Investigating Both the Antimicrobial Efficacy of a Non-woven PHMB Dressing and the Ability of the Dressing to Absorb Wound Slough

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Introduction

Advanced Medical Solutions (AMS) have developed a high absorbing gelling fiber dressing composed of carboxymethylcellulose (CMC) fibers and Polyhexamethylene Biguanide (PHMB). The product is indicated for moderately to highly exuding wounds due to its significant absorbency capabilities, whereby the product can absorb high amounts of fluid whilst retaining its integrity by gelling.

Wound exudate presents in various forms, from thin and runny to thick and viscous. Consisting of water, white cells, electrolytes, matrix metalloproteinases (MMPs) and growth factors, exudate constitutes as a complex mixture of compounds.[1] Typically, wound exudate viscosity increases when in the presence of more protein.[2] Additionally, presence of white blood cells and bacteria in a wound, will thicken exudate and change its appearance.

The management of wound exudate presents a clinical challenge, especially when encountering thick exudate (viscous exudate) as many products do not have capabilities to manage the viscosity while enabling exudate absorption. If not appropriately handled, excess exudate may lead to maceration and create an environment for bacterial growth.[3]

Typically, *in vitro* fluid handling data presented to clinicians is focused on just one type of solution (solution A), which has a viscosity like water (142mmol sodium ions and 2.5mmol calcium ions).[2] As not all exudates are of thin viscosity, it was important to assess whether the CMC PHMB dressing was able to manage thick exudate (viscous exudate) in this investigation.

Another aspect of the CMC PHMB dressing is its antimicrobial performance. As stated by A. Philippe, secondary dressings are essential as they have an impact on the efficacy of the primary dressing.[4] As CMC PHMB is indicated for use with secondary dressings, an investigation was performed, to confirm that the dressing remained effective at reducing microbial load, whilst it was under compression (which was verified by applying a pressure of approximately 55mmHg, which is representative of having a secondary dressing or bandaging applied to the primary dressing).

Method

Slough Absorption and Retention Test Method - BS EN13726-1:2002

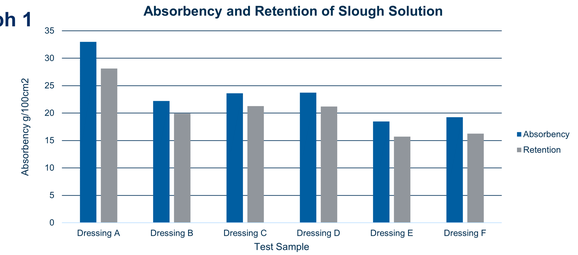
- A slough solution prepared to simulate thick wound exudate, consisted of simulated wound fluid (SWF) and a thickening agent.
- The amount of slough absorbed was determined by weighing samples (Example - CMC PHMB gelling fiber) before and after the solution was applied.
- The samples were left to incubate at 37°C for 30 minutes in between the weighing's.
- The amount of slough retained by the sample was assessed by applying a weight (equivalent of the pressure from a secondary dressing or bandaging) onto the dressing for 30 seconds.

Antimicrobial Efficacy Under Compression Test Method

- The antimicrobial properties of the dressing were assessed in accordance with AATCC TM-100 guidelines, whilst applying a known pressure to test samples to incorporate a compression element.
- The assessment was performed against clinically relevant wound microorganisms over a period of 168hrs, to simulate the intended wear time of the device.

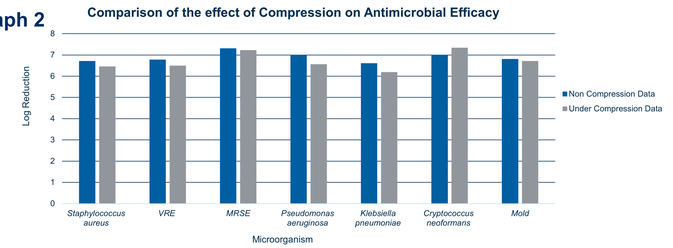
Results

Graph 1



Graph 1 – Outlines the average absorbency g/100cm² and retention g/100cm² values across all samples. The higher the data point, the greater the absorbency and retention capabilities of the dressing.

Graph 2



Graph 2 – Documents the log reduction values of the CMC PHMB gelling fiber when tested for antimicrobial efficacy under no compression conditions vs under compression, simulating the use of a secondary dressing or bandaging. All microorganisms achieved total eradication.

Discussion

Slough Testing

The data documented within **Graph 1** shows the CMC PHMB gelling fiber (Dressing A) can effectively absorb more viscous solutions. On average, the dressing absorbed 33g/100cm² per sample, which was 28% more than Dressings B-F tested. Dressing A also retained the slough solution when the dressing was subject to compression. Results obtained demonstrated 24% more slough to be retained within the PHMB gelling fiber dressing than products B-F tested. This *in vitro* data is a promising sign of the product's potential ability at slough removal.

It must also be noted that the CMC PHMB dressing remained integral during and after the test, whereas Dressing F considerably shrank in size from its dry sample size.

Image 1

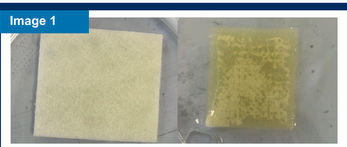


Image 1 – Dressing F - Before slough solution (left) and after slough solution applied (right), highlighting the change in size of the dressing

Compression – Antimicrobial Efficacy Testing

The antimicrobial efficacy testing has successfully shown the PHMB gelling fibers ability to remain effective whilst under simulated compression. All microorganisms tested obtained a ≥ 4.0 log reduction, within 168hrs **(Graph 2).** The dressing performed consistently across a range of species; gram positive/ negative bacteria, yeast and a mold.

Graph 2 highlights the antimicrobial performance of the dressing has not been affected with extra pressure applied, as the dressing still achieved total eradication for every microorganism.

Conclusion

- The CMC PHMB gelling fiber absorbed a greater percentage of the slough solution than the other products tested, absorbing **28%** more.
- The highest amount of slough retained was achieved by the CMC PHMB gelling fiber dressing, it retained **28g/100cm².**
- The data indicates the product can absorb a viscous solution, which offers benefits within a clinical setting when determining the appropriate treatment to utilise for wounds that range in exudate type.
- The antimicrobial efficacy of the CMC PHMB gelling fiber remains effective whilst the dressing is under compression.

References

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2. J. R. Forss, *Journal of Wound Care*, 2022, **31**, https://doi.org/10.12968/-jowc.2022.31.3.236
3. E. Chamanga, *Br J Community Nurs*, 2015, **20**, doi: 10.12968/bjcn.2015.20.Sup9.S8
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Data on file: LD108-23, P4297R, P5140R

Dressing A = AMS PHMB CMC gelling fiber; Dressing B = Aquacel® Ag Advantage; Dressing C = Durafiber®; Dressing D = Durafiber Ag®; Dressing E = Exufiber®; Dressing F = Exufiber Ag®

AMS CMC PHMB gelling fiber is not FDA cleared or approved in the European Union or UK.

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