Glass-like well plates for high-throughput lipidomics: Limiting analyte loss and reducing extractables

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Introduction

Careful selection of sample contact surfaces is critical for reducing background contaminants and maximising analyte recovery in sensitive analytical workflows. For hydrophobic analytes and strong organic solvents, inert glass surfaces are preferred, as extended contact with polypropylene (PP) can result in non-specific adsorption and increased extractables (1, 2). However, the use of glass vials or inserts introduces handling and alignment challenges in automated systems, which favour the well plate (WP) format (Fig. 1).

To determine whether the Pure-Pass™ glass-like coated (GLC) WP can overcome these challenges, lipids were extracted from blood plasma and analysed by GC- and LC-MS. Pure-Pass™ GLC WPs matched the performance of glass vials and glass inserts for lipid recovery, with a 20% mean signal improvement compared to extraction in a standard PP tube. A separate study, conducted with Helmholtz Munich, also demonstrated interchangeability with glass, showing excellent correlation across 19 lipid classes (R^2 = 0.99). This surface compatibility may be partly attributed to the high purity Pure-Pass™ PP base, which significantly reduced extractables in strong organic solvents compared to standard commercially available PP.

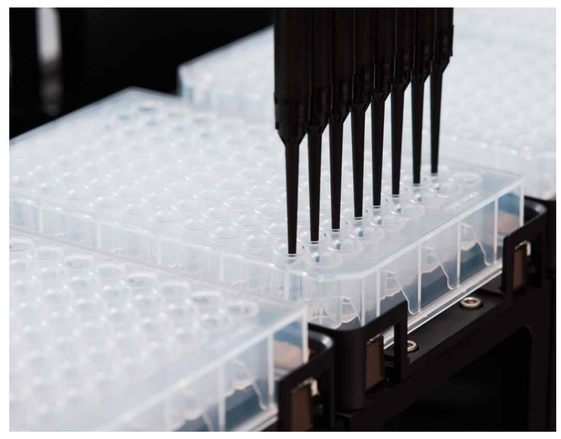


Figure 1. Well plates pair effectively with automated liquid handling systems. This can be attributed to their ANSI/SLAS plate geometry with no separate components that introduce misalignment or handling issues.

Results and discussion

Trajan Pure-Pass™ GLC performs comparatively to the inert surface of glass

Data courtesy of Fabien Riols, Helmholtz Munich, demonstrates a strong correlation (R^2 = 0.99) between Pure-Pass™ GLC plates and glass vials across 19 lipid classes following sample preparation and overnight storage (Fig. 2). This suggests that, for the lipids tested, workflows can be smoothly transitioned from glass vials to the high-throughput Pure-Pass™ GLC well plates.

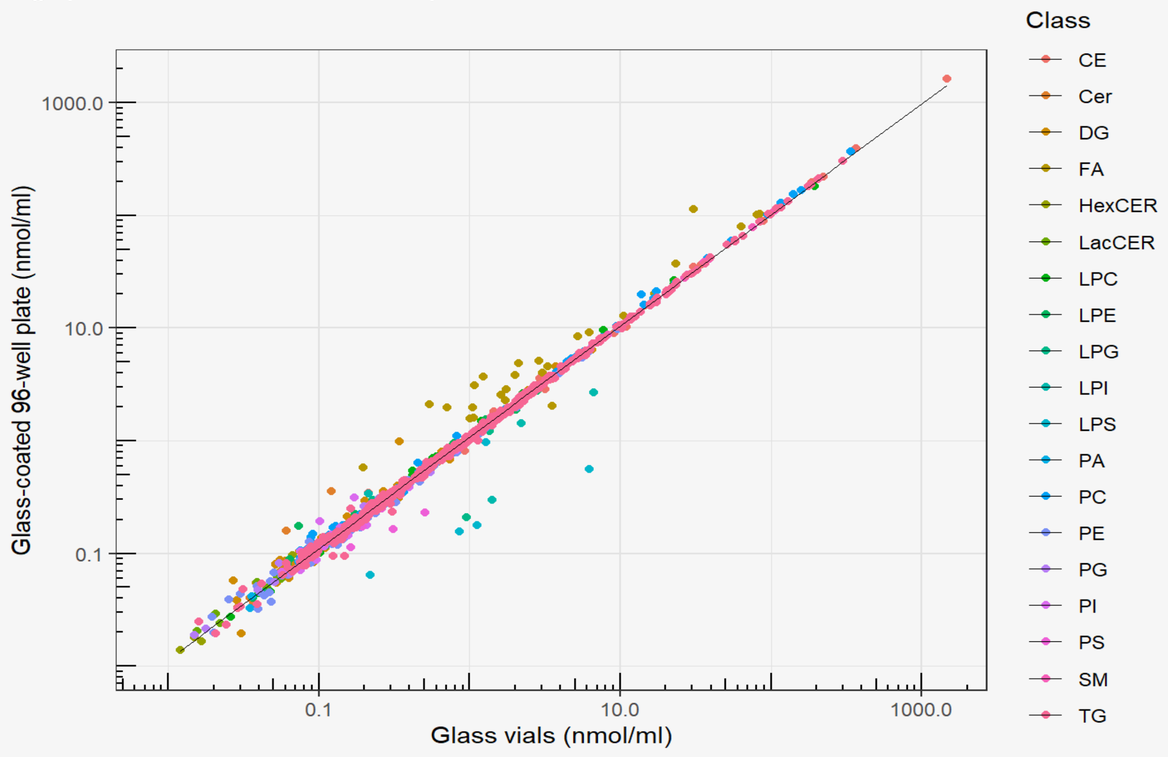
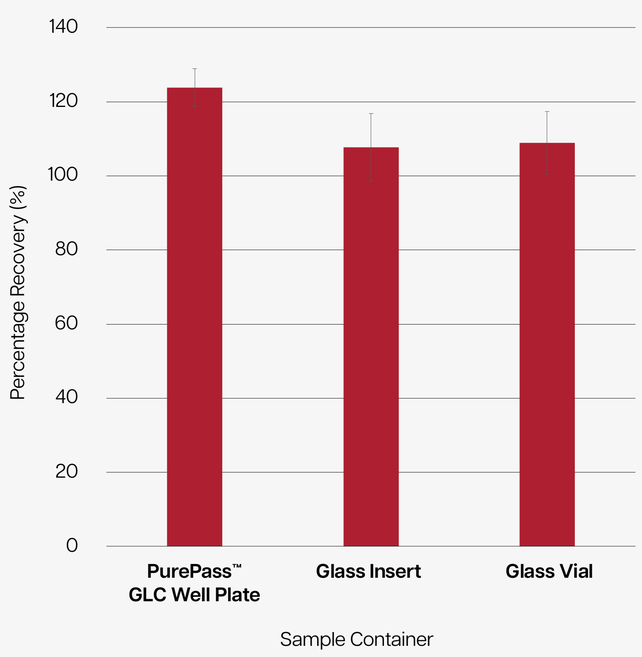


Figure 2. Correlation of lipid concentrations from an internal reference plasma extracted in Pure-Pass™ GLC 96-well plates and glass vials. Samples were vortexed, centrifuged, evaporated, reconstituted and kept for overnight storage at 15 °C before analysis in the LC-QTrap6500+.



Sample recoveries in Pure-Pass™ GLC plates were marginally higher than glass inserts and vials for an LC-MS butanol:methanol workflow, with recoveries 20% higher than in the standard PP 1.5 mL tube (Fig. 3).

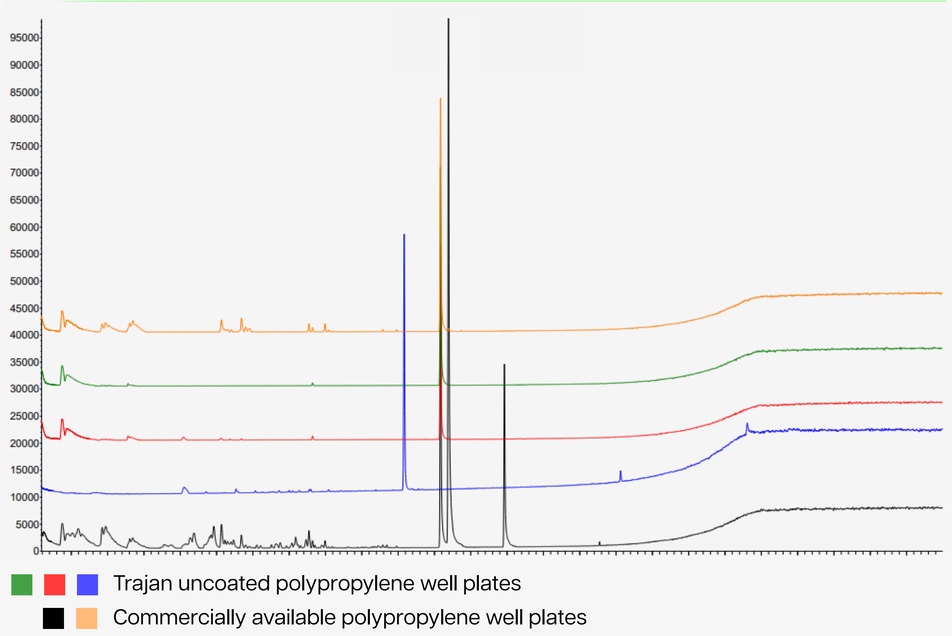
Similar results were observed in a GC-MS FAME workflow, with GLC plates achieving comparable recoveries to glass vials.

Figure 3: Lipids from a blood plasma reference standard were extracted with butanol:methanol in Pure-Pass™ GLC well plates, glass vials and glass inserts. Data for 52 lipid species were analysed by LC-MS and presented together as the mean % recovery relative to a standard PP tube.

Trajan Pure-Pass™ polypropylene reduces extractables

Many lipidomics methods require harsh solvents for lipid extraction, which may reduce the risk of analyte loss due to non-specific binding. However, in harsh solvents, the standard high throughput PP well plate significantly increases the risk of extractables and leeching (Fig. 4). Using a high purity Pure-Pass™ PP base for the GLC plates limits extractables, leading to cleaner, more repeatable results.

[A] 24-hour extraction using 1 ppm C19 in ethyl acetate



[B] 24-hour extraction using 1 ppm C19 in methanol

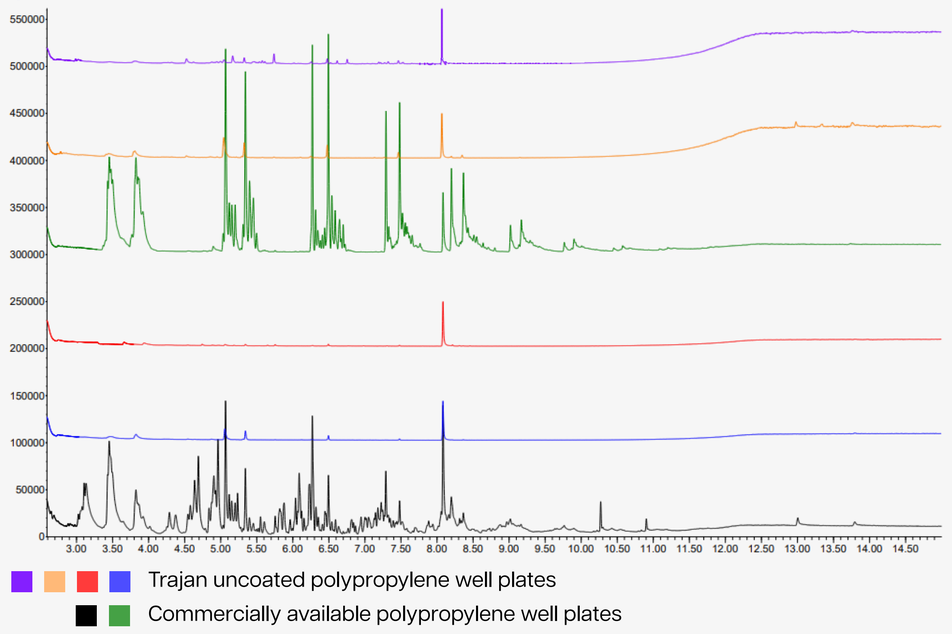


Figure 4. GC-MS chromatograms comparing (a) the ethyl acetate extraction profiles and (b) the methanol extraction profiles from different batches of Trajan PP WPs (prior to applying the glass-like coating) to those of other commercially available PP plates.

References

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2. Canez, C. R., & Li, L. (2024). Studies of labware contamination during lipid extraction in mass spectrometry-based lipidome analysis. Analytical Chemistry, 96(8), 3544–3552. https://doi.org/10.1021/acs.analchem.3c05431

Conclusion

Pure-Pass™ GLC WPs demonstrate high analyte recoveries and low extractables, showing glass-like performance can be achieved without compromising throughput in an increasingly automated field.

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For more information on Pure-Pass GLC, visit **www.trajanscimed.com/plates**