

Comparative Study SARSTEDT Blood Sedimentation Systems

S-Monovette® ESR, S-Sedivette®,
Sediplus® S 200 and S 2000 ESR Timers



Introduction:

For blood sampling to perform ESR* determination, the SARSTEDT range includes the S-Monovette® and S-Sedivette® systems.

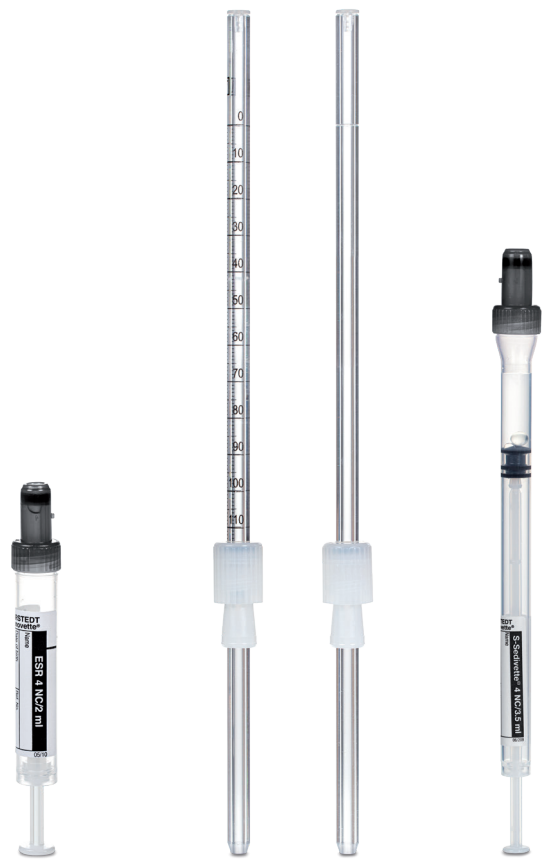
The S-Monovette® system is supplied with a pre-dosed 0.106 molar citrate solution. One sample contains a mixing ratio of 1 volume of citrate solution plus 4 volumes of blood once samples have been collected in accordance with pertinent instructions. Both this mixing ratio and the molarity of the citrate solution conform to the requirements recommended by Westergren (1), various standards (2, 3), and technical literature (e.g. 5).

To perform ESR with the S-Monovette®, a sedimentation pipette is assembled that complies with functional and dimensional Westergren provisions and standards (3,4). In conclusion and without restriction, the S-Monovette® ESR constitutes a blood sedimentation system that corresponds to the Westergren method.

The S-Sedivette® significantly differs from the Westergren system and the S-Monovette® ESR in both its geometry and the fact that it contains a citrate buffer solution. As an enclosed

system, the S-Sedivette® particularly reduces the risk of infection and provides considerable benefits in hygienically handling the blood sample.

The following comparative studies are intended to demonstrate that the S-Sedivettes as well as the Sediplus® S 200 and Sediplus® S 2000 instruments used for ESR determination in conjunction with this system render results comparable to those obtained with the Westergren method.



S-Monovette® ESR

Westergren pipette

S-Sedivette®

*: Erythrocyte Sedimentation Rate

**Comparison of Measuring Accuracy –
S-Monovette® ESR vs. S-Sedivette®**

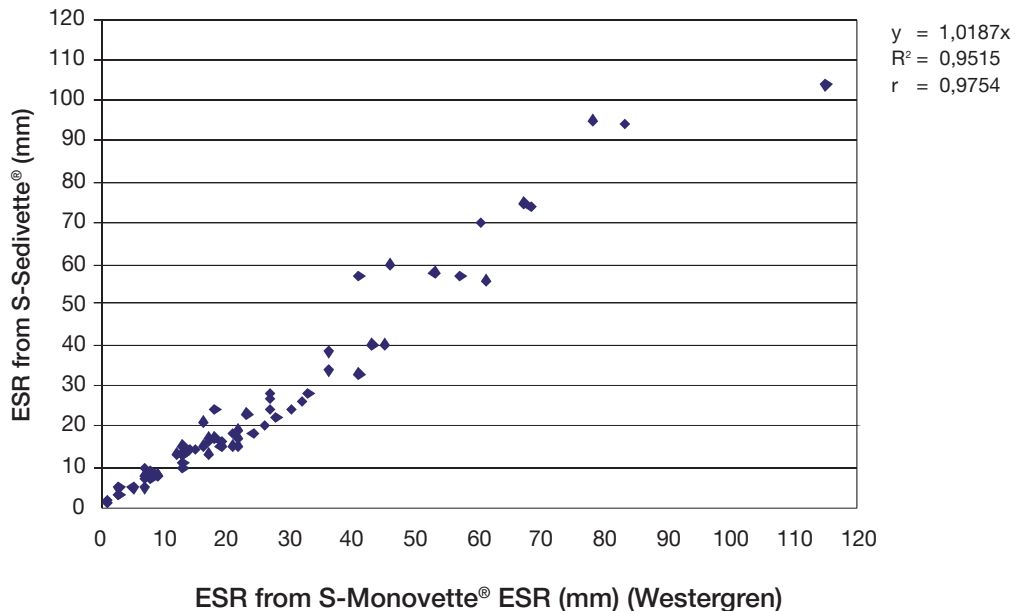
In cooperation with St. Martinus District Hospital, Olpe/Germany, venous blood samples were collected from 64 patients in one S-Monovette® ESR and one S-Sedivette® each. The S-Monovettes ESR and S-Sedivettes were thoroughly mixed immediately after sampling.

Measurements were started within one hour after blood collection. All S-Monovettes ESR and

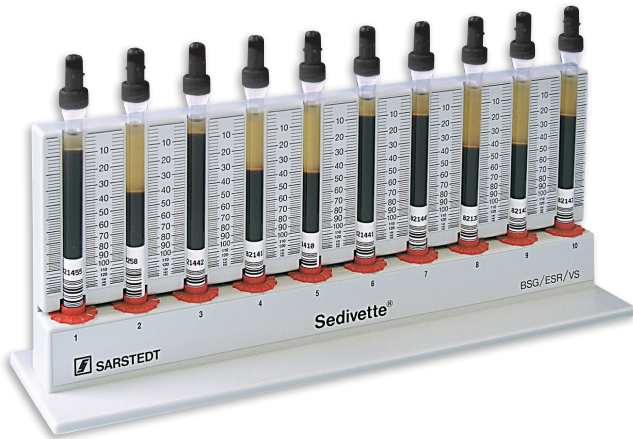
S-Sedivettes were thoroughly mixed once again just prior to sedimentation testing. After one hour, the ESR results were read from the graduation on the individual racks involved.

Graph 1 below illustrates the comparability ascertained for the ESR values.

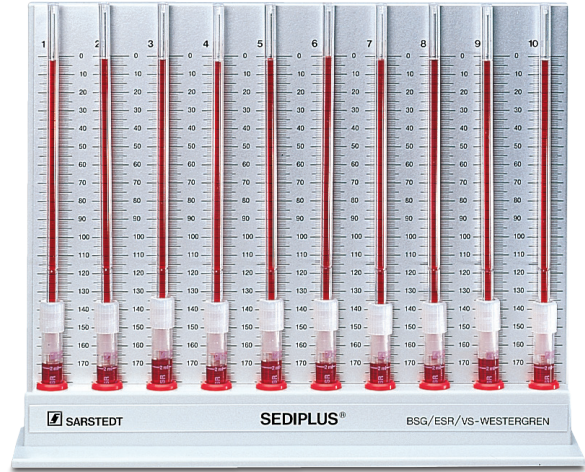
**Graph 1: ESR comparison – S-Monovette® ESR vs. S-Sedivette®
1h values, manual reading**



A linear gradient of $y = 1.0187x$ and a correlation value of $r = 0.9754$ were established.



ESR rack for S-Sedivette®



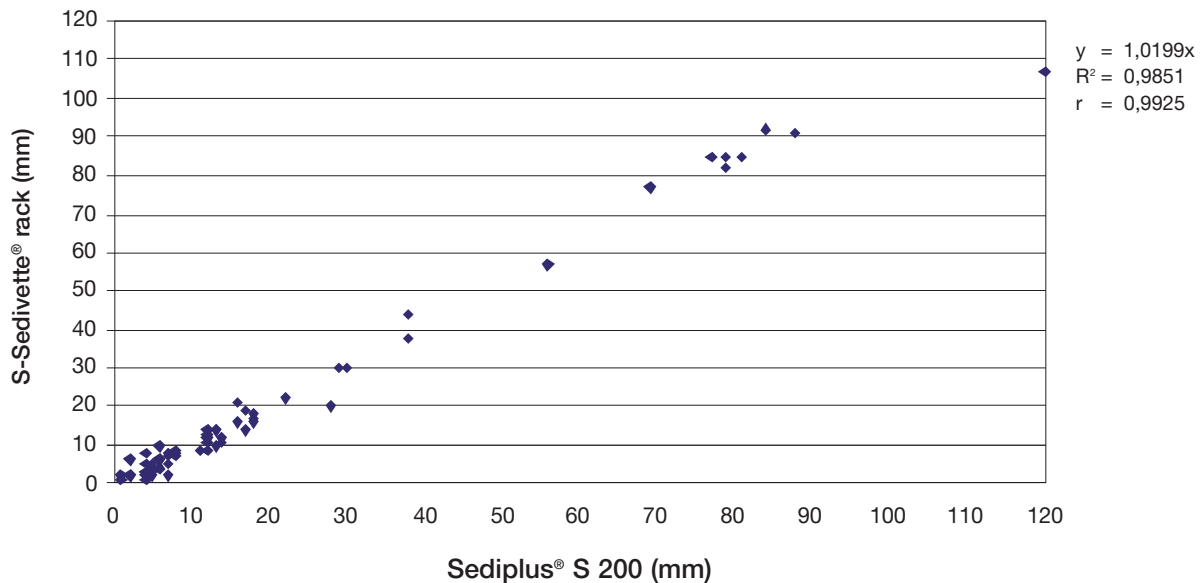
ESR rack for S-Monovette®

**Comparison of Measuring Accuracy –
Sediplus® S 200 vs. Sediplus® S 2000**

Another study was performed at Oststadt Hospital, Bremen/Germany, to determine the measuring accuracy of SARSTEDT’s Sediplus® S 200 and Sediplus® S 2000 instruments. Sampling was conducted as described previously except that two S-Sedivettes each were collected per patient. One test result each was read from the graduation of the S-Sedivette® rack and the other from the individual measuring instrument used (either Sediplus® S 200 or Sediplus® S 2000). All values were determined after a sedimentation period of one hour.

Graph 2 illustrates the comparability determined between the S-Sedivette® placed in the rack and the sample processed in the Sediplus® S 200. Graph 3 illustrates the comparability of ESR values established for the S-Sedivette® in the rack and the sample in the Sediplus® S 2000.

**Graph 2: ESR comparison – S-Sedivette®
Sediplus® S 200 vs. S-Sedivette® rack, manual
1h values (n=64)**



A linear gradient of $y = 1.0199x$ and a correlation value of $r = 0.9925$ were established.

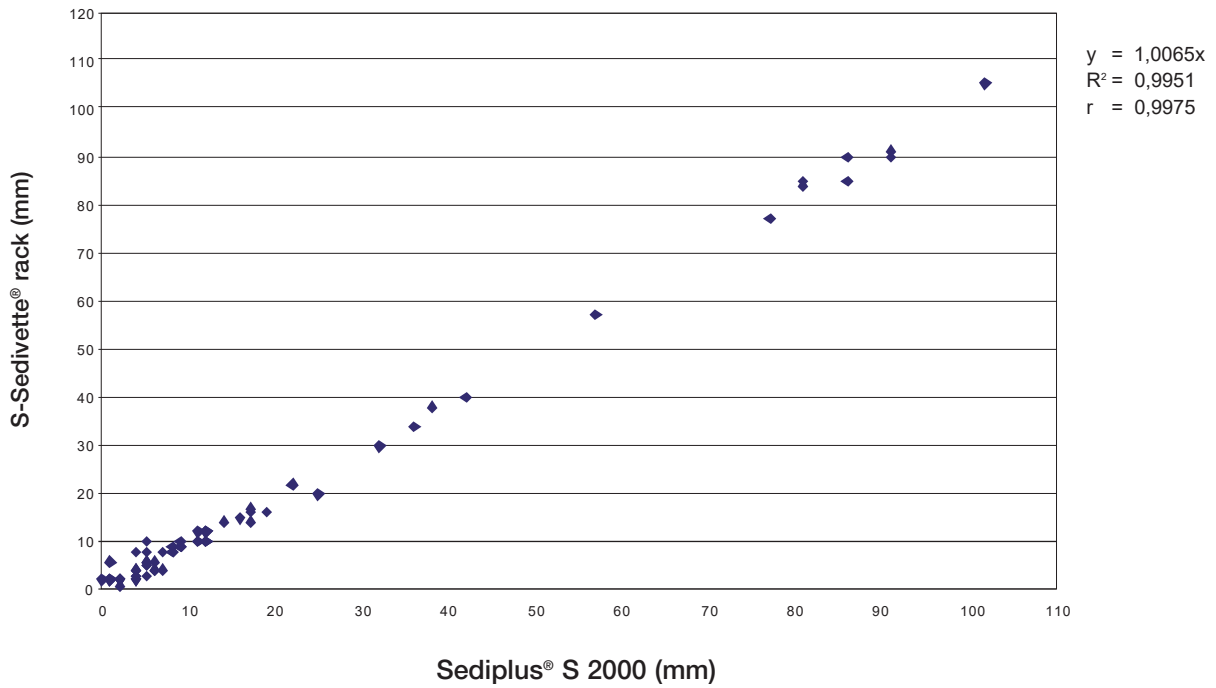


Sediplus® S 200



Sediplus® S 2000

Graph 3: ESR comparison – S-Sedivette®
Sediplus® S 2000 vs. S-Sedivette® rack, manual
1h values (n-63)



A linear gradient of $y = 1.0065x$ and a correlation value of $r = 0.9975$ were established.

Conclusion:

As described above, the S-Monovette® ESR complies with any and all criteria required by the Westergren method. Therefore, the ESR values obtained with this S-Monovette® system are expressed in terms of ESR values Westergren. Consequently, we have decided in favor of a direct comparison between the Westergren method (with S-Monovettes ESR) and our S-Sedivette® system.

The choice of the correct time of reading the ESR value was derived from a comprehensive set of technical literature (2, 3, 5, 6) according to which any and all standards and authors exclusively refer to a 1h value. Westergren himself pointed out in 1924 that ‘... if the results are to be read only once, there is no doubt that the 1h value is the most important’ (1).

In comparing S-Monovettes ESR and S-Sedivettes, visual reading of the values shown on the individual graduated racks revealed good consistency. The linear gradient of $y = 1.0187x$ is almost equivalent to a gradient of $y = 1.0x$ of an ideal straight line. Accordingly, no systematic deviation of the S-Sedivette® results from the Westergren values has been ascertained. The correlation value of $r = 0.9754$ reveals a close connection between the ESR values obtained from the S-Monovette® ESR and the S-Sedivette®.

Also, it should be noted that significant differences were found even among the ESR values determined in multiple ESR testing from the same blood sample. In 1924, Westergren made the following

statement after testing his method in 280 repeated ESR determinations: ‘The error spread of the ESR reaction is about 10% of the reading plus 1 mm’ (1).

In both studies, the ESR values obtained in the S-Sedivettes and in the Sediplus® S 200 and S 2000 instruments revealed linear gradients of approximately $y = 1.0x$ as well as correlation values of $r = 0.9925$ for the Sediplus® S 200 and $r = 0.9975$ for the Sediplus® S 2000. Consequently, both instruments provide very good measuring accuracy.

These results establish the comparability between the Westergren ESR values and those obtained in S-Sedivettes, regardless of whether values were determined by visual determination in a Sedivette® rack or automatically in the Sediplus® S 200 or S 2000 measuring instruments.

References

- [1] Westergren, A.: Die Senkungsreaktion. Erg. Inn. Med Kinderh., 26 (1924), 577 – 733
- [2] DIN 58935-1:1997-12 Hämatologie-Bestimmung der Erythrozyten-Sedimentationsgeschwindigkeit im Blut - Teil 1: Ausgewählte Methode
- [3] ISO 13079:2011-07 Laboratory glass and plastics ware – Tubes for the measurement of the erythrocyte sedimentation rate by the Westergren method
- [4] CLSI H2-A5 2011: Procedures for Erythrocyte Sedimentation Rate Test.
- [5] Thomas, L.: Labor und Diagnose. Digitale Ausgabe Labor & Diagnose 2020; Kapitel 19.3.2 Blutkörperchensenkungs-Reaktion (BSR) (www.labor-und-diagnose-2020.de/k19.html#_idTextAnchor8638)
- [6] ICSH recommendations for measurement of erythrocyte sedimentation rate. J. Clin. Pathol. 1993 46:198-203

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