Electronic Supplementary Material

# Exploring the attachment of the Mediterranean medicinal leech (*Hirudo verbana*) to porous substrates

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**Table S1.** Overview of the nomenclature and fabrication specifications of the tested substrates, as well as on the type and dimensions of their structural elements**.** AGLM, transparent acrylic glass-like material; *d*, structure element diameter; ER, transparent epoxy resin; *h*, structure element height or depth; *l*, structure element length; PO, polyester; *s*, separation between the centres of two neighbouring structural elements; *w*, structure element width; , mean ‘effective’ porosity. Schematic drawings of the test substrates are illustrated in figure 1.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Substrate title** | **Type** | **Abbreviation** | **Geometry** | **Pattern** | **Material** | ***s* (mm)** | ***d* (mm)** | ***l* (mm)** | ***w* (mm)** | ***h* (mm)** | **(%)** |
| Reference A | - | RA | - | - | ER | - | - | - | - | - | 0 |
| Reference B | - | RB | - | - | AGLM | - | - | - | - | - | 0 |
| Cylinder | Everted | CYE | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Cylinder | Inverted | CYI | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Square | Everted | SE | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Square | Inverted | SI | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Hemisphere | Everted | HE | Circular | Offset | ER | 2.3 | 2.0 | - | - | 1.0 | 0 |
| Hemisphere | Inverted | HI | Circular | Offset | ER | 2.3 | 2.0 | - | - | 1.0 | 0 |
| Pyramid | Everted | PE | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Pyramid | Inverted | PI | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Truncated Pyramid | Everted | TPE | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Truncated Pyramid | Inverted | TPI | Square | Even | ER | 3.3 | - | 3.0 | 3.0 | 1.0 | 0 |
| Cone | Everted | COE | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Cone | Inverted | COI | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Truncated Cone | Everted | TCE | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Truncated Cone | Inverted | TCI | Circular | Offset | ER | 3.3 | 3.0 | - | - | 1.0 | 0 |
| Pore 1 | Perforated | P1 | Circular | - | AGLM | - | 0.5 | - | - | - | 1 |
| Pore 2 | Perforated | P2 | Circular | - | AGLM | - | 1.0 | - | - | - | 4 |
| Pore 3 | Perforated | P3 | Circular | - | AGLM | - | 1.5 | - | - | - | 9 |
| Pore 4 | Perforated | P4 | Circular | - | AGLM | - | 2.0 | - | - | - | 16 |
| Grid 1 | Perforated | G1 | Circular | Offset | ER | 3.8 | 2.0 | - | - | - | 18 |
| Grid 2 | Perforated | G2 | Circular | Offset | AGLM | 1.0 | 0.5 | - | - | - | 22 |
| Grid 3 | Perforated | G3 | Circular | Offset | ER | 2.6 | 2.0 | - | - | - | 35 |
| Grid 4 | Perforated | G4 | Circular | Offset | AGLM | 1.5 | 1.0 | - | - | - | 38 |
| Grid 5 | Perforated | G5 | Circular | Offset | AGLM | 2.0 | 1.5 | - | - | - | 55 |
| Grid 6 | Perforated | G6 | Circular | Offset | AGLM | 2.5 | 2.0 | - | - | - | 60 |
| Grid 7 | Perforated | G7 | Rectangular | Even | PO | 2.0 | - | 1.7 | 0.9 | - | 62 |
| Grid 8 | Perforated | G8 | Circular | Offset | ER | 2.3 | 2.0 | - | - | - | 74 |

**Table S2.** Properties of the acrylic glass-like material and the epoxy resin as indicated by the respective manufacturer.

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Acrylic glass-like material** | **Epoxy resin** |
| Tensile strength | 50 – 65 MPa | 71 MPa |
| Elongation at break | 10 – 25 % | - |
| Modulus of elasticity | 2000 – 3000 MPa | - |
| Flexural strength | 75 – 110 MPa | 100 MPa |
| Flexural modulus | 2200 – 3200 MPa | 3000 MPa |
| Heat deflection temperature | @ 0.45 MPa: 45 – 50 °C  @ 1.82 MPa: 45 – 50 °C | -  - |
| Impact strength | 20 – 30 J/m (ASTM) | 27 kJ/m² (ISO) |
| Water absorption | 1.1 – 1.5 % | - |
| Glass transition temperature | 52 – 54 °C | 60 °C |
| Shore hardness | 83 – 86 | - |
| Rockwell hardness | 73 – 76 | - |
| Polymerized density | 1.18 – 1.19 g/cm³ | - |
| Ash content | 0.02 – 0.06 % | - |

**Table S3.** Leech behaviour during turn table experiments. The table shows the percentages of both sessile and moving leeches per tested substrate. COE, everted cones; COI, inverted cones; CYE, everted cylinders; CYI, inverted cylinders; G1–G8, pore grid substrates with increasing mean ‘effective’ porosity; HE, everted hemispheres; HI, inverted hemispheres; PE, everted pyramids; PI, inverted pyramids; RA, reference substrate A; SE, everted squares; SI, inverted squares; TCE, everted truncated cones; TCI, inverted truncated cones; TPE, everted truncated pyramids; TPI, inverted truncated pyramids.

|  |  |  |
| --- | --- | --- |
| **Test substrate** | **Percentage of sessile leeches** | **Percentage of moving leeches** |
| RA | 60 % | 40 % |
| G1 | 77 % | 23 % |
| G3 | 97 % | 3 % |
| G8 | 97 % | 3 % |
| HE | 100 % | 0 % |
| HI | 97 % | 3 % |
| PE | 100 % | 0 % |
| PI | 100 % | 0 % |
| CYE | 93 % | 7 % |
| CYI | 87 % | 13 % |
| COE | 93 % | 7 % |
| COI | 90 % | 10 % |
| SE | 90 % | 10 % |
| SI | 97 % | 3 % |
| TCE | 100 % | 0 % |
| TCI | 93 % | 7 % |
| TPE | 87 % | 13 % |
| TPI | 97 % | 3 % |



**Figure S1.** Setup of the turn table apparatus. (a) Overview image of the components and their assembly. (b) Close-up image of the 3D-printed test substrate holder and the associated rotatable scale. 1, aluminium frame; 2, rotation axis; 3, wooden board; 4, pivot bearings; 5, high-speed camera setup; 6, counterweights; 7, 3D-printed substrate holder; 7a, 3D-printed frame; 7b, test substrate; 7c, metal bracket; 7d, angled mirror; 7e, coordinate paper; 7f, rotatable plate; 7g, immovable plate; 8, stepper motor; 9, power supply; 10, cogs and drive belt; 11, notebook running Motion Studio; 12, bubble level.

**Supplementary Videos**

Video S1: Exemplary video of a turn table measurement of *H. verbana* on substrate RA. Recorded with 50 fps, playback rate 50 fps.

Video S2: Exemplary video of a pull-off force measurement of *H. verbana* on substrate RA. Recorded with 25 fps, playback rate 5 fps.

Video S3: Attachment process of the anterior suction disc of *H. verbana* on substrate RA. Recorded with 50 fps, playback rate 5 fps.

Video S4: Attachment process of the posterior suction disc of *H. verbana* on substrate RA. Recorded with 50 fps, playback rate 5 fps.

Video S5: Detachment process of the anterior suction disc of *H. verbana* on substrate RA. Recorded with 50 fps, playback rate 5 fps.

Video S6: Detachment process of the posterior suction disc of *H. verbana* on substrate RA. Recorded with 50 fps, playback rate 5 fps.

Video S7: Attachment process of the anterior suction disc of *H. verbana* on substrate G1. Recorded with 50 fps, playback rate 5 fps.

Video S8: Attachment process of the posterior suction disc of *H. verbana* on substrate G1. Recorded with 50 fps, playback rate 5 fps.

Video S9: Detachment process of the anterior suction disc of *H. verbana* on substrate G1. Recorded with 50 fps, playback rate 5 fps.

Video S10: Detachment process of the posterior suction disc of *H. verbana* on substrate G1. Recorded with 50 fps, playback rate 5 fps.