Automatic Urine Culture Analysis using CPSe Agar and the WASPLab Chromogen Detection Module

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Introduction

Urine cultures are among the most common specimen received by clinical laboratories and generate a major share of the laboratory workload. Chromogenic agar has been used to expedite culture results, but technologists are still needed to review every plate. In this study we evaluate the WASPlab (Copan, Brescia, IT) software to interpret urine specimens plated to chromID CPS Elite (BioMérieux, Marcy-l'Etoile, FR) agar.

Method

Urine specimens submitted for bacterial culture were enrolled and plated on chromID CPS elite agar using a 1µl loop on the WASPlab. Images of each plate were taken after 0 and 16 h of incubation. Each image was read by both a technologist and the WASPLab software. Software results were reported as negative if ≤10 colonies were detected or positive if >10 colonies were detected. Results were compared to manual reading using the same images on an HD monitor and all testing was blinded from the software's results. For manual testing, any specimen containing more than 3 different colony morphologies was reported as negative due to potential contamination. Discrepant specimens were sent for secondary review for colony quantitation.

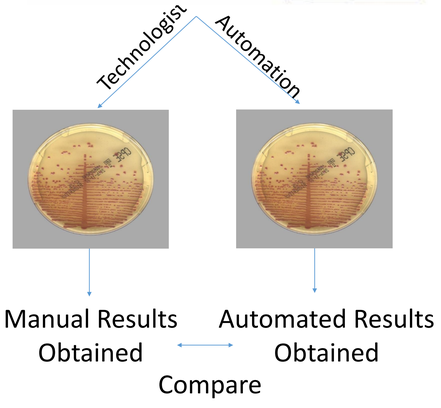


Figure 1. Modeling Chromogenic Detection

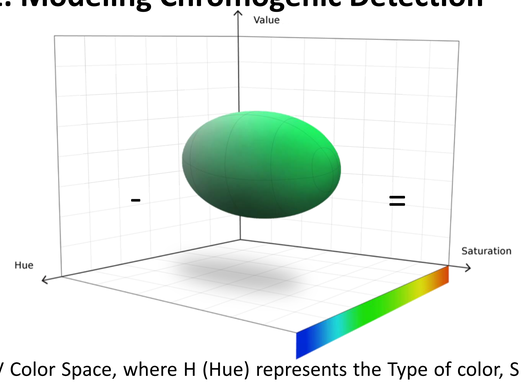


Figure 1: HSV Color Space, where H (Hue) represents the Type of color, S (Saturation) represents the Intensity of the color and V (Value) represents the Brightness of the color. The "bubble" is the visual representation of the threshold volume in this three-dimensional space.

Table 1. Performance of the WASPLab digital imaging of CPSe plates compared to manual reading

		Manual result	
		Negative	Positive
Software result	Negative	2906	40
	Positive	654	1651

Positive Percent Agreement = 97.6%
Negative Percent Agreement = 81.6%

Table 3. Re-evaluation of discrepant results

		Manual result	
		Negative	Positive
Software result	Negative	2946	0
	Positive	654	1651

Positive Percent Agreement = 100%
Negative Percent Agreement = 81.6%

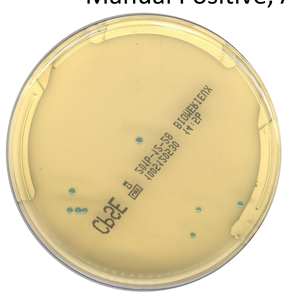
Table 2. Breakdown of results based on software colony count

Count Software	Negative (manual)	Contaminated (>3 colony types)	Positive (manual)
0	1514	0	0
1-10	1431	1	40
11-100	459	41	429
>100	23	131	1222
Total	**3387**	**173**	**1691**

First column represents colony count category that was determined by the software analysis. Out of the 5,251 specimens 173 were contaminated which all but 1 resulted in a manual negative automation positive result.

Figure 2. Image examples of discrepant specimens

Manual Positive, Automation Negative

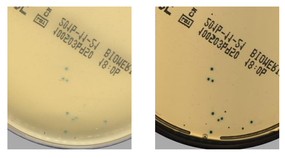


9 colonies

8 colonies

Manual Negative, Automation Positive

White light Backlight



8 colonies white light
13 colonies backlight

Conclusions

- High positive percent agreement: 97.6% and 100% after second review
- Human error occurred in all 40 manual positive, automation negative
- 55.3% urines specimens could be quickly removed as negative with software
- 26.3% of automation positive. manual negative are due to specimens with >3 potential pathogens.
- Future studies will differentiate chromogen color to detect contaminated plates
- Need time-motion studies to understand potential value of CPSe agar with software