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Supplementary Information

Porous PDMS structures for the storage and release of aqueous solutions into fluidic environments

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Figure S1: SEM imaging of a sugar templated PDMS sponge, shown at various magnifications of (a) $45\times$, (b) $100\times$, and (c) $250\times$.



Figure S2: Comparing the velocity of red dye released into the channel when red dye pipetted directly into the channel and when loaded into the sponge, extracted from **Movie S2**.



Figure S3: Comparison of the passive release of stored food dye into a narrow channel using: (a) Droplet and (b) Sugar templated PDMS sponges. (c) Shows the progress of the red food dye though the narrow channel over time. Snapshot images are extracted from **Movie S3**.



Figure S4: Comparison of the passive release of stored food dye into a narrow channel using: (left) Sugar and (right) Droplet templated PDMS sponges placed at the opposite wells of a 22 mm channel. Snapshot images are extracted from **Movie S4**.



Figure S5: Left column: A wet sponge (prefilled with water) can be passively loaded with red food dye. Right column: In contrast, a dry sponge is not loaded with red dye.



Figure S6: Passive loading of multiple liquid solutions, demonstrated by loading blue, red and green dyes into the droplet templated PDMS sponge over a period of 60 minutes.



Figure S7: Passive loading and mixing of multiple liquid solutions, demonstrated by loading blue and red dyes into the droplet templated PDMS sponge followed by the passive release of mixed dye from the outlet channel over a period of 150 minutes.



Figure S8: Comparison of adsorption of dye into cylindrical structures made of ordinary PDMS, OH terminated PDMS, and our droplet template sponge, shown (a) 1 minute, (b) 2 hours, (c-d) 24 hours after placing into a 35 mm petri dish.



Figure S9: Variations of the average diameter of interconnecting holes versus the average diameter of pores, obtained from SEM imaging of droplet templated PDMS sponges.



Figure S10: SEM imaging of droplet templated PDMS sponges shown at $200 \times$ with different pore sizes. For the sponge with small pores, the pore size is measured as $267.9 \pm 59.1 \mu$ m (average \pm standard deviation) and interconnecting holes as $19.1 \pm 9.2 \mu$ m. For the sponge with large pores, the pore size is measured as $497.3 \pm 94.7 \mu$ m and interconnecting holes as $29.6 \pm 13.9 \mu$ m.



Figure S11: Qualitative comparison of the passive release of stored food dye into a 24 mm channel using sugar sponge, droplet sponge with large pores, droplet sponge with reference pores, and droplet sponge with small pores. Snapshot images are extracted from **Movie S5**.



Figure S12: Geometry of the numerical model used for studying the effect of interconnecting hole dimensions on diffusion rate of stored liquids. Geometry consists of three interconnected pores (shown as pores 1 to 3 in the inset), which are connected to a longer channel, which represents the liquid filled container. In our simulation, the pore diameter, D_{pore} is set to 350 µm, whereas the width of the interconnecting holes, $d_{inter-pore}$ is varied as 15, 25, and 50 µm. Mesh generation is conducted using Gambit software.



Figure S13a: Contours of mass fraction obtained by numerical simulations over 6 minutes, showing the diffusion rate of food dye through the channel for the model with $D_{pore}=350 \ \mu\text{m}$ and $d_{inter-pore}=25 \ \mu\text{m}$. Simulations are performed using ANSYS Fluent software by solving the differential equation governing the transport of species in liquid environments: $\frac{\partial c}{\partial t} = D \nabla^2 c$, in which *c* is the concentration, *t* is time, and *D* is the diffusion coefficient of dye in water.



Figure S13b: Comparing the diffusion rate of dye from sponges over 6 minutes with various $d_{inter-pore}$ of 15, 25 and 50 µm, obtained from numerical model. In all cases, D_{pore} = 350 µm.



Figure S14: Comparison of the passive release of stored food dye into a 24 mm well using (a) Droplet and (b) Sugar templated PDMS sponges. (c) Compares the area of the red food dye into the well plate over time. Snapshot images are extracted from **Movie S6**.



Figure S15: Comparison of the passive release of stored food dye into a 24 mm well using: **(left)** Sugar and **(right)** Droplet templated PDMS sponges, placed at the opposite sides of the well. The sponges were loaded with blue and red dyes for better visual comparison. Snapshot images are extracted from **Movie S7**.



Figure S16: Passive release of 1 μ g/ml ionomycin from the PDMS sponge into a 6-well plate to induce intracellular calcium signalling of endothelial cells. (**a-d**) Intracellular calcium signalling of endothelial cells in response to the passive release of 1 μ g/ml ionomycin over a 10 minute period, (**e**) Normalised intensity profiles for 30 randomly selected cells, (**f**) Normalised intensity profiles for five cells (designated with **i** to **iv** in Figure **S3a** located radially with respect to the sponge. Scale bar is 600 μ m.