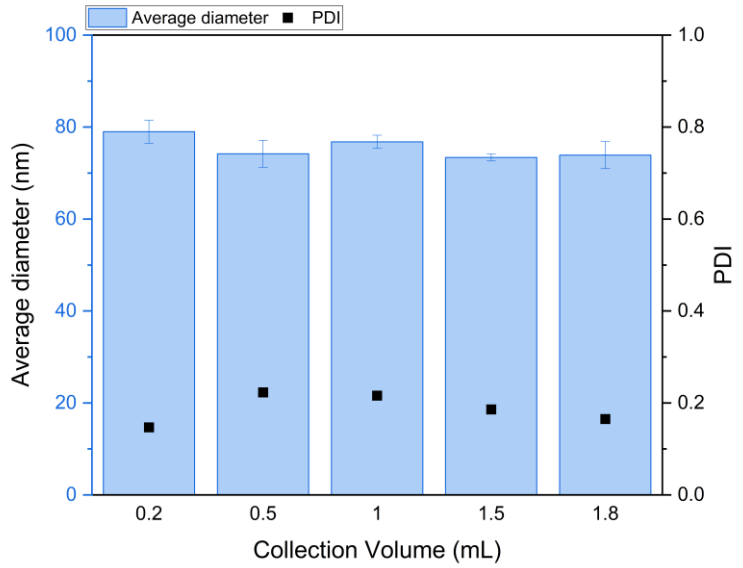


Fig. (E) depicts the encapsulation efficiency of the payload (pDNA and mRNA) in the lipid nanoparticles prepared using nanomake-L.

The encapsulation efficiency of the LNPs was determined through Ribogreen Assay.

nanomake L™ for preparation of lipid nanoparticles



Lipid composition	ALC-0315: DSPC: CHOL: DMG PEG 2000 50: 10: 38.5: 1.5
Organic solvent	Ethanol
Aqueous phase	Citrate buffer (50 mM, pH 3)
Total flow rate	12 mL/min
Flow rate ratio (Org./Aq.)	1:3

Fig. (F) depicts the effect of sample collection volume on the size and PDI of the lipid nanoparticles prepared using nanomake-L.

The size and PDI of the LNPs was determined through Dynamic Light Scattering.

nanomake L™ for preparation of polymeric nanoparticles

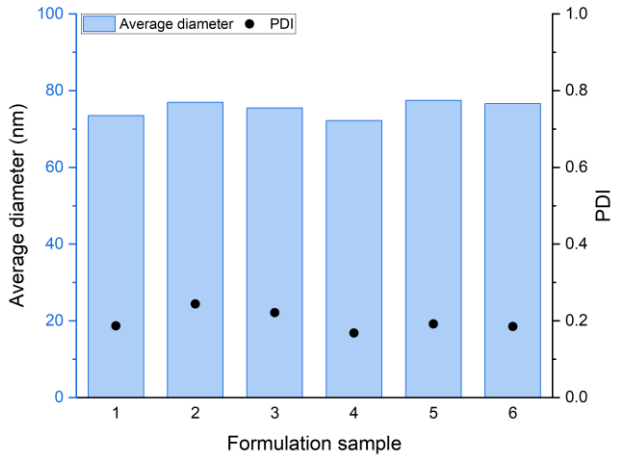


Fig. G

Polymer type	Poly (DL-lactide-co-glycolide), 50:50 2 mg/mL
Organic solvent	Acetone
Aqueous phase	0.4 % w/v Poloxamer 188 (aq.)
Total flow rate	6 mL/min
Flow rate ratio (Org./Aq.)	1:8

			Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm):	75.80	Peak 1:	92.08	100.0	39.44
PdI:	0.187	Peak 2:	0.000	0.0	0.000
Intercept:	0.928	Peak 3:	0.000	0.0	0.000
Result quality :	Good				

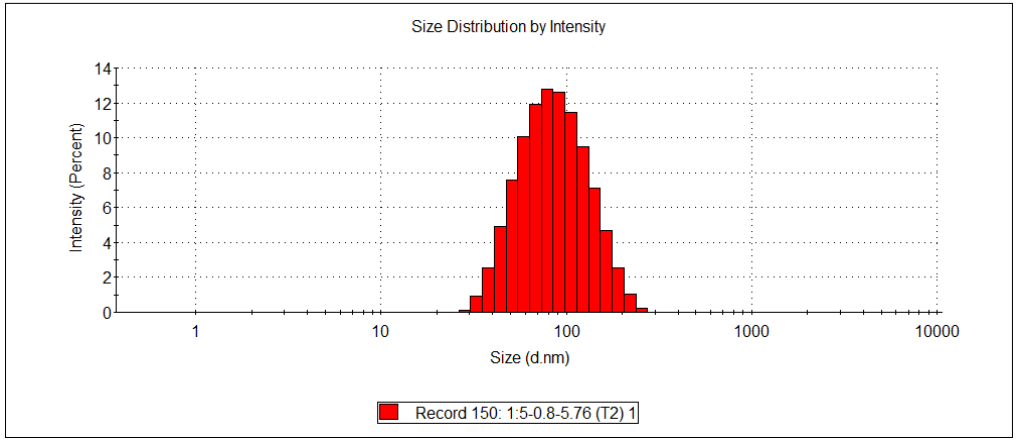


Fig. (G) shows the robustness of nanomake-L™ in the preparation of polymeric nanoparticles. The formulation's Z-average (diameter-nm) and PDI were 76.60 nm ± 3.96 and 0.185 ± 0.12, respectively.

nanomake L™ for preparation of polymeric nanoparticles

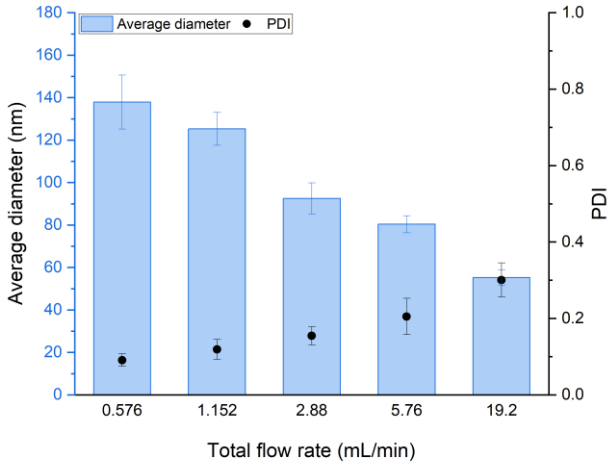


Fig. H

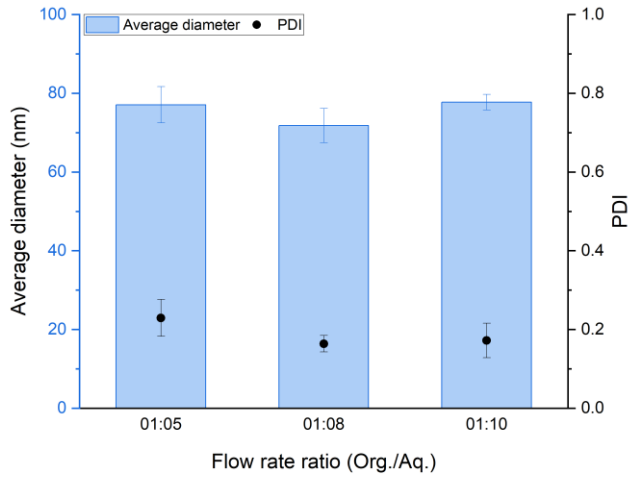


Fig. I

Polymer type	Poly (DL-lactide-co-glycolide), 50:50 2 mg/mL
Organic solvent	Acetone
Aqueous phase	0.4 % w/v Poloxamer 188 (aq.)

Fig. (H) and (I) show the effect of different flow rate ratios and flow rate on the average diameter and PDI of the prepared nanoparticles. All formulations were prepared in triplicate.

nanomake L™ for preparation of polymeric nanoparticles

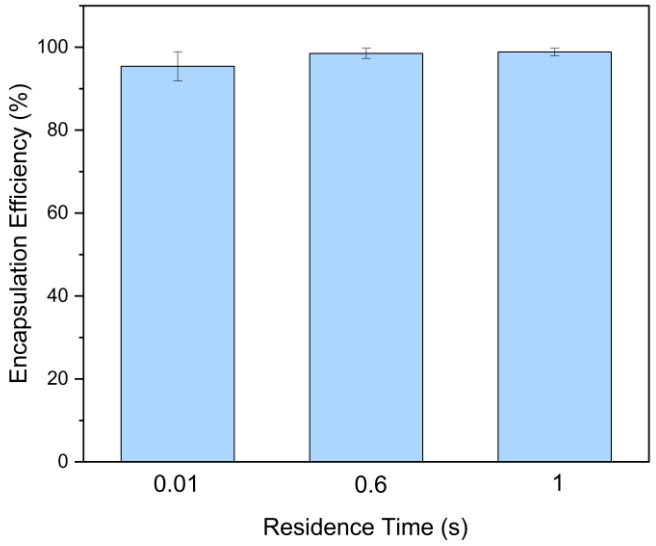
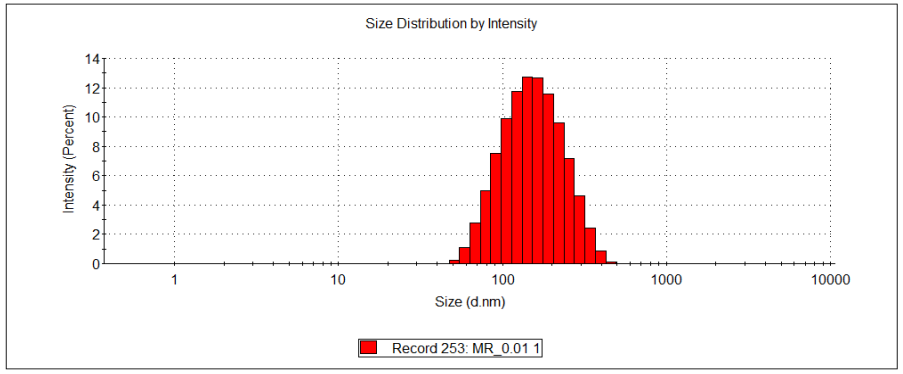


Fig. (J) shows the effect of residence time on the encapsulation efficiency of the prepared drug-loaded polymeric nanoparticles. All formulations were prepared in triplicate.

		Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm): 135.2	Peak 1:	164.3	100.0	69.70
PdI: 0.172	Peak 2:	0.000	0.0	0.000
Intercept: 0.947	Peak 3:	0.000	0.0	0.000
Result quality : Good				



Polymer type	Poly (DL-lactide-co-glycolide), 50:50 1% w/v
Organic solvent	Acetonitrile
Aqueous phase	1 mg/mL Bovine Serum Albumin (BSA) in 1% Poloxamer-188 (aq.)
Residence Time	0.01-1 second
Flow rate ratio (Org./Aq.)	1:3

Next Steps & Contact Information

Request a Demonstration

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info@amarbiosystems.com

+91 22 62255000

www.amarbiosystems.com

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Valson Compound, L.B.S. Marg, Bhandup (W), Mumbai - 400078