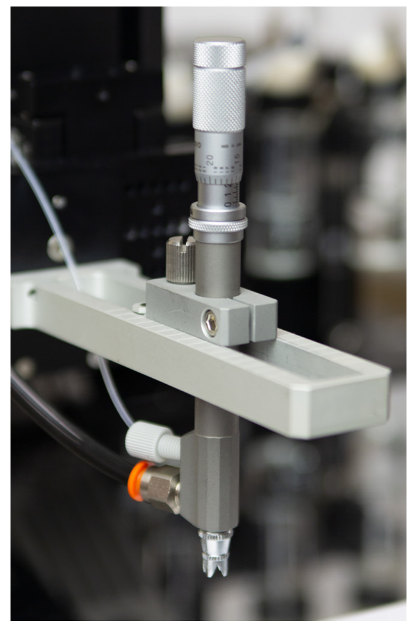
Comparison of BioDot's AirJet™ aerosol dispenser to dip coating of conjugates and blocking reagents in a lateral flow assay

The purpose of this study was to determine if using the AirJet aerosol dispensing technology to dispense buffer onto blocking paper and dispense gold conjugate onto glass fiber produces equivalent results to dip coating the materials. In this limited study both AirJet dispensing and dip coating produced similar results in consistancy and elution values.   AirJet dispensing also proved to increased processing speeds, reduce reagent waste, provided quantiative reagent volumes and created a cleaner manufacturing process.

INTRODUCTION

In lateral flow test manufacturing, deposition of buffer and conjugate is typically accomplished using a saturation method called impregnation or dip coating. This involves either soaking the material in a bath (batch processing) or running web materials through a dipping tank (in-line processing), followed by drying. The quantity of reagent delivered to the membranes via dipping relies heavily on membrane characteristics and web speed (for in-line processing), large volumes of reagent must be used to fill the dipping tank and processing speeds are slow to allow for reagent absorption. This application note compares using AirJets, on an in-line manufacturing system, to deliver blocking buffer and gold conjugate, to the results of a dipping process.

AirJet™



The AirJet is a unique dispensing technology ideal for quantitative and uniform dispensing of fluids with particulates. The AirJet is an aerosol dispenser, similar to an artist's airbrush, coupled with a syringe pump. Dispense volume, line width and air pressure are all adjustable, allowing for the dispensing of finite lines on materials or for full coating/impregnation of the material.

METHODS

1. A total of 4 AirJet dispensers were selected. Two each to avoid overspray and delivery of large volumes and separate sets to avoid cross contamination.
2. The web materials were tested for tensile strength, and it was determined that Ultra-Lo tension configuration was required to avoid snapping the membranes.
3. The webs were sprayed with the required volumes of reagent, and it was determined that a speed of 25 mm/s was sufficient for proper drying.
4. A total of 100 meters of fiberglass was sprayed with the conjugates, half with Solution A and the other half with Solution B.
5. A total of 100 meters of blocking paper was sprayed with a blocking buffer.
6. Random segments of both materials were excised and tested using an elution method for absorbance. Within these segments, random regions (pads) were tested.

AirJet™ Dispensing
Conjugate & Buffer

RR120 w/4 AirJets™

MATERIALS

1. Blocking paper roll
2. Glass fiber conjugate pad roll
3. Blocking buffer
4. Gold conjugate "Solution A"
5. Gold conjugate "Solution B"
6. Equipment used:
   RR120 In-Line System
   Ultra-Lo Tension configuration
   (4) AirJet™ Dispensers
   (2) Drying towers

RESULTS

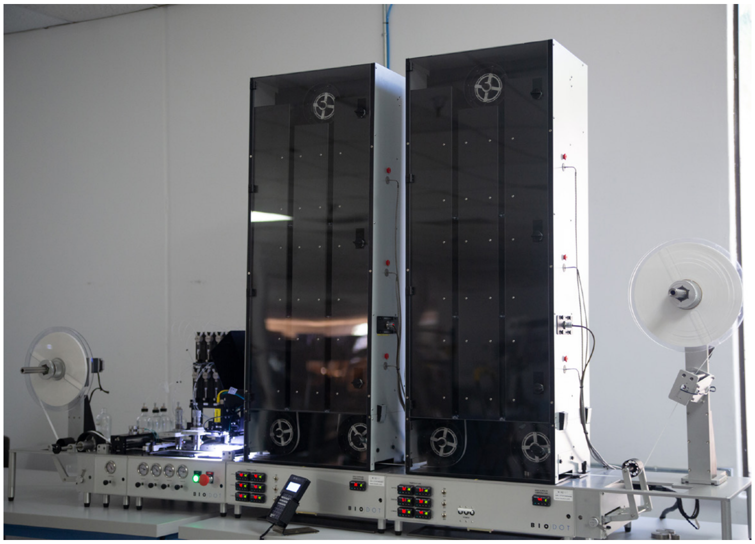
Spraying of the blocking buffer showed results comparable to dipping **(Table 1)**, with absorbance values showing < 5% CV.

Spraying of the conjugate A and B solutions also yielded results comparable to dipping **(Table 2)**, with absorbance values < 6% in all cases and typically within 3% CV.

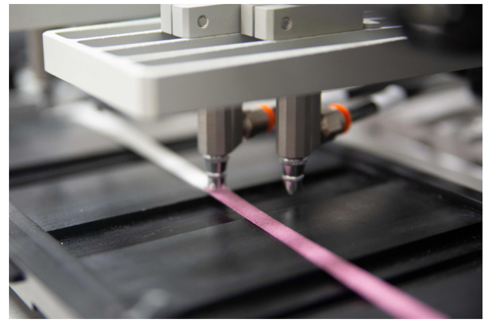
Table 1

Pad	Region 1	Region 2	Region 3	Region 4	Region 5	Avg.	STDEV	% CV
1	0.2841	0.2985	0.2913	0.3184	0.3005	0.2986	0.0128	4.3
2	0.3118	0.2932	0.3191	0.3012	0.2871	0.3025	0.0131	4.33
3	0.2896	0.2955	0.3115	0.3095	0.2966	0.3005	0.0095	3.16
4	0.2975	0.281	0.3024	0.2885	0.307	0.2953	0.0105	3.56
5	0.2896	0.3091	0.3101	0.3265	0.3175	0.3106	0.0136	4.39
6	0.3055	0.3154	0.3132	0.3124	0.3128	0.3119	0.0037	1.2
7	0.2987	0.2876	0.2947	0.3141	0.3174	0.3025	0.0128	4.23

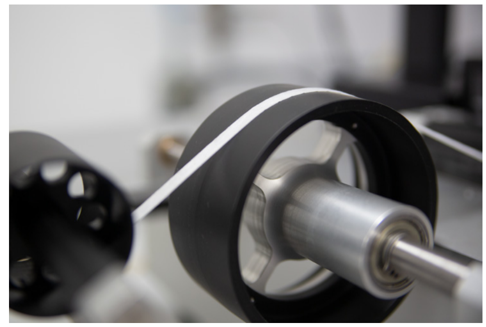
Average elution values of blocking buffer, based on absorbance measurements, from five randomly selected regions of blocking paper. Seven different paper strips were sprayed with a blocking buffer and tested, and the results indicate good consistency. The values tested from paper sprayed with a blocking buffer are comparable to those found from paper impregnated with a blocking buffer.



RR120 w/2 Drying Towers



AirJet™ Dispensing



Low Tension Option

Table 2

Pad	Region 1	Region 2	Region 3	Avg.	STDEV	% CV
1	0.11	0.1148	0.1099	0.1116	0.0028	2.51
2	0.1085	0.1093	0.107	0.1083	0.0012	1.08
3	0.0942	0.0889	0.0942	0.0924	0.0031	3.31
4	0.1026	0.0945	0.0926	0.0966	0.0053	5.5

Pad	Region 1	Region 2	Region 3	Avg.	STDEV	% CV
1	0.2821	0.288	0.2886	0.2862	0.0036	1.25
2	0.3169	0.3024	0.3234	0.3142	0.0108	3.42
3	0.2925	0.2889	0.2821	0.2878	0.0053	1.83
4	0.2485	0.2523	0.2448	0.2485	0.0038	1.51

Average elution values of gold conjugate solutions 'A' (Top) and 'B' (Bottom). Based on absorbance measurements, from three randomly selected regions of fiberglass conjugate pad. Four different fiberglass pads were sprayed with each conjugate solution and tested, and the results indicate good consistency. The values tested from fiberglass sprayed with conjugate are comparable to those found from fiberglass impregnated with the conjugates.

CONCLUSIONS

The AirJet technology enables the delivery of a precise quantity of reagent to the pads and membranes while allowing for good control over spreading. Not only is this process more efficient than dip coating, but it also reduces the inherent variability found in some of the materials. In addition, it allows for faster drying, thus leading to increased throughput. Lastly, elimination of a dip tank filled with reagent and instead quantitatively dispensing a programmed volume saved on reagent waste.