Applications

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Technical Report

Eppendorf Polypropylene Microplates – Fast and secure identification of samples

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Abstract

Compared to micro test plates made from polystyrene, plates made from polypropylene show higher resistance to temperature as well as chemicals, thus being suitable for a broader spectrum of applications. However, visual detection of samples through the wells is more difficult, as the material is less transparent than polystyrene. In this Technical Report it will be demonstrated that the Eppendorf Microplates feature the highest level of transparency compared to other polypropylene plates and therefore facilitate sample identification considerably. Furthermore, it will be shown that due to the unique, contrast-rich labeling, test takers are able to find specific well positions approximately 20-30 % faster.

Introduction

Due to increasing sample numbers as well as the trend towards miniaturization, traditional laboratory sample processing in single containers is frequently replaced by high throughput processing in polypropylene plates of the 96 well or 384 well format. Applications include sample storage, as well as pipetting, incubation and centrifugation steps during sample preparation. The standard tubes in microliter scale (0.5 ml, 1.5 ml, 2.0 ml) are covered by different types of plates: Deepwell plates are ideal for larger volumes, and the lower rising micro test plates are a practical solution for reactions of smaller volumes.

Polypropylene plates are suitable for a wider spectrum of applications than plates made from polystyrene, which find their main application in methods such as ELISA. Polypropylene plates feature high resistance to temperature as well as chemical robustness. Furthermore, polypropylene has a lower binding affinity for biomolecules such as DNA or proteins. However, in principle this material is cloudier and less light-transmissive than polystyrene, which makes sample identification through the wells more challenging.

During manual processing of plates, good readability of the alphanumeric labeling is of critical importance for speedy and error-free work. This is mainly dependent on the size of the lettering and the contrast to the surrounding material. Traditional microplates often display labeling which is hard to discern. Especially when protective goggles are worn or work is performed inside a biosafety cabinet, identification of the grid can be considerably impaired by the greater distance to the plate or by light reflections.

Introduction

For the Eppendorf Microplates, the reliable OptiTrack® matrix of the Eppendorf Deepwell plates was adopted (Fig. 1), which features a contrast-rich, well readable grid, especially designed for fast and error-free well identification. Furthermore, emphasis during material selection and manufacturing was placed on maximum transparency in order to facilitate sample identification through the wells.

Within this Technical Note material transparency and readability of the grid of the Eppendorf Microplates were compared to plates made by other manufacturers. To this end, identification of pellets of different sizes inside the wells, as well as transparency of the material, were compared to plates made by other manufacturers. Furthermore, the speed at which single wells could be identified in different plates was tested.

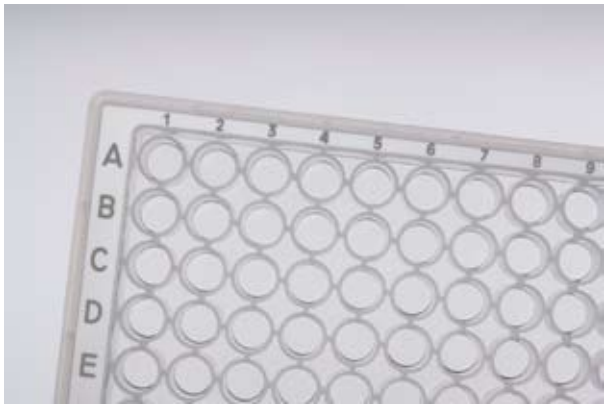


Figure 1: OptiTrack matrix of the Eppendorf Microplates

Materials and Methods

1. Transparency

a) Pellet identification

Different dilutions of a bacterial suspension were pipetted into wells of the Eppendorf Microplate 96/V and into wells of 96 well micro test plates with V-bottom made by other manufacturers in order to produce pellets of different sizes. To this end, *E. coli* bacteria (strain DH5α) were incubated over night at 37 °C. The culture was diluted to an OD of 1.0, 0.5 and 0.25 using LB medium. 100 µl were pipetted into each well; each dilution was pipetted into a new row, leaving a vacant row between each occupied row. Subsequently, the plates were centrifuged in the Eppendorf Centrifuge 5810 R (swing out rotor A-4-62, 2200 x g, 10 min). The LB medium was removed and the pellets were dried. The plates were then photographed, and the visibility of the pellets was subject to visual evaluation.

b) Light transparency measurements

The transparency of flat bottom micro test plates was quantified using absorbance measurements. To this end, the optical density of empty Eppendorf Microplates 96/F and 384/F, as well as two flat bottom plates of the 96 well format and one 384 well plate made by different manufacturers, were measured. The Safire²™ (Tecan) was used for scans covering the range of wavelengths between 350 and 650 nm. In addition, the Eppendorf Microplate 96/V and two competitors' plates of the same format were placed at an angle on a piece of paper with printed text and then photographed from above in order to compare the clarity, i.e. the readability of the writing beneath the plates.

2. Alphanumerics

The aim of this experiment was to render the readability of the grid measurable and thus evaluable. Hence, a test was developed, which would determine the speed at which individual wells within a 96 well plate could be found. One clear Eppendorf Microplate was used, along with three comparable 96 well plates by other manufacturers. Following predetermined co-ordinates, test individuals were to place one pipette tip each into the respective wells. The time required to complete 10 wells on one plate was determined using a stop-watch. This procedure was preferred over pipetting in order to prevent the factor of pipetting experience from skewing the experiment. Each person tested each plate type (in different order). In order to avoid habituation effects, a new pattern, devised by a random generator, was outlined for each plate. 7 individuals participated in this experiment.

Results and Discussion

1. Transparency

a) Pellet identification

As shown in figure 2, the material that the Eppendorf Microplates 96/V are made from is considerably clearer than the competitors' plates. The different pellet sizes can be distinguished effortlessly, and even the smallest pellet size can be easily identified. The smallest pellets of OD = 0.25 cannot be clearly distinguished from empty wells when viewed through the bottoms of plates made by other manufacturers. Since even the largest bacterial pellets are not clearly visible, it is difficult to estimate their size. The reasons are lower transparency of the material as well as, in part, the workmanship of the plate bottoms.

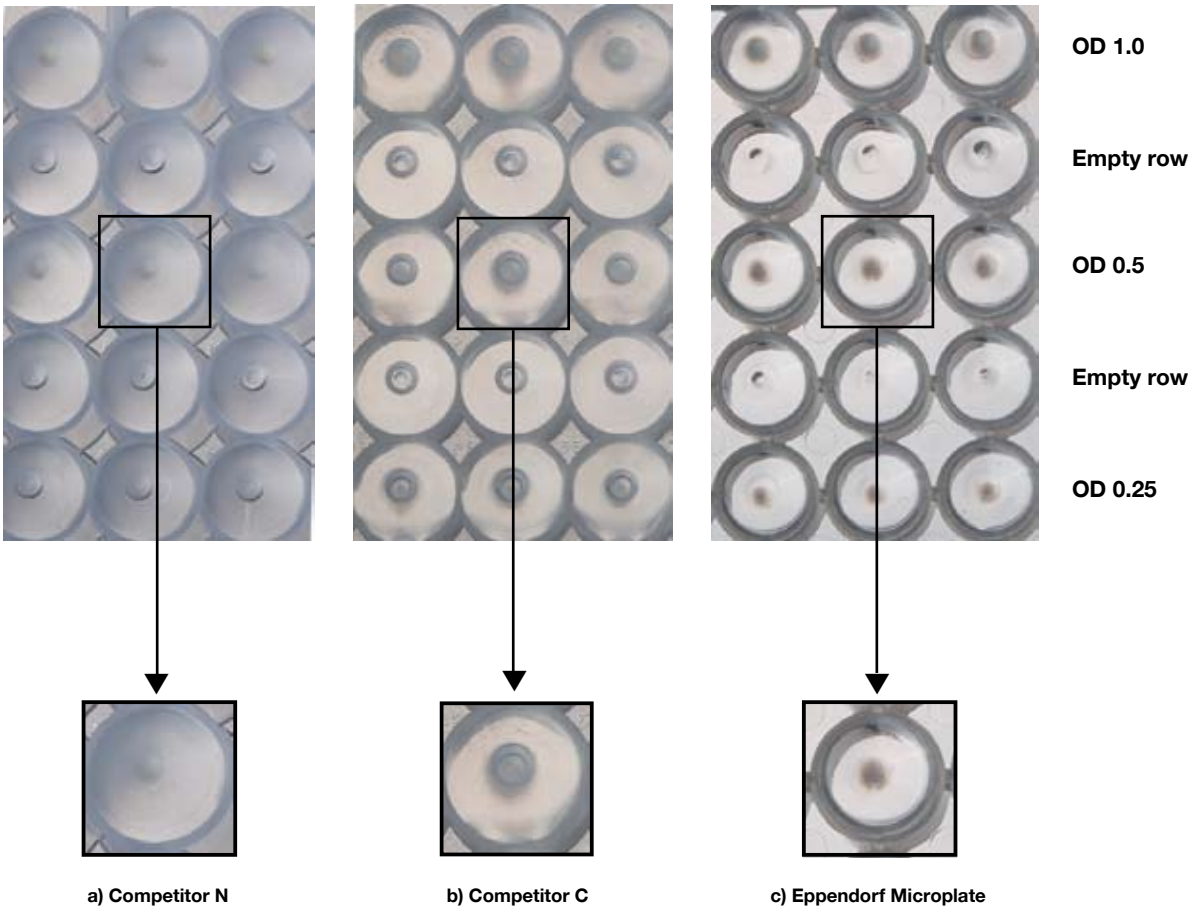


Figure 2: Wells of 96 well plates containing pellets of different sizes on the well bottom.
The photographs were taken under identical lighting conditions.

b) Light transparency measurements
The data resulting from the absorption measurements are shown in figure 3, expressed as light transparency. These data confirm that transparency across the entire measured spectrum is higher for the Eppendorf Microplates 96/F and 384/F than for the competitors' plates of the 96 well and 384 well formats. This test confirms that samples are easily identifiable through the well bottoms of Eppendorf Microplates.
The example of the Eppendorf Microplate 96/V, illustrated in figure 4, demonstrates the high clarity of the material. Here, the printed letters are easily readable through the well bottom, while this is not the case for the competitors' plates.

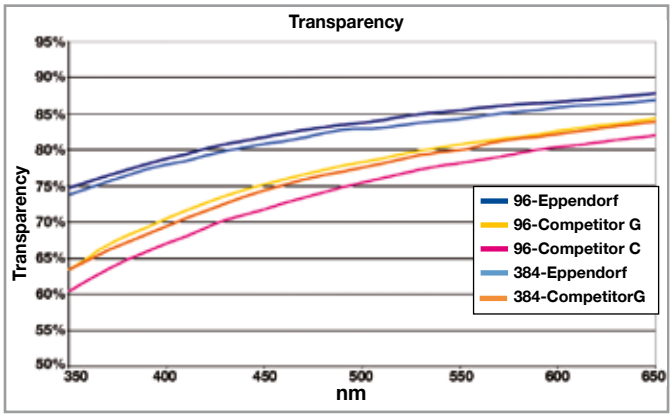
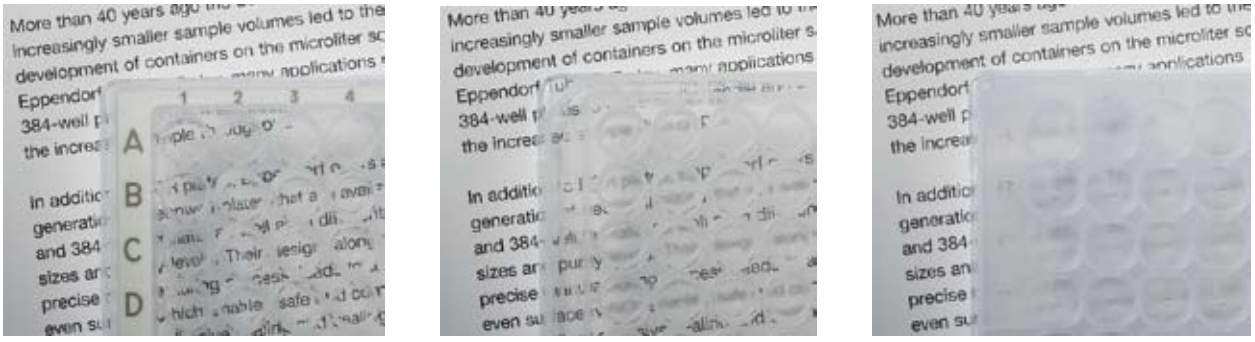


Figure 3: Diagram of the transparency of empty micro test plates, calculated from absorbance measurements across the spectrum of wavelengths between 350 and 650 nm.



Eppendorf Microplate **Competitor G** **Competitor N**

Figure 4: Readability of printed writing through the bottoms of micro test plates

2. Alphanumerics
The evaluation of the "insertion test" (Fig. 5) shows that the OptiTrack Matrix of the Eppendorf Microplates facilitates faster identification of wells than possible with the conventional grid of competitors' plates. The average time required for marking 10 wells on one plate is 38 s for Eppendorf plates, whereas for plates with a standard matrix these values range between 48 and 53 s. Thus, the Eppendorf Microplate wells are identifiable between 20 and 30 % faster. It is further obvious that the range between minimum value and maximum value is very narrow for Eppendorf plates, while these values are spread considerably farther apart when other plates are tested. Labeling which is difficult to read can therefore lead to higher variability in time sensitive experiments, since well identification requires variable lengths of time. In the case where wells need to be counted using a filled pipette tip in order to reach the correct well, the risk of contamination is added.

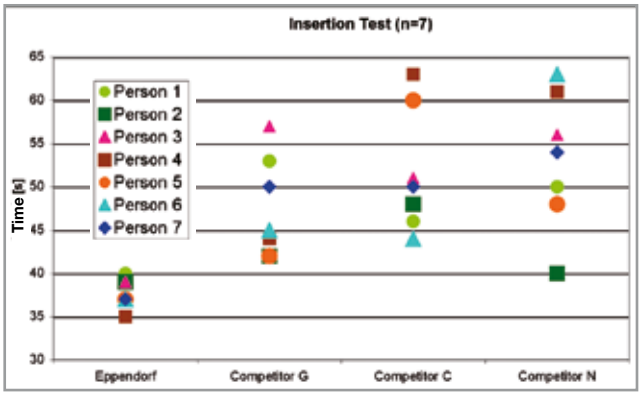


Figure 5: Time required for the "insertion test" per person and plate. Each colored symbol represents one test individual and shows the time required for the plate indicated

Conclusion

The experiments described here show that the transparency unique for Eppendorf Microplates made from polypropylene facilitates detection of sample material and thus contributes to comfortable and safe work processes. Compared to the conventional grid, the contrast-rich OptiTrack matrix allows considerably faster identification of individual wells. These advantages not only facilitate the work; in addition, errors and contamination are avoided, which would result in considerable amounts of extra work. The equally speedy well identification thus contributes to improved reproducibility when processing time-sensitive reactions.

Ordering information

Eppendorf Microplates*, 80 plates (5 bags of 16 plates each)					
Product name	**Quality**	**Well color**	**Border color**	**Order no. international**	**Order no. North America**
Microplate 96/F	PCR clean Sterile	clear	white	0030 601.106 0030 602.102	951040005 951040021
Microplate 96/U	PCR clean Sterile	clear	white	0030 601.203 0030 602.200	951040048 951040081
Microplate 96/U	PCR clean	black	white	0030 601.807	951040102
Microplate 96/U	PCR clean	white	grey	0030 601.572	951040145
Microplate 96/V	PCR clean Sterile	clear	white	0030 601.300 0030 602.307	951040188 951040227
Microplate 96/V	PCR clean	black	white	0030 601.904	951040260
Microplate 96/V	PCR clean	white	grey	0030 601.670	951040308
Microplate 384/F	PCR clean Sterile	clear	white	0030 621.107 0030 622.103	951040341 951040383
Microplate 384/V	PCR clean Sterile DNA LoBind, PCR clean	clear	white	0030 621.301 0030 622.308 0030 623.304	951040421 951040464 951040546
Microplate 384/V	PCR clean	black	white	0030 621.905	951040481
Microplate 384/V	PCR clean	white	grey	0030 621.670	951040503

*All Microplates are available with barcode upon request.

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