Backwashing in pressurized porous media filters: effects of porous media and underdrain design

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Irrigation engineering and management research group(2)

Doctorate Programme in the Environment

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Drip irrigation system layaut

https://lama.es/portfolio_page/arena/
https://krishibazaar.in/blog/the-benefits-of-drip-irrigation-system-on-your-farm

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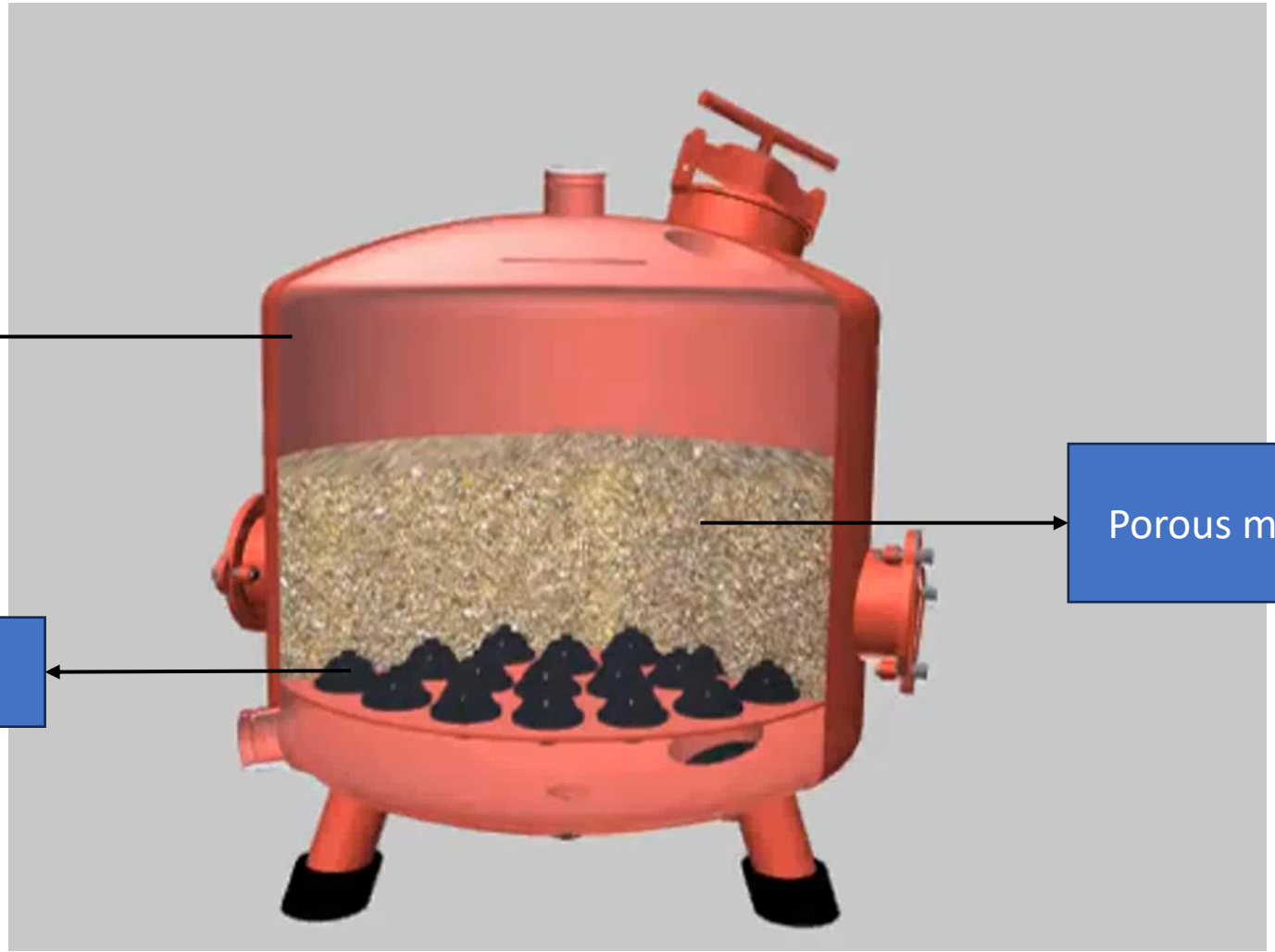
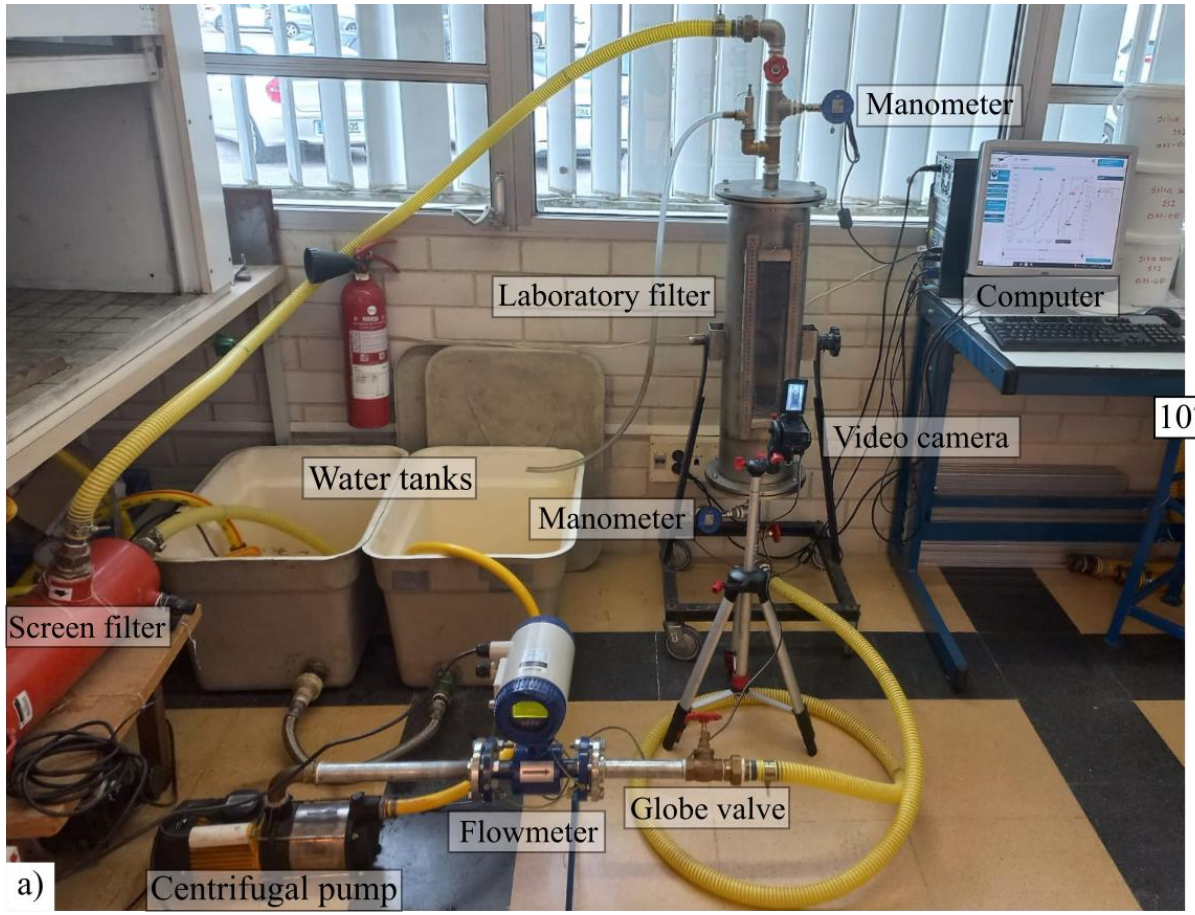
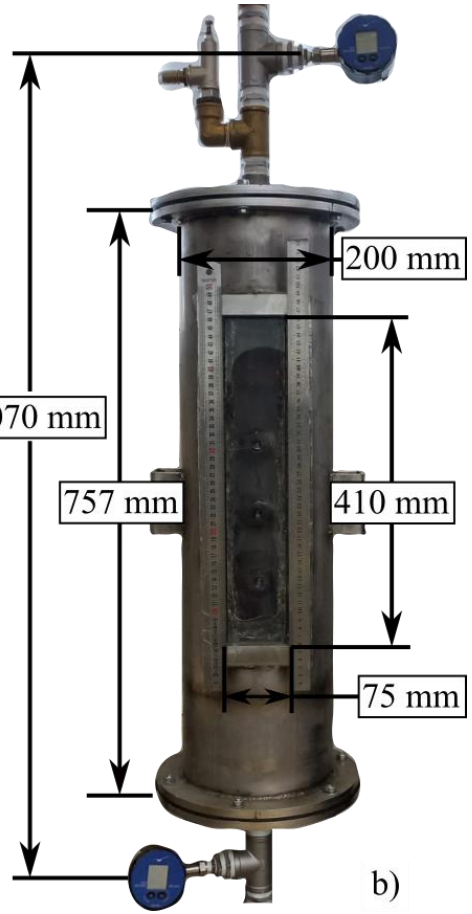
Pressure sand filter in irrigation systems

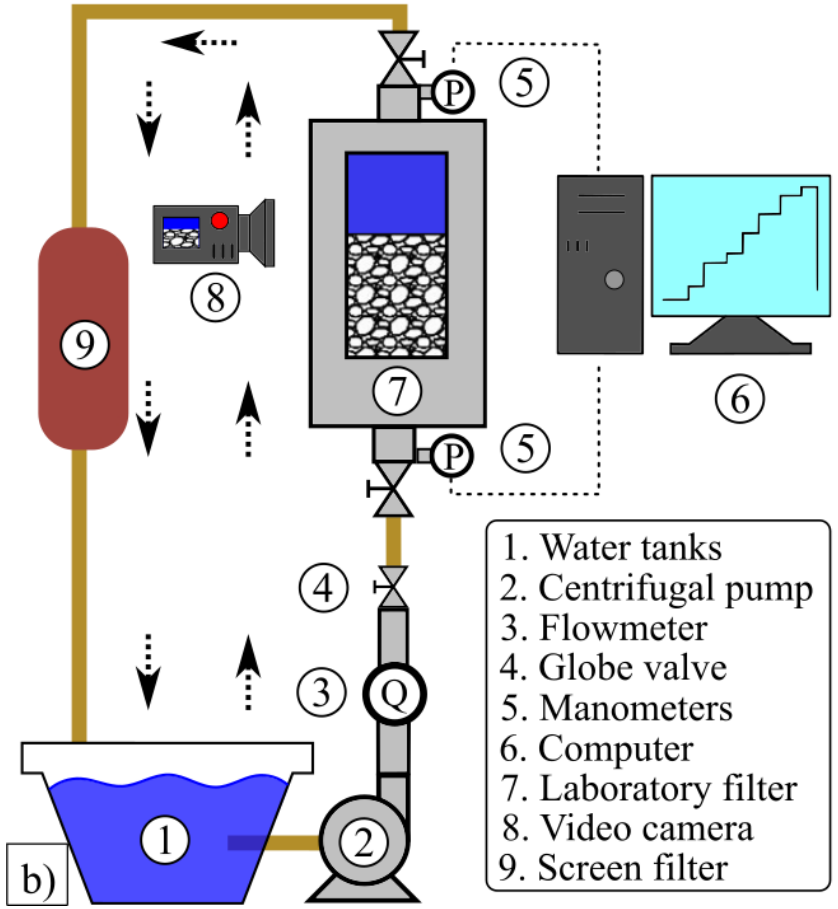


https://www.f-w-s.com/filtros-industriales/filtro-multimedia/filtro-arena-agua-solidos.html

Experimental setup



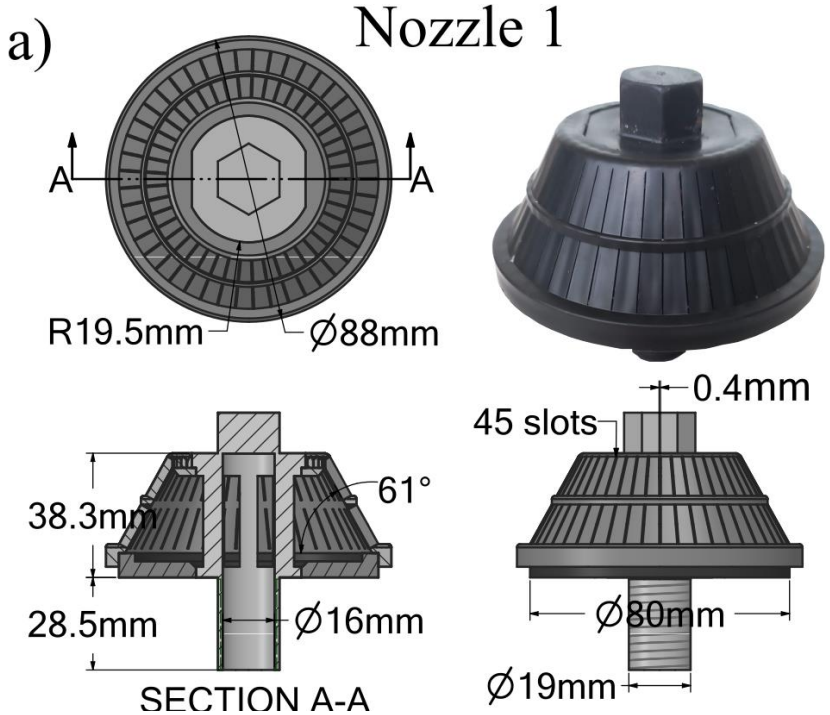


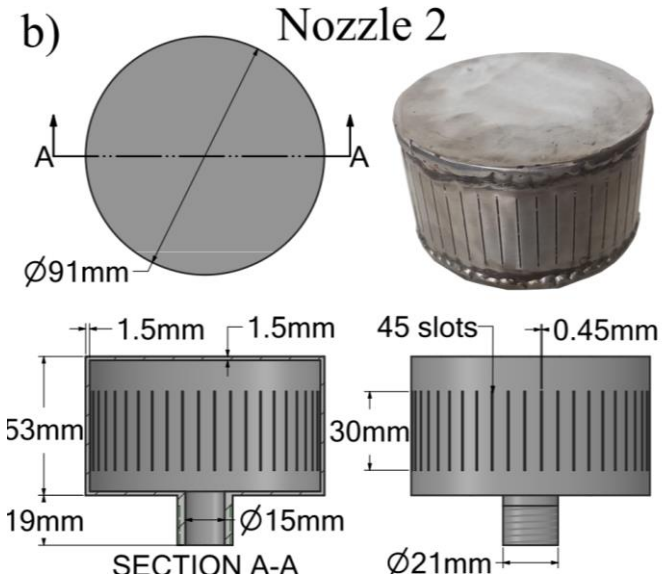


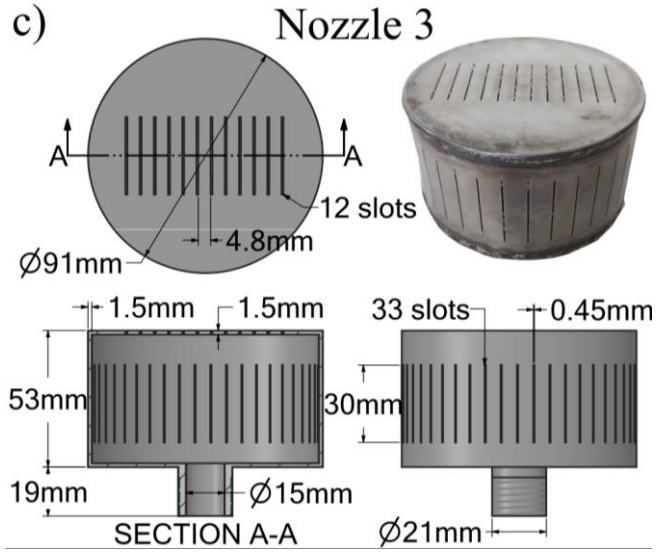
Experimental setup

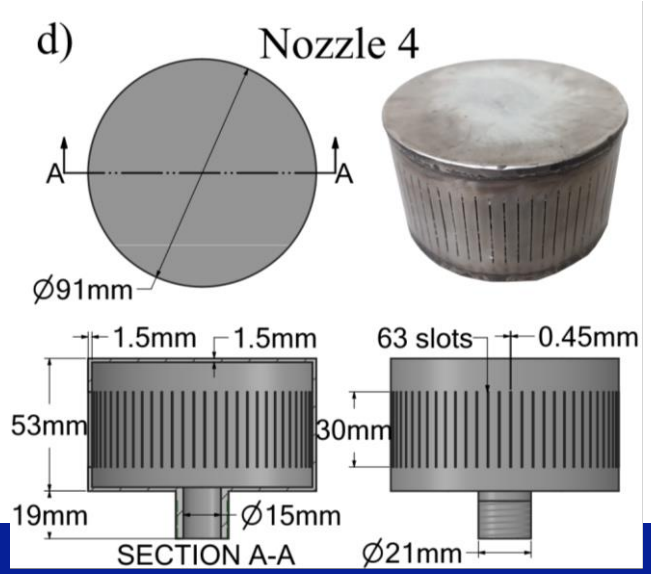
Property	Units	Silica sand (SS1)	Silica sand (SS2)	Glass Microspheres (MS)
Grain size range	mm	0.75 - 0.85	0.63 - 0.75	0.63 - 0.75
Equivalent diameter (d_{eq})	mm	0.922 ± 0.019	0.715 ± 0.015	0.652 ± 0.014
Particle density (ρ_p)	kg m^{-3}	2510 ± 55	2410 ± 12	2436.6 ± 11
Porosity (ε)	-	0.40	0.42	0.38
Sphericity coefficient (ψ)	-	0.89	0.89	1

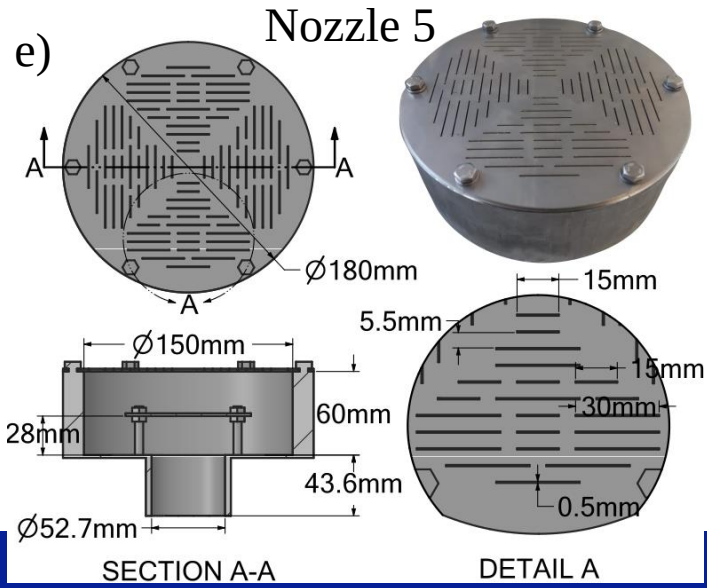
Experimental setup



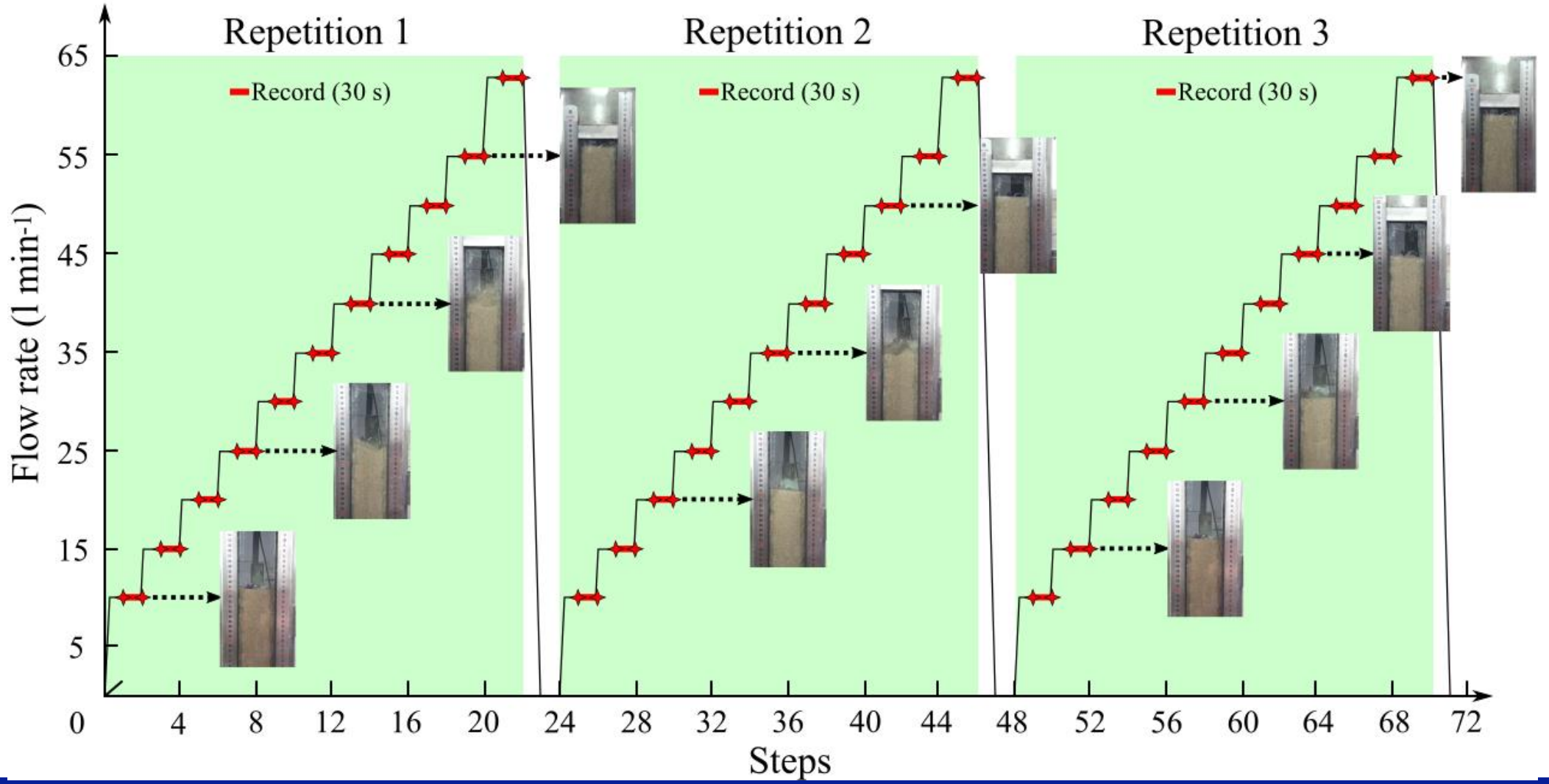




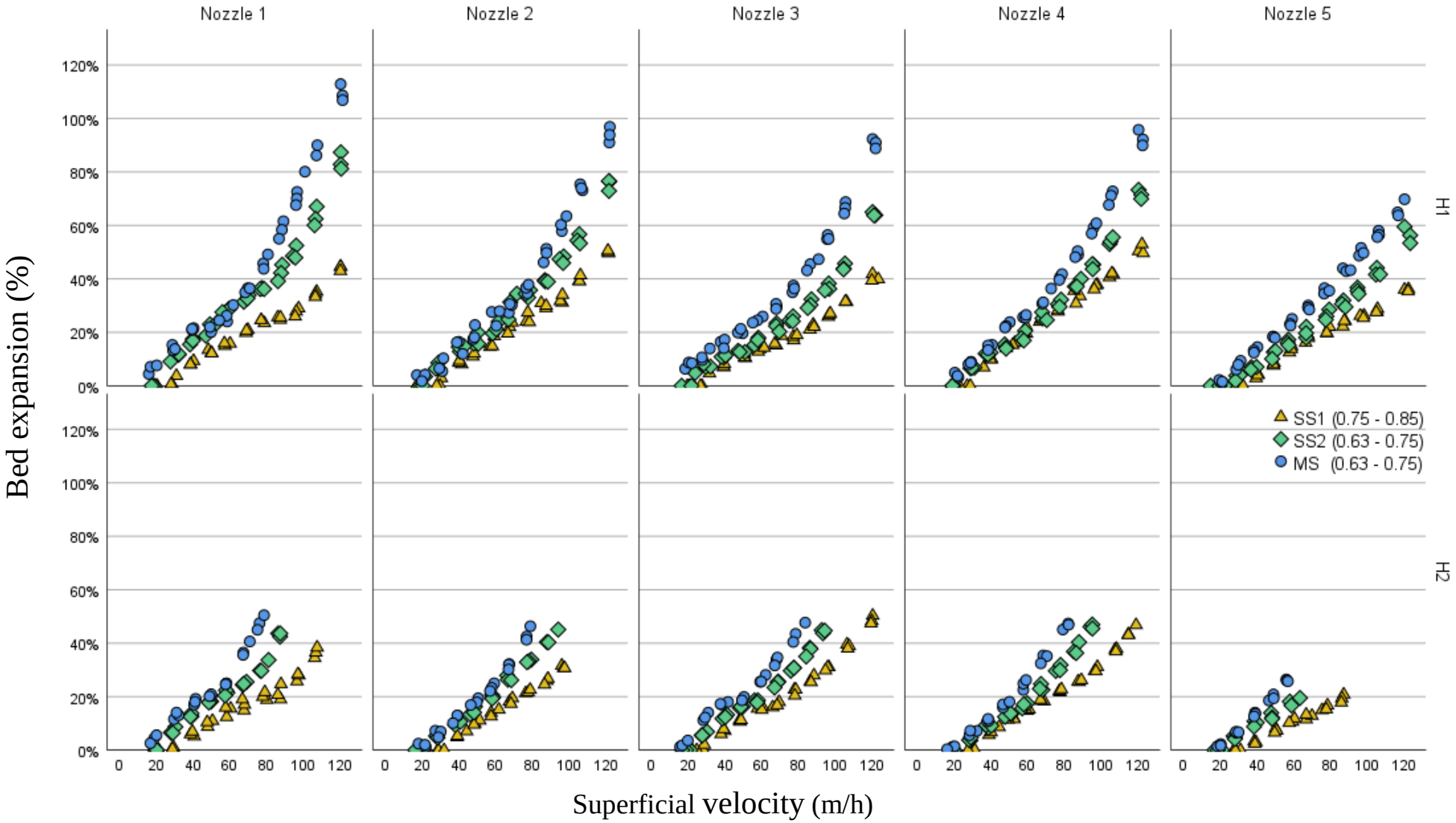




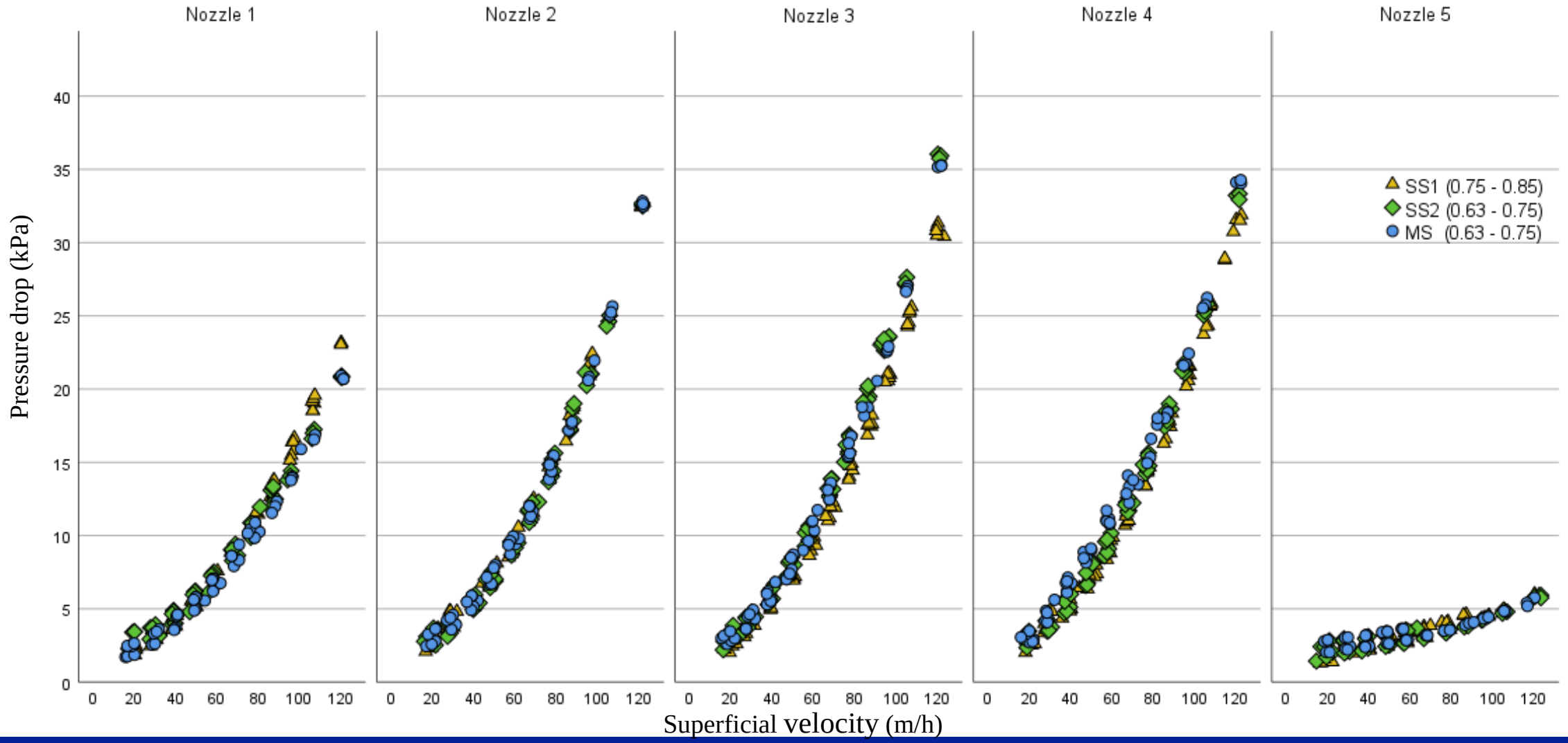
Experimental setup



Bed expansion results

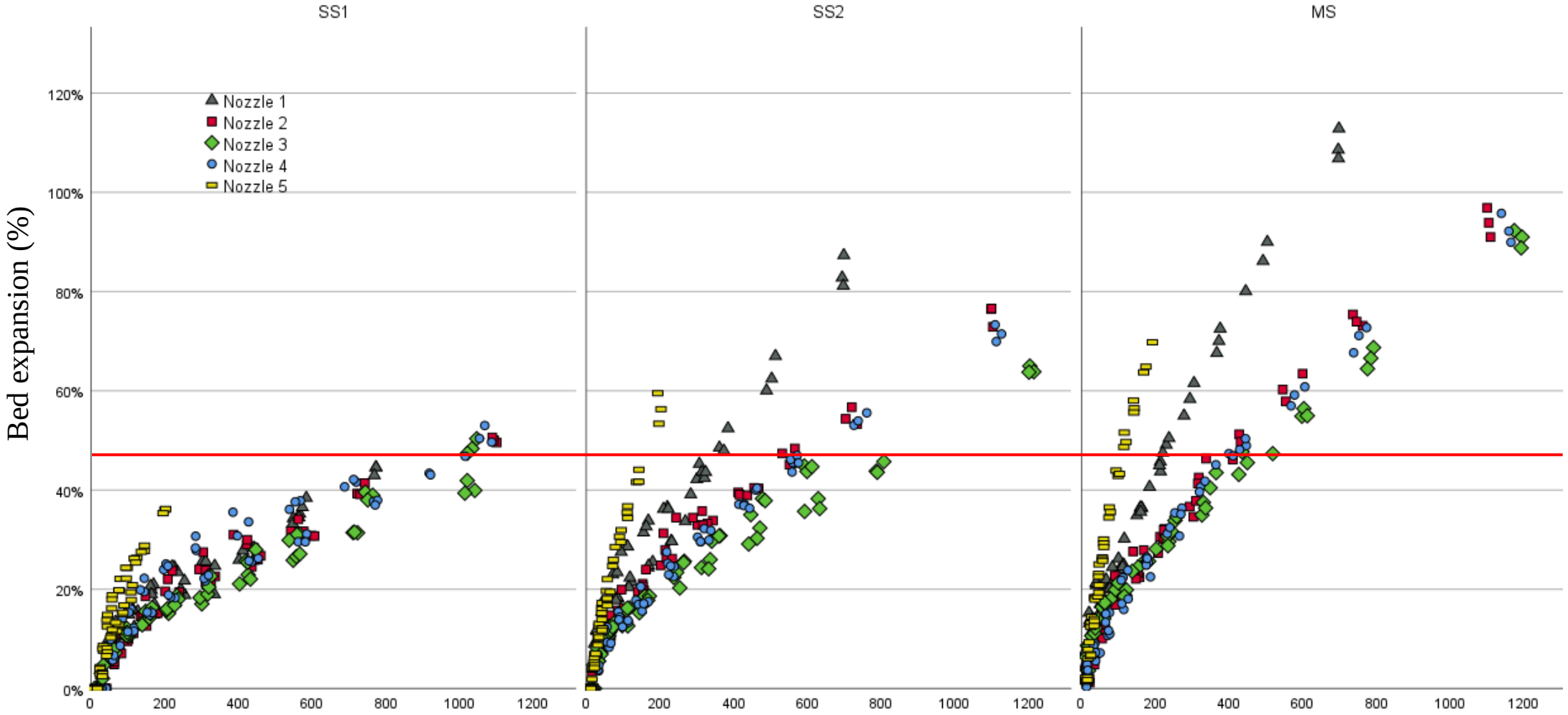


Pressure drop (Δp) results



Results

$$P_h = \Delta p Q$$

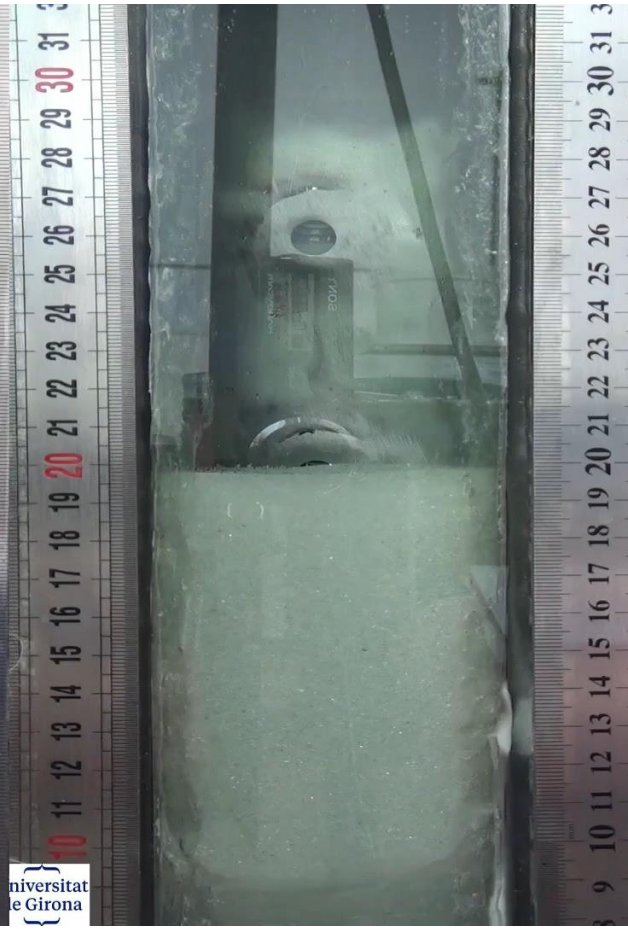


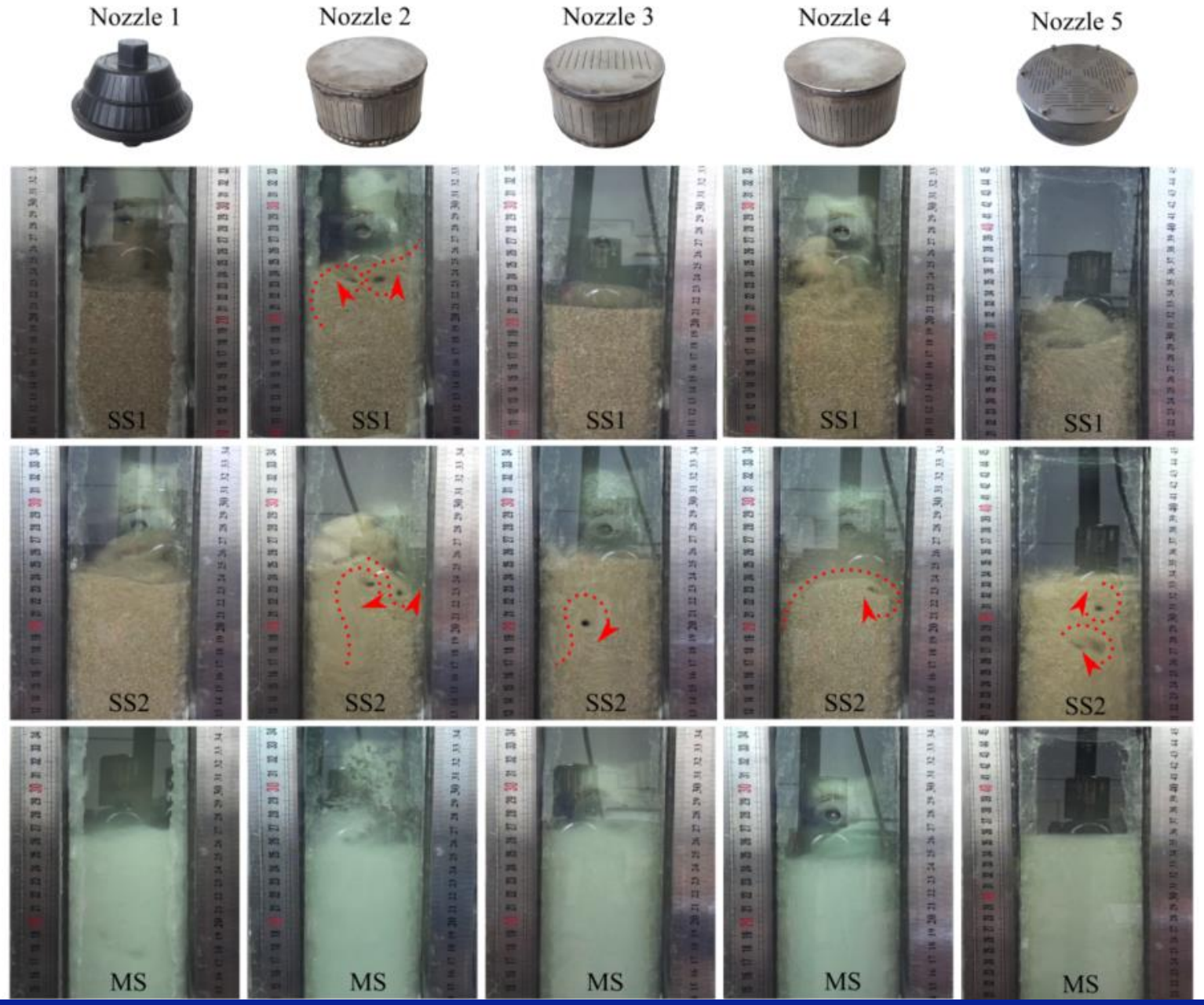
Nozzle 1

Nozzle 2

Nozzle 3

Nozzle 4




Nozzle 1
Nozzle 2
Nozzle 3
Nozzle 4
Nozzle 5
SS1
SS1
SS1
SS1
SS1
SS2
SS2
SS2
SS2
SS2
MS
MS
MS
MS
MS

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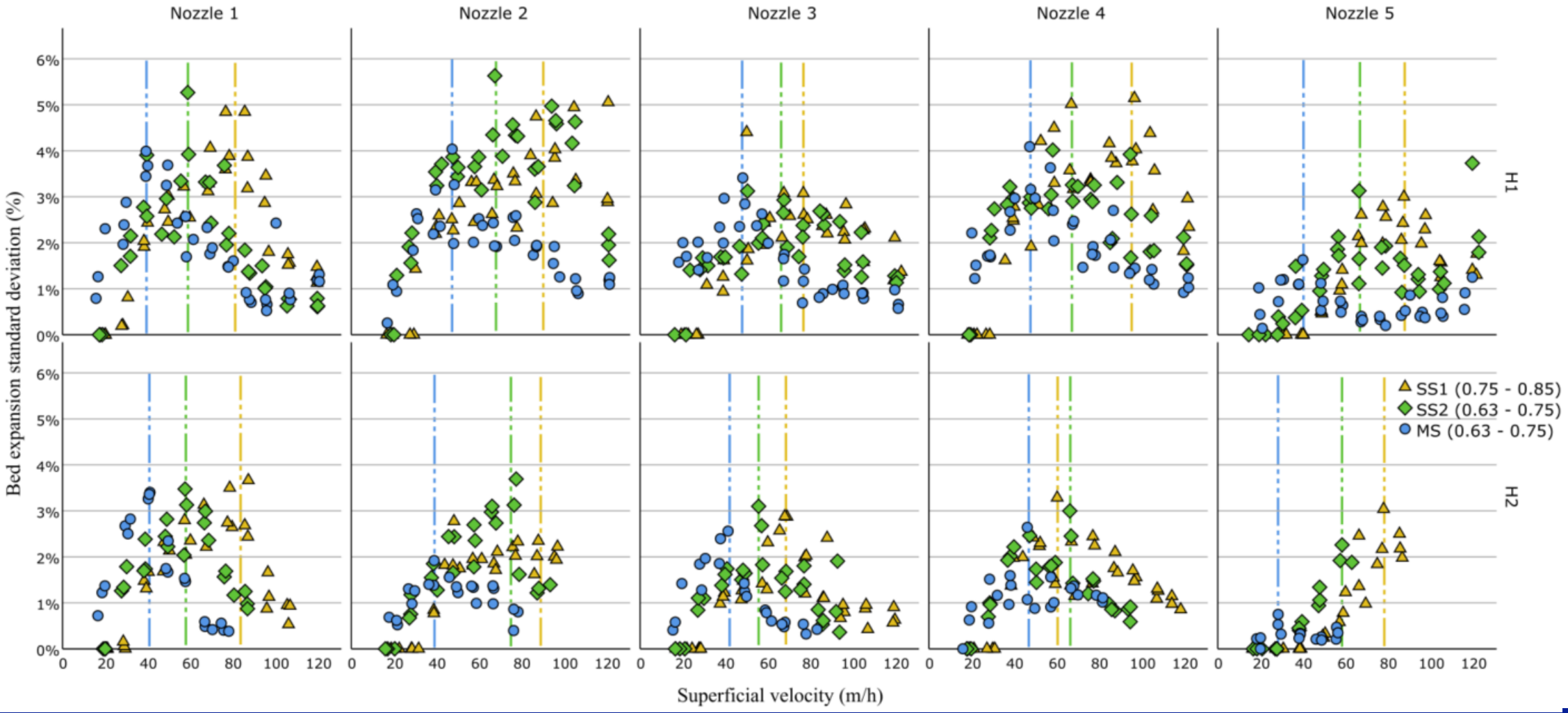
Results



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Conclusions

- An experimental study of the backwashing regime in a laboratory pressurized granular media filter was carried out **for three different media types, two initial bed heights, and five different nozzles**. The range of backflow superficial velocities analyzed included operating conditions similar to those encountered in commercial application.

- Video and data recordings of 820 backwashing tests were analyzed.

- The nozzle design plays a main role on the total pressure drop.

- The nozzle design influences the fluidized bed dynamics.

- The height of the expanded bed is mostly dependent on the media type.

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Research Paper

Effects of porous media type and nozzle design on the backwashing regime of pressurised porous media filters

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