

XS-1000i – New Sysmex 5-part diff haematology analyser with fluorescence technology



Fig. 1: SYSMEX XS-1000i

Since the introduction of fluorescence technology for leukocyte differentiation by SYSMEX in the year 1999, thousands of laboratories worldwide have been working with this still novel method in blood diagnostics. During that time, many users have been able to develop – jointly with SYSMEX – new parameters and applications which help improving the diagnosis and therapy of patients. And

until today, fluorescence-based leukocyte differentiation offers potential for further developments – as studies have shown, in sepsis diagnostics for example.

Aside from the SYSMEX high-end haematology analysers of the xE- and xT-series for the medium-sized laboratory, there are now two new haematology analyser systems of the x-CLASS working with this fluorescence technology: XS-1000i and XS-800i. Specially tailored to the requirements of small laboratories with low sample volumes or as backup systems, the XS-1000i and XS-800i are offering proven technology and handling of the x-class coupled with innovative changes.

Haematology is fluorescence flow cytometry – anywhere

But what exactly is so special about the fluorescence technology by SYSMEX? From a purely technical point of view, the RNA and DNA components in the cell are stained with special fluorescence dyes, patented by SYSMEX, without destroying the cell. It is thus possible to measure – with suitable detectors – the nucleic acid percentage of each cell as a physical characteristic of this cell. Thus, the cell nucleus will be analysed together with the cytoplasm which goes far beyond the simple differentiation according to the size and internal density or, respectively, the granularity of the cell. This will be realized with special semiconductor lasers, detectors as well as especially specific reagents.

The advantage of this technology is its very specific and, at the same time, sensitive detection of immature blood cells and malignant or, respectively, abnormal cells, such as e.g. reactive lymphocytes in the peripheral blood. Due to their proliferation or protein synthesis activity, e.g. within the scope of antibody production, such blood cells naturally have an increased nucleic acid percentage which can be detected by the correspondingly increased fluorescence signal. Precisely that characteristic distinguishes the quality of the fluorescence technology and its reliability in practice: Among many normal blood samples, one pathological sample can thus be filtered out.

The following figure illustrates the DIFF scattergram of the new xs-series. In addition to the complete differential blood count of the 5 leukocyte populations, all important warning messages from the high fluorescence area of the scattergram will be generated.

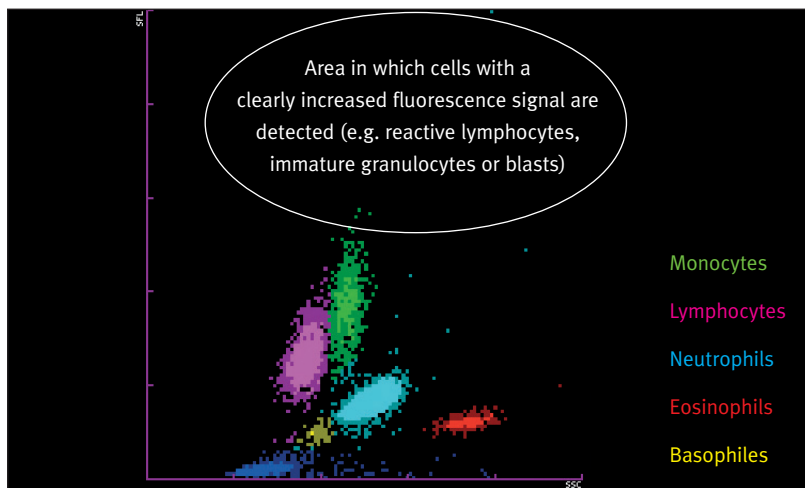


Abb. 3: DIFF scattergram of the xs-series with the 5 leukocyte populations and the area for the warning messages, should the relevant pathological cells be present in the blood

However, fluorescence technology does not only offer a reliable warning message with immature or reactive cells. At the same time, it is also a suitable method for excluding negative effects on the differential blood count due to otherwise troubling particles, e.g. lysis-resistant erythrocytes, lipids or technical artefacts such as air bubbles or contaminations. All of the mentioned particles have no nucleic acid

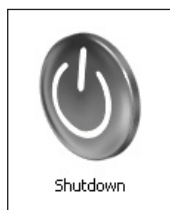
components and thus do not provide any detectable fluorescence signal. For this reason, they always come to lie in the dark blue so-called »ghost area« of the scattergram and do not influence the differential blood count.

Whether a warning message refers to a morphological abnormality, such as e.g. »Blasts?«, or an increased or, respectively, reduced cell count, e.g.»Lymphopenia«, all warning messages of the xs-series are principally adjustable to the individual requirements of each laboratory. This does not influence the specificity of the warning messages, but their sensitivity in the detection of pathological samples which can thus be increased or reduced.

In addition to the fluorescence technology for optimal leukocyte differentiation, other proven methods have also been kept in the xs-series. This includes keeping a separate measuring channel only for the haemoglobin measurement. The detergent here used (sodium lauryl sulphate) does not only lyse the erythrocytes included in the sample, but also the leukocytes. Thus, pronounced leukocytoses are no reason for having to dilute the samples since the measured haemoglobin value is reliable. The same applies for highly lipaemic samples in which the soap-like character of the reagent eliminates disturbing effects of the lipids in the haemoglobin measurement.

Ease of handling

As with all SYSMEX instruments, for us, the most important criterion is the development of a robust system with minimum maintenance expenditure for the laboratory. The systems of the xE- and xT-series already require only one daily shutdown which is, moreover, fully automatic. For the xs-series, it was possible to even further reduce the maintenance required by the user: A single push of a button is necessary for the daily 2-minute fully automatic shutdown. And no additional reagent will be required for it.

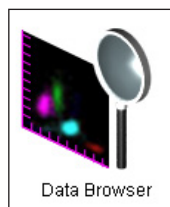


Shutdown: Push the button, wait for 2 minutes, ready!

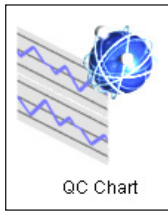
Other functions and menu structures of the software were completely taken over from the other systems of the x-CLASS and partly further simplified in their handling:



All measured samples are stored in a central database which includes up to 10,000 results including all graphics. All stored samples can be retrieved at any time – by means of comprehensive sorting and filtering criteria, as well as various search functions. The processing status is also evident for every single result – validated, printed out or transmitted to the laboratory EDP.



Operation and data analysis is performed via a menu for all graphic and numerical results of a sample. Also included are – in addition to an overview page for all values of the findings report – so-called »research parameters«, such as e.g. the number of immature granulocytes (IG# and IG%). Error messages and validation status of the sample are here also immediately visible.



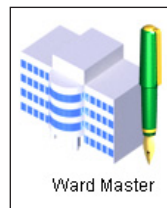
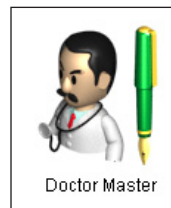
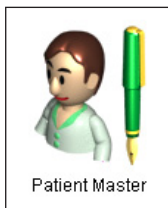
The xs-software offers 20 QC files with 300 data items each which are presented in line graphics (L-J chart). Additionally, the most current QC measurement at the time is presented in special, separate so-called radar graphics enabling a quick overview of the QC status of all parameters. Should any parameter drop from the QC, this will be visible at a glance.



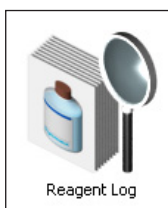
Every error message by the instrument includes a proposal for a countermeasure which can be confirmed by simply clicking on the »OK« button in the Help window. Thus, the failure can be directly remedied without any loss of time. Maintenance services, replacement of reagents, or measures in case of insufficient sample volume intake can be performed directly via the Help menu.



Two different printouts can be generated with the xs-analyser: The standard findings report printout, and a »laboratory internal printout«. With the latter, non-validated results or additional parameters can also be printed out, such as e.g. the values of immature granulocytes. The default settings of both printouts can be individually changed and even expanded, e.g. by the laboratory's logo in the header.



If additional data aside from the sample number are known, the xs-system can directly receive these data from the laboratory EDP and store them together with the sample number. Alternatively, however, the data can also be directly entered into the xs-instrument and will then also be available on the findings report.



A system for reagents management permits to check at any time which reagents have been replaced when and by whom. At the same time, it is shown when a new reagent is expected to be connected.

20 µl aspiration volume in XS-1000i and XS-800i

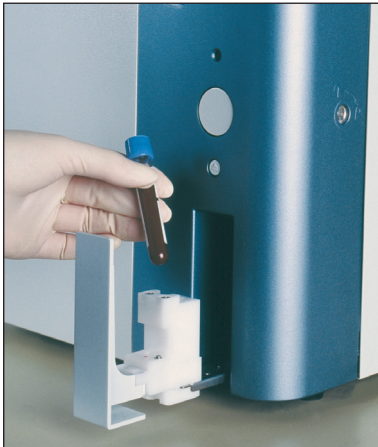


Fig. 4: In the XS-1000i, the tube cap can be pierced to minimize the risk of direct contact with the sample.



Fig. 5: In the XS-800i, blood samples can only be analysed manually and in open condition which is advantageous especially for minimal blood volumes.

Technically, both instruments are absolutely identical and structurally similar; only the aspiration method for the blood samples differs. While the XS-1000i analyser takes in blood samples in a closed system where the tube cap is pierced and any direct contact with the sample will be avoided, in the XS-800i analyser, the samples can only be manually aspirated with opened tube. This type of intake is advantageous especially if there are only minimal blood volumes available (such as e.g. in paediatric hospitals) or if micro-tubes are primarily used. Micro-tubes can of course also be used in the XS-1000i analyser; a special adapter is supplied with all instruments. In both instruments, the aspiration volume remains equally low in any case: Only 20 µl are used for the complete differential blood count.

Both instruments have a novel blood sensor to guarantee at any time precisely the 20 µl aspiration volume and thus the reliability of the analysis results.

For a higher degree of automation and standardization in the workflow, the XS-1000i analyser furthermore offers the possibility of optionally connecting a sampler. In such a sampler, the samples will then be mixed upside-down and the barcode is read automatically to query the corresponding sample request from the laboratory EDP.