

Protocol	#A.1
Title	BOMB magnetic racks
Keywords	magnetic racks; magnetic separation; microplate; deep-well plate; HT; microcentrifuge tubes
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Online	https://bomb.bio/protocols/
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Summary

Racks for magnetic separations can be purchased commercially or prepared in house with a 3D printer [1] or from recycled laboratory materials. Strong magnets can be purchased cheaply in bulk.

Equipment and materials

3D printer (e.g CTC Bizer Dual, Makerbot)

1.75 mm filament (PLA, ABS, PETG or any other suitable)

Strong Neodymium permanent magnets. Please get informed how to work safely with strong neodymium magnets to avoid injuries!


24x NdFeB N45 rod magnets Ø5 x 15 mm, diametrically magnetised (for the BOMB microplate rack)

e.g. magnetkontor.de Art.Nr.: S-05-15-N1-Ni

8x NdFeB N50 block magnets 12x8x2 mm (for the BOMB tubes rack)

e.g. maqna.de Articletype: QA-12x8x2-N50-N

3D Printing

Step	Task
	<i>The procedure requires at least basic experience with 3D printing</i>
1	Download the desired STL 3D model files from our homepage (https://bomb.bio/protocols/) or use the provided links to Thingiverse projects in the respective figure description
2	Use a suitable slicing software to prepare 3D printer run files (Simplify 3D, MakerWare etc.)
3	Print the model using your desired filament and material. We generally use 1.75 mm PLA, ABS or PETG filaments and print using 40-60% infill, with three shells finish and a layer height of 0.2 mm
4	Measure the dimensions of the print with a calliper, and if necessary, adjust the printer settings accordingly
5	Remove the over extruded material, if desired sand the surfaces for a nice smooth finish
6	Install magnets (we take care that the polarity of the magnets is maintained) and glue them with appropriate adhesive (e.g. superglue). Please check the compatibility of the used adhesive with the material used for printing
End	Test the functionality of the rack with suspended magnetic beads

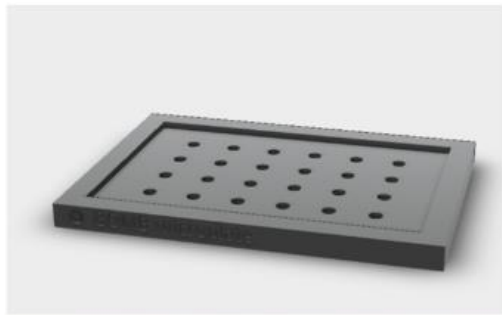
Modifications

The magnetic racks can be prepared using different materials having different colours. The 3D model files that are provided here for printing can be modified to fit the user's needs for example using a free Tinkercad software (<https://www.tinkercad.com/>). The magnetic racks can be also constructed without a 3D printer, for example by drilling holes in a PCR plate racks and inserting the magnetic rods as seen in figure 3.

Troubleshooting

Problem	Solution
The print does not maintain the model dimensions	Calibrate your 3D printer or use a suitable slicing software
Adhesive dissolves the printed material	Choose a compatible adhesive with the material used for 3D printing

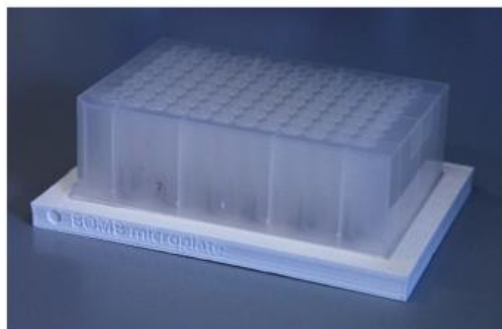
Exemplary results



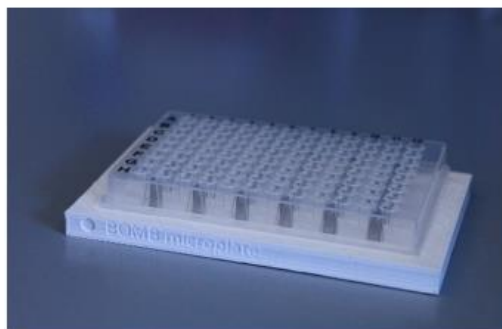
3D model



BOMB microplate
magnetic rack

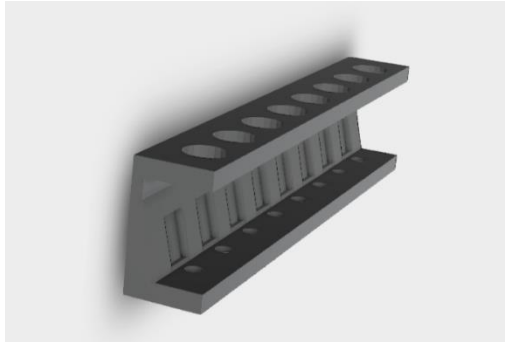


+ 96x1.2 ml
deepwell plate

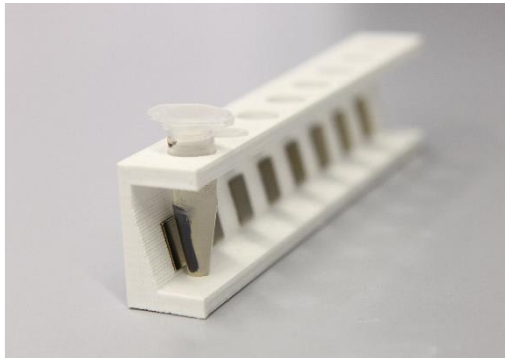


+ 96x0.2 ml
skirted PCR plate

Fig 1. BOMB microplate magnetic rack with different 96-well plates. Find the respective 3D model file on Thingiverse (<https://www.thingiverse.com/thing:3169529>).



3D model



BOMB microtube
magnetic rack

Fig 2: BOMB tubes magnetic rack can hold up to eight 1.5 ml micro-centrifuge tubes. Find the respective 3D model file on Thingiverse (<https://www.thingiverse.com/thing:3199242>).

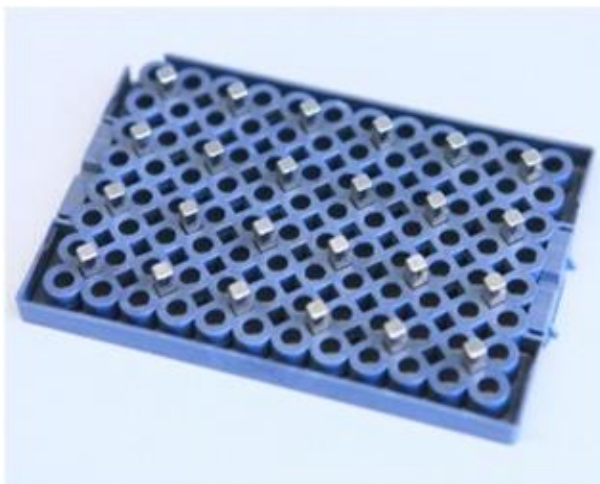


Fig 3: Cheap, custom made magnetic racks made from common laboratory supplies.

References

1. Baden T, Chagas AM, Gage G, Marzullo T, Prieto-Godino LL, Euler T. Open labware: 3-D printing your own lab equipment. PLOS Biol. Public Library of Science; 2015;13: e1002086. doi:10.1371/journal.pbio.1002086