



THE SMARTTRACK® REDUCES PREPARATION TIME BY UP TO 21 % AND SUBSEQUENT PERFORMANCE BY UP TO 36 % AS AN ORGANISATION SYSTEM.

The aim of the following analysis was to quantify the efficiency improvement in the ubiquitous attempt of “pipetting a triple determination.” The execution was divided into three phases and compared with and without the use of the SmartRack®.

During setup or preparation, an efficiency improvement of 21 % was achieved. In the second phase of execution, efficiency was increased by at least 36 %. During teardown and cleaning, the required time can be minimized by up to 37 %.

The results were statistically validated with 99.99 % confidence. Simultaneously, a reduced standard deviation was observed in all three phases when including the SmartRack®, thereby supporting a standardized approach.

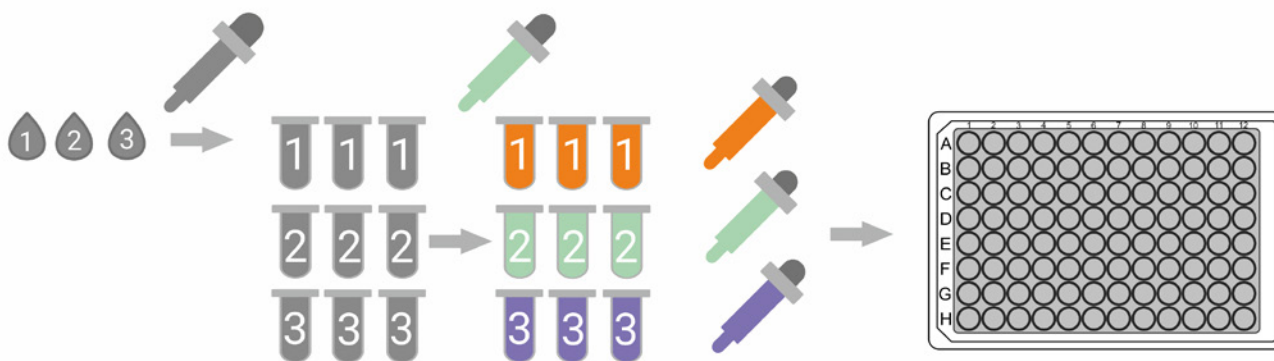


Fig.1: Schematic diagram of the experimental setup and execution, image by ibrandify on Freepik

DESCRIPTION OF THE SIMULATION OF THE EXAMPLE EXPERIMENT:

To simulate the pipetting of the triplicate determination, a pH test was conducted on three synthesized sample solutions. In 100 ml round-bottom flasks, a neutral, an acidic, and a basic solution were prepared. For a pH range between 6 and 8, 50 ml of water was added to the round-bottom flasks. To establish an acidic solution with $c[H^+] > 10^{-7}$, three small spoonfuls of citric acid were added to 50 ml of water. A concentration of $[c] < 10^{-7}$ was achieved by adding three small spoonfuls of sodium carbonate.

100 μ l of each solution was transferred into three Eppendorf tubes for the addition of the indicator. After adding 3 drops of diluted Unitest solution, the colored sample solutions were pipetted into a well plate. Subsequently, the intensity will be measured photometrically as an example.

The required times for the three phases of preparation/setup, execution, and breakdown/cleaning were recorded and statistically analyzed with and without the use of the SmartRack® for $n = 10$.

” It is often the case that after the test is before the test.

The SmartRack® enables efficient and quick dismantling, reassembly and cleaning of the workstation.

Time savings of up to 37 % are possible. Up to 30 % of the total working time can be saved even for relatively simple pipetting. “

COMPARISON OF THE PROCEDURE WITH AND WITHOUT APPLICATION OF THE SMARTRACK®:

Preparation/Setup: The time-consuming setup of tripods, three-finger clamps with sleeves and cork rings is replaced by the pre-assembled SmartRack® with the required modules. The glassware and consumables were already in place. Only the necessary chemicals had to be brought to the workstation.

Execution: By using the SmartRack®, samples could be easily removed from the module holder single-handedly. In the previous use of three-finger clamps, samples had to be unscrewed with both hands. The pipettes and pipette tips needed for pipetting could be taken from the module holders in the SmartRack®, and used tips could be disposed of in the waste. Recorded observations were immediately digitally noted on the tablet. Thanks to the module holders, equipment and samples could be stored vertically, and the workstation was used for safe and organized experiment execution.

Deconstruction/Cleansing: Through the utilization of SmartRack®, disassembling the experimental setup comprising stands, sleeves, three-finger clamps, and cork rings, as well as their cleansing, has been avoided. Potentially contaminated module brackets can be cleansed in the industrial dishwasher or autoclave. Additionally, the module brackets can be reused in the SmartRack for the subsequent analysis or swiftly adjusted.

ADDED VALUE WITH THE SMARTRACK®:

Temporal savings were achieved in setup and preparation through a minimal number of pathways and the intuitive click-and-module system. On average, the time for the initial phase was reduced by 21 %.

During execution, time could be saved in sample handling by operating the module holders with one hand. The tablet holder with a tablet provides the opportunity to digitize results directly and avoid transmission errors. The vertical storage option resulted in an 80% space saving and improved visibility.

As a result, the experiment could be conducted 36 % more efficiently.

The time for dismantling is almost entirely eliminated, as only contaminated modules needed to be replaced or new module holders can be clicked in for the next experiment. Time savings amounted to 37 %.

In Table 1, the recorded times were averaged and their standard deviation was calculated.

Statistical parameter	with SmartRack®	without SmartRack®
Standard deviation, total	14,64	39,89
Average total duration	577,28	823,26
Standard deviation structure/ preparation	0,32	0,00
Average duration setup/preparation	308,64	382,10
Standard deviation realization	14,39	29,25
Average duration Implementation	207,91	327,00
Standard deviation dismantling/cleaning	0,34	1,92
Average duration dismantling/cleaning	60,65	96,09

Table 1: Statistical parameters of the tests with and without SmartRack® (SR) in the three phases: Setup/preparation, execution, dismantling/cleaning as well as the total duration of the test.

STATISTICAL EVALUATION

Using the OriginPro2021 program, the samples for each phase were checked for normal distribution and homogeneity of variances. In case of non-homogeneity of variances, the Welch correction was applied in the subsequent mean t-test.

In all three phases, the means of the experiments with or without SmartRack® significantly differ with a probability of error of 0.0001%. Proper application of the SmartRack resulted in reduced standard deviations during setup, execution, and dismantling. Consequently, the inclusion of the SmartRack® supported a standardized approach.

CONCLUSION

The use of SmartRack® in pipetting, a fundamental step in sample processing, preparation, or treatment across all industries (biology, chemistry, biochemistry, pharmacy, food chemistry, microbiology), resulted in an overall reduction of the total experiment time by 30%. The laboratory organization system, when compared to experiments without SmartRack, led to a more efficient, less error-prone, and standardized workflow.

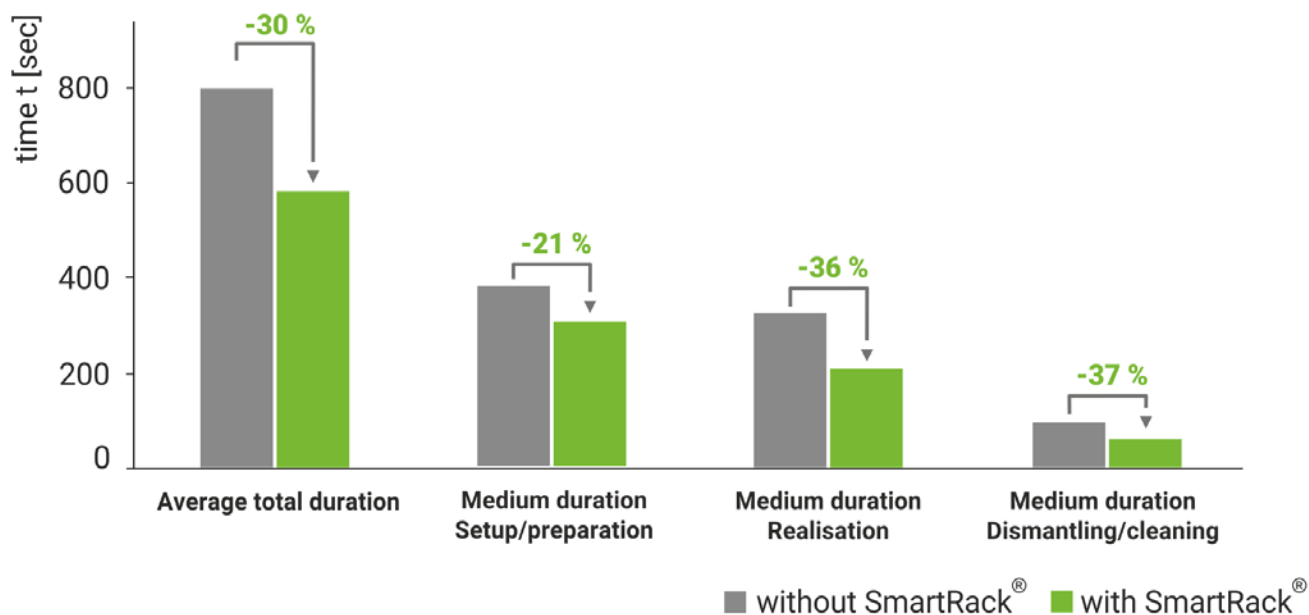


Fig. 2: Overview of the test duration with SmartRack® (SR) and without SmartRack®

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Better Basics Laborbedarf GmbH
 Loebtauer Str. 69, 01159 Dresden, Germany

T: +49 (0) 176 6233 8026 (Sales partners)
 T: +49 (0) 178 9617 577 (Direct customers)
 E: inquiry@better-basics.de
 W: www.Better-Basics-Laborbedarf.de

Impress:

Better Basics Laborbedarf GmbH, Loebtauer Str. 69, D-01159 Dresden

E-Mail: info@better-basics.de

CEO: Mario Schneider

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