Automation in Routine Microbiology – Performance Data of a New Automated Inoculation System

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Abstract

Background: Automation in clinical microbiology laboratories is increasing. Automated inoculation systems potentially improve the precision and traceability of inoculation while at the same time increasing the overall sample throughput.

Materials/methods: The Autoplak DxM 6100 Advanced System (Beckman Coulter, Brea, USA) is a new automated inoculation system that can process liquid based microbiology (LBM) specimens. In addition to the inoculation of solid media (agar plates – including bi-plates) the device can also inoculate liquid culture media and glass slides for later staining for microscopy. To evaluate the performance characteristics of the Autoplak DxM 6100 Advanced System as well as its suitability for a high throughput workflow we ran preliminary test with more than 200 specimens using 14 different media from 3 different manufacturers. In addition, integration in routine workflow was tested using MRE screening LBM samples, inoculating TSA agar and chromogenic, selective agar plates with the three quadrant streak.

Results: Accuracy and reproducibility of all streaking patterns on all tested media were very good. Also, preparation of glass slides for later staining and inoculation of liquid media from the same specimens was highly reproducible. These parameters did not vary if media were inoculated individually or in combination from the same specimen. Inoculation rate depended on streaking pattern and the combination of media types. Solid media could be inoculated with the highest throughput of samples followed by broth and slides. If more than one type of media was used per sample (solid and broth, solid and slides, solid and broth and slide) there was only a limited increase in time per sample compared to the individual inoculation. Workflow integration was possible at different starting points (sample activation, labeling, and inoculation) due to a flexible LIS interface. Hands-on time was short, loading of samples and consumables could be adopted to support high sample throughput and maximize walk-away time.

Background

- Automating routine procedures in medical laboratories has become a key feature of modern diagnostics in part due to the potential increase in precision and traceability.
- In medical microbiology, automation has – in addition to ID/AST testing – so far largely focused on inoculation.
- In the laboratory, automated inoculation systems may increase the overall sample throughput, and can also improve the workflow.

Material and Methods

In this study, we evaluated a new automated specimen processor, the Autoplak DxM 6100 Advanced System (Beckman Coulter, Brea, USA) Image 1) and assessed its suitability for integration into the routine workflow of a medical laboratory.

The system can process liquid specimens such as urine, spinal fluid and liquid based microbiology (LBM) specimens. It can inoculate liquid media, such as thioglycolate bouillons, and solid media, such as blood agar-, including bi-plates, as well as prepare glass slides for staining (e.g. Gram-stain).

The Autoplak DxM 6100 Advanced System can perform several streaking patterns, such as the simple-, three- and four-quadrant streaks, and patterns can also be completely customized.

Before introducing the system into the laboratory routine, the system's performance (plate and broth inoculation, slide preparation) was extensively tested.

To assess the potential of integration into routine, MRSA screening was used. In the study, an average of more than 400 samples per day were processed in order to determine whether this new automated inoculation system could cope with a large number of samples.

Results

Performance:

- Reliable, reproducible and highly accurate inoculation of plates (Image 2) and liquid media as well as preparation of glass slides for later staining.
- The type of specimen did not impact the system's performance
- Different media inoculated individually or in combination from the same specimen did not influence the quality of the results.
- Performance did not vary significantly with regard to different combinations of media and slides. Tested combinations include one or more solid media and/or one or more liquid media and/or glass slides.
- Streaking patterns could be easily adapted by optimizing the pattern and strength employed by the metal loop.
- Adaptable combination of media (input and output) including more than one solid and more than one liquid medium per sample.
- Inoculation rate depended on streaking pattern and the combination of media.
    - Solid media > broth > slides
    - Limited increase in processing time if a combination of media-types was used

Integration into routine workflow:

- Few interactions between the operator and the instrument (loading / unloading of samples and plates).
- Easy to handle, limited hands-on-time.
- Full integration into the laboratory information system possible.
- Loading of samples and consumables can be optimized to support high sample throughput and maximize walk-away time.
- Workflow integration possible at different starting points:
    - sample activation
    - inoculation
- Handling of different solid and liquid media from different manufacturers.
- Highly customizable in terms of streaking patters, media combinations, and plate sorting
- During the study period (3 months) there were failures requiring external technical assistance

Conclusion

Media inoculation was highly reproducible and accurate. Sample throughput of the system and adaptability of the LIS interface as well as the wide range of usable samples and media allowed for flexible integration in routine workflow.

Image 1: Autoplak DxM 6100 Advanced System

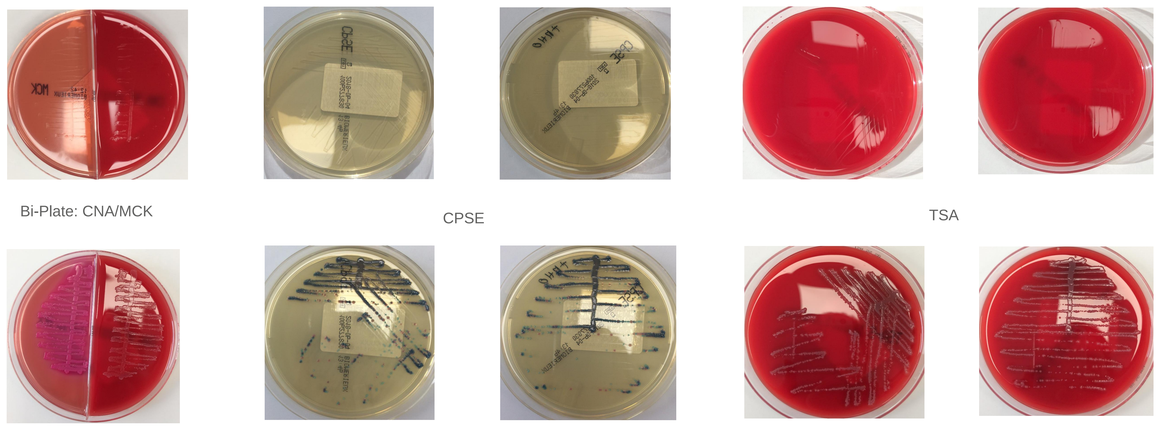

Image 2: Examples of Media Plates Incolated with *Escherichia coli* and *Enterococcus* spp.

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